United States Department of the Interior

FISH AND WILDLIFE SERVICE
International Affairs
5275 Leesburg Pike, MS: IA
Falls Church, VA 22041-3803

In Reply Refer To:
FWS/AIA/DMA

OCT 11 2017

Memorandum

To: The File

From: Chief, Branch of Permits

Subject: Enhancement Finding for Lions Taken as Sport-hunted Trophies in Zimbabwe during 2016, 2017 and 2018

After evaluating the available information from the Government of Zimbabwe, other information available to the U.S. Fish and Wildlife Service (Service), and comments received from interested parties, the Service has determined that permits for the importation of sport-hunted trophies of wild lions (*Panthera leo melanochaita*), which are threatened under the Endangered Species Act (ESA), taken in Zimbabwe during the 2016, 2017, and 2018 calendar years **meet** the enhancement criteria under the Service's regulations at 50 CFR 17.32. Therefore, applications received for import of such specimens will be considered to have met this requirement. In accordance with the 4(d) rule for *P. l. melanochaita*, 50 CFR 17.40(r), the Service will review each application for import of such specimens on a case-by-case basis and each application will also need to meet all other applicable permitting requirements before it may be authorized. The Service will reassess the situation in Zimbabwe towards the end of the 2018 season to determine if hunts conducted in 2019 and beyond continue to meet the enhancement criteria under 50 CFR 17.32.

Governance of the Lion in the United States:

On October 29, 2014, the Service published in the Federal Register a finding that listing the African lion subspecies (*Panthera leo leo*) as a threatened species under the ESA was warranted and proposed a rule under section 4(d) of the ESA to provide conservation measures for the African lion. 79 Fed. Reg. 64472. On December 23, 2015, after fully considering the comments from the public and the peer reviewers on the proposed rule, the Service published in the Federal Register the final rule in which the taxonomic classification of the Asiatic lion (previously classified as *P. l. persica* and listed as an endangered species under the ESA) was changed to *P. l. leo* (Asia and western, central and northern Africa) and listed as an endangered species, and the *P. l. melanochaita* (southern and eastern Africa) subspecies was listed as a threatened species with a rule under section 4(d) of the ESA, which is set forth at 50 CFR 17.40(r) (USFWS 2015; 80 Fed. Reg. 79999). The effective date of this listing is January 22, 2016. Therefore, as of January 22, 2016, the lion

subspecies *Panthera leo melanochaita*, whose range includes Zimbabwe, is listed as threatened under the ESA and is regulated under an ESA section 4(d) special rule [50 CFR 17.40(r)].

Section 9 of the ESA and our implementing regulations at 50 CFR 17.21 and 50 CFR 17.31 set forth a series of general prohibitions that apply to all endangered and threatened wildlife, respectively, except where a 4(d) rule applies to threatened wildlife, in which case the 4(d) rule contains all the applicable prohibitions and exceptions. Under the 4(d) rule for *P. l. melanochaita*, all of the prohibitions under 50 CFR 17.31 apply to *P. l. melanochaita* specimens. These prohibitions, at 50 CFR 17.21 and 17.31, in part, make it illegal for any person subject to the jurisdiction of the United States to "take" (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or to attempt any of these) within the United States or upon the high seas; import or export; deliver, receive, carry, transport, or ship in interstate or foreign commerce, by any means whatsoever, in the course of commercial activity; or sell or offer for sale in interstate or foreign commerce any lion specimens. It also is illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken in violation of the ESA. Permits may be issued to carry out otherwise prohibited activities involving endangered and threatened wildlife species under certain circumstances. Regulations governing permits for endangered species, such as *P. l. leo*, are codified at 50 CFR 17.22. Regulations governing permits for threatened species, such as *P. l. melanochaita*, are codified at 50 CFR 17.32.

In sum, under paragraph 50 CFR 17.40(r)(1), all the prohibitions and exceptions under 50 CFR 17.31 and 50 CFR 17.32 apply to *P. l. melanochaita*. Accordingly, the Service may authorize the import of a sport-hunted lion trophy from Zimbabwe, but only if it first makes a finding that permitting the import of a trophy would enhance the survival of the species in the wild.

As we explained when finalizing the 4(d) rule for *P. l. melanochaita*, any person wishing to conduct an otherwise prohibited activity, including all imports of *P. l. melanochaita* specimens, must first obtain a permit under 50 CFR 17.32. As with all permit applications submitted under 50 CFR 17.32, the individual requesting authorization to import a sport-hunted trophy of *P. l. melanochaita* bears the burden of providing information in their application showing that the activity meets the requirements for issuance criteria under 50 CFR 17.32. In some cases, such as for import of sport-hunted trophies, it is not always possible for the applicant to provide all of the necessary information needed by the Service to make a positive determination under the ESA to authorize the activity. In such cases, the Service may consult with the range country and other interested parties to the extent practicable to obtain necessary information. The Service has the discretion to make the required findings on sport-hunted trophy imports of *P. l. melanochaita* on a countrywide basis, although individual import permits will be evaluated and issued or denied for each application. While the Service may make enhancement findings for sport-hunted trophy imports of *P. l. melanochaita* on a countrywide basis, the Service encourages the submission of information from individual applicants. We rely on the information available to the Service and may rely on information from sources other than the applicant when making a permitting decision.

General considerations:

As we also explained when finalizing the 4(d) rule, our threatened species permitting regulations at 50 CFR 17.32 provide issuance criteria for threatened species permits (50 CFR 17.32(a)(2)) , but do not specify what would constitute the enhancement of propagation or survival with regard to authorizing the import of parts or products of *P. l. melanochaita,* including sport-hunted trophies.

Therefore, when making a determination of whether an otherwise prohibited activity enhances the propagation or survival of *P. l. melanochaita,* the Service examines the overall conservation and management of the subspecies in the country where the specimen originated and whether that management of the subspecies addresses the threats to the subspecies (*i.e.,* that it is based on sound scientific principles and that the management program is actively addressing the current and longer term threats to the subspecies). In that review, we evaluate whether the import contributes to the overall conservation of the species by considering whether the biological, social, and economic aspects of a program from which the specimen was obtained provide a net benefit to the subspecies and its ecosystem.

The Service will evaluate any application received that involves *P. l. melanochaita* in the context of enhancement of propagation or survival permitting in accordance with our threatened species permitting regulations at 50 CFR 17.32 and issuance criteria for threatened species permits (50 CFR 17.32(a)(2)). These include, in addition to the general permitting criteria in 50 CFR 13.21(b):

(i) Whether the purpose for which the permit is required is adequate to justify removing from the wild or otherwise changing the status of the wildlife sought to be covered by the permit;

(ii) The probable direct and indirect effect that issuing the permit would have on the wild populations of the wildlife sought to be covered by the permit;

(iii) Whether the permit, if issued, would in any way, directly or indirectly, conflict with any known program intended to enhance the survival probabilities of the population from which the wildlife sought to be covered by the permit was or would be removed;

(iv) Whether the purpose for which the permit is required would be likely to reduce the threat of extinction facing the species of wildlife sought to be covered by the permit;

(v) The opinions or views of scientists or other persons or organizations having expertise concerning the wildlife or other matters germane to the application; and

(vi) Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application.

In addition to these factors, particularly in relation to sport hunting, we find the *IUCN Species Survival Commission (SSC) Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0* (IUCN SSC 2012), to provide useful principles, which, considered in conjunction with our threatened species issuance criteria, will aid the Service when making an enhancement finding for importation of sport-hunted trophies of *P. l. melanochaita.* This document sets out guidance from experts in the field on the use of trophy hunting as a tool for "creating incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources" (IUCN SSC 2012, p. 2) and recognizes that recreational hunting, particularly trophy hunting, can contribute to biodiversity conservation and more specifically, the conservation of the hunted species.

The SSC document lays out five guiding principles that, considered in conjunction with our threatened species issuance criteria, will aid the Service when making an enhancement finding for importation of sport-hunted trophies of *P. l. melanochaita:*

(a) *Biological sustainability:* The hunting program cannot contribute to the long-term decline of the hunted species. It should not alter natural selection and ecological function of the hunted species or any other species that share the habitat. The program should not inadvertently facilitate poaching or illegal trade in wildlife by acting as a cover for such illegal activities. The hunting program should also not manipulate the ecosystem or its component elements in a way that alters the native biodiversity.

(b) *Net Conservation Benefit:* The biologically sustainable hunting program should be based on laws, regulations, and scientifically based quotas, established with local input, that are transparent and periodically reviewed. The program should produce income, employment, and other benefits to create incentives for reducing the pressure on the target species. The program should create benefits for local residents to co-exist with the target species and other species. It is also imperative that the program is part of a legally recognized governance system that supports conservation.

(c) *Socio-Economic-Cultural Benefit:* A well-managed hunting program can serve as a conservation tool when it respects the local cultural values and practices. It should be accepted by most members of the community, involving and benefiting local residents in an equitable manner. The program should also adopt business practices that promote long-term economic sustainability.

(d) *Adaptive Management: Planning, Monitoring, and Reporting:* Hunting can enhance the species when it is based on appropriate resource assessments and monitoring (*e.g.*, population counts, trend data), upon which specific science-based quotas and hunting programs can be established. Resource assessments should be objective, well documented, and use the best science available. Adaptive management of quotas and programs based on the results of resource assessments and monitoring is essential. The program should monitor hunting activities to ensure that quotas and sex/age restrictions of harvested animals are met. The program should also generate reliable documentation of its biological sustainability and conservation benefits.

(e) *Accountable and Effective Governance:* A biologically sustainable trophy-hunting program should be subject to a governance structure that clearly allocates management responsibilities. The program should account for revenues in a transparent manner and distribute net revenues to conservation and community beneficiaries according to properly agreed decisions. All necessary steps to eliminate corruption should be taken and to ensure compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.

This approach to enhancement findings for the importation of sport-hunted trophies of *P. l. melanochaita* is consistent with the purpose and intent of the Endangered Species Act. As such, before the Service will authorize the importation of a sport-hunted trophy, we must determine that the trophy-hunting program is managed to ensure the long-term survival of the species. As part of this evaluation, we recognize that in many parts of the world, wildlife exists outside of protected areas and must share the same habitat and compete with humans living in these areas for space and resources. As identified in the *IUCN SSC Guiding Principle on Trophy Hunting as a Tool for Creating Conservation Incentives*, if communities that share these resources with wildlife do not

perceive any benefits from the presence of wildlife, they may be less willing to tolerate the wildlife. However, under certain circumstances, trophy hunting can address this problem by making wildlife more valuable to the local communities and encourage community support for managing and conserving the hunted species, as well as other species.

When evaluating whether the importation of a trophy of *P. l. melanochaita* would be authorized pursuant to 50 CFR 17.32, in accordance with our threatened species issuance criteria, we will examine how a country's management program for lions addresses the three main threats that have led to the decline of the subspecies: habitat loss, loss of prey base, and human-lion conflict. When examining a management program and whether trophies taken as part of that program meet the issuance criteria, we study a number of factors. Some of the factors we consider include whether the program is based on sound scientific information and identifies mechanisms that would arrest the loss of habitat or increase available habitat (*i.e.,* by establishing protected areas and ensuring adequate protection from human encroachment). We consider whether the management program actively addresses the loss of the lion's prey base by addressing poaching or unsustainable offtake within the country. A component of a management plan from which trophy imports would meet the issuance criteria would be whether there are government incentives in place that encourage habitat protection by private landowners and communities and incentives to local communities to reduce the incursion of livestock into protected areas or to actively manage livestock to reduce conflicts with lions. We examine if the hunting component of the management program supports all of these efforts by looking at whether hunting concessions/tracts are managed to ensure the long-term survival of the lion, its prey base, and habitat. Hunting, if properly conducted and well managed, can generate significant economic benefits that may contribute to the conservation of lions. In looking at whether we are able to authorize the import of a trophy under the issuance criteria of 50 CFR 17.32, we will examine if the trophy hunting provides financial assistance to the wildlife department to carry out elements of the management program and if there is a compensation scheme or other incentives to benefit local communities that may be impacted by lion predation. We will also consider how a U.S. hunter's participation in the hunting program contributes to the overall management of lions within a country.

Management programs for *P. l. melanochaita* are expected to address, but are not limited to, evaluating population levels and trends; the biological needs of the species; quotas; management practices; legal protection; local community involvement; and use of hunting fees for conservation. In evaluating these factors, we will work closely with the range countries and interested parties to obtain the information. By allowing entry into the United States of *P. l. melanochaita* trophies from range countries that have science-based management programs, we anticipate that other range countries would be encouraged to adopt and financially support the sustainable management of lions that benefits both the species and local communities. In addition to addressing the biological needs of the subspecies, a scientifically based management program would provide economic incentives for local communities to protect and expand *P. l. melanochaita* habitat.

Basis for Finding for Lions in Zimbabwe:

On February 1, 2016, the Service sent a letter to the Parks and Wildlife Management Authority in Zimbabwe (ZPWMA) with a list of questions related to management plans, population status, conservation, management, hunting policies, and regulations of Zimbabwe's lion populations. Additionally, in the letter the Service referenced the *IUCN Species Survival Commission (SSC)*

Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0 (IUCN SSC 2012), as it provides useful principles which, when considered in conjunction with the Service's permit issuance criteria, would aid when making the required enhancement finding for permitting importation of sport-hunted lion trophies.

On February 16, 2016, the Service sent a second request to ZPWMA for specific documents related to the conservation status of lions in Zimbabwe. ZPWMA responded to the Service's request on February 17, 2016, with a copy of *Conservation Status of African Lion in Zimbabwe*, and subsequently, on November 29, 2016, provided a copy of *Enhancement and Non-detriment Finding for Lion (Panthera leo) in Zimbabwe*. The Service has also been corresponding with ZPWMA regarding African elephant management for several years. In this correspondence, ZPWMA, as well as other sources, have provided the Service with documents and information that are relevant to our evaluation of lions in Zimbabwe. These documents, along with the Service's own final rule on the lion listing under the Act, as well as other relevant information from reliable sources and contained in comments received from interested parties, were the basis of this finding.

Governance of Lions in Zimbabwe: The legal framework for Zimbabwe's regulatory mechanism is informed by the Wildlife Policy (1992), which is intended to maintain a protected area network for the conservation of the nation's wild resources and biological diversity. The Wildlife Policy (1992) provides for the Government of Zimbabwe to maintain a network of protected areas known as the Parks and Wild Life Estate, comprised of the country's National Parks, safari areas, botanical gardens, and sanctuary and recreational areas, for the conservation of the nation's wild resources and biological diversity (CITES 2016; ZPWMA 2016). It is intended to create economic activity to enhance rural development and encourages the conservation of wild animals and their habitats outside the protected areas.

ZPWMA was established by the Parks and Wildlife Act of 1996 (Chapter 20:14) [as amended by Act Number 19 of 2001] which came into operation on June 1, 2002, through Statutory Instrument 144C of 2002. The Act provides for the establishment of a Parks and Wildlife Board; establishment of national parks, botanical reserves, botanical gardens, sanctuaries, safari areas and recreational parks; and the preservation, conservation, propagation or control of wildlife, fish, and plants of Zimbabwe and the protection of her natural landscape and scenery. The Parks and Wild Life Act includes sections on virtually every aspect of ZPWMA, including requirements for annual financial audits and reporting to the central government. The Parks and Wild Life Act also provides for substantial penalties for the unlawful possession of or trading in protected wildlife species. In addition, the General Laws Amendment Act (No. 5) of 2010 provides for mandatory imprisonment for poaching.

The Parks and Wildlife Act, Chapter 20:14, devolved authority to manage and benefit from wildlife on communal and private lands to the landholders. In 1982, the legal provisions of this Act were extended to Rural District Councils (RDCs), on behalf of rural communities in communal lands whose areas contain viable populations of wildlife. Communal areas in Zimbabwe are administered by RDCs, which have become a mechanism for implementation of the government's policy of conservation by utilization of natural resources. It enables local communities to manage and benefit from wildlife resources through the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) established in 1989. CAMPFIRE was developed to encourage reduction in human-wildlife conflicts through conservation-based community development and to provide an economic incentive to improve community tolerance of wildlife, including lions. At the time, the

CAMPFIRE program was the model for community-based conservation efforts in several other African countries and was identified as an innovative program. Under a community-based conservation program, like CAMPFIRE, rural communities should benefit from revenue generated by sport hunting.

As Zimbabwe's premiere wildlife agency, the main functions of the ZPWMA are to control, manage and maintain Zimbabwe's wildlife resources and perform the service function with the primary role of protecting and conserving Zimbabwe's natural heritage for the present and future generations on behalf of the State. It also provides the cornerstone of Zimbabwe's tourism industry (ZPWMA 2015). The rationale behind the establishment of the ZPWMA was to allow for a self-funding mechanism, and thereby reduce its dependence on the national treasury. In January 1996, the Government of Zimbabwe approved the establishment of the Parks and Wild Life Conservation Fund that provides for financing wildlife operations directly from revenues generated through wildlife-related activities. The funding for ZPWMA is therefore coming from revenue generated through sport hunting conducted on state and private lands, concession leases, National Park visitor fees, and other wildlife-related fees. While there have been requests by ZPWMA for funding from the central treasury in the past, to our knowledge, no other significant government funding has been provided, and only limited outside funding from NGOs or other governments appears to be available.

A major component of ZPWMA's mandate is law enforcement. ZPWMA had 2,146 rangers at its establishment in 2002 (ZPWMA 2016); however, by the end 2015, there were 1,448 rangers in post (67% of 2002 level). Of the 1,448 rangers in post, 1,004 are deployable for anti-poaching operations (ZPWMA 2016). Hunting operators are obligated through their concession lease agreements to assist with anti-poaching efforts (ZPWMA 2016). Reportedly, USD590,000 was spent on anti-poaching efforts by Bubye Valley Conservancy (BVC) alone during 2015 (K. Leathem, pers. comm., as cited in du Preez et al. 2016), and USD546,000 is spent annually on anti-poaching by Save Valley Conservancy (SVC) (Lindsey et al. 2012); these expenses are mainly covered by sport-hunting revenue (du Preez et al. 2016). If anyone is found in possession of poached specimens, they must pay a fine of USD5,000 or face a mandatory jail sentence. If convicted of lion poaching, courts could require the payment of a compensation fee of USD20,000 (ZPWMA 2014). Poaching mainly occurs along the boundaries of the protected areas where lions are incidentally snared as non-target prey. Between 2013 and 2015, 21 lions were killed illegally, with six animals killed through snaring in the area adjacent to Hwange National Park in 2015; poverty stands as the major driver of illegal hunting (ZPWMA 2016).

Zimbabwe is a member of the Southern African Development Community (SADC). Under the SADC Treaty, Article 5(g) establishes objectives to, among other aspects, promote the sustainable use of wildlife, harmonization of legal instruments governing wildlife use and conservation, promote the conservation of shared wildlife resources through the establishment of trans-frontier conservation areas (TFCA), and facilitate community-based natural resources management practices. To implement the SADC Treaty, member states are required to establish management programs for the conservation and sustainable use of wildlife. According to the ZPWMA *Enhancement and Non-Detrimental Findings for Panthera leo in Zimbabwe*, Zimbabwe has two established TFCAs, the Great Limpopo Trans-frontier Park (GLTP), which includes Gonarezhou National Park, and the Limpopo/Shashe TFCA. Additionally, there are other TFCAs that are in various stages of development, including Lower Zambezi-Mana Pools, Zimbabwe-Mozambique-Zambia (ZiMoZa), Chimanimani, and the Kavango-Zambezi (KAZA) trans-frontier conservation

area (TFCA) initiative, which links 52 million hectares of conservation areas between itself, Botswana, Zambia, Namibia, and Angola (ZPMWA 2016; Masterson 2016). Through TFCAs, wildlife management entities are linking many of the major protected areas by removing boundary fences along national borders that separate many reserves in addition to creating or improving corridors to link good-quality habitat for wildlife (Newmark 2008). The principle of ecological and migratory connectivity lies at the heart of the TFCA initiative linking large protected areas across international boundaries and providing space for wildlife populations.

In addition to Zimbabwe's domestic laws, it is also a Party to CITES. The lion is listed in Appendix II of the Convention. As an Appendix-II species, certain criteria must be met before such species can be exported, including a finding from the exporting country's CITES Scientific Authority that the proposed activity will not be detrimental to the survival of the species in the wild. In their reply to our inquiry, Zimbabwe provided a copy of their CITES non-detriment finding for lions. Their finding applied to all lion exports from Zimbabwe.

Current Lion Status in Zimbabwe: When the Service listed the lion in southern and eastern Africa as threatened under the ESA, three primary threats to the species throughout its range were identified: loss of habitat, loss of prey base, and human-lion conflict. While human population growth clearly has an impact due to lose of available habitat for lions, increasing human population has a direct impact on prey base. Prey availability affects the reproduction, recruitment, and foraging behavior of lions and, as a result, strongly influences lion movements, abundance, and population viability (Winterbach et al. 2012, as cited in USFWS 2015). Lion densities are directly dependent on prey biomass (Hayward et al. 2007). Outside of protected areas, the lion's prey base is much reduced (du Preez et al. 2016); inadequate management and law enforcement has led to poaching of the lion's prey base in Africa for bushmeat, which has been critically depleted (USFWS 2015). Population trends across eastern and southern Africa show that most prey species have declined in recent years, and for Zimbabwe droughts have been a critical factor (ZPWMA 2016). A reduced prey base results in a relatively greater chance of lions encountering livestock (du Preez et al. 2016). While actual losses of livestock to predators may be relatively low, the perceived financial cost to farmers can be high, and lions are persecuted intensely in livestock areas as a consequence. Their scavenging behavior makes them particularly vulnerable to the practice of lacing prey carcasses with poison to eliminate predators (CITES 2016). Co-existence of lions and people is promoted through giving value to lions, through tourism and hunting in CAMPFIRE areas (ZPWMA 2014). The threat to lions from habitat loss is especially present in Sebungwe and the South East Low Veld where the fragmented nature of the protected areas is compounded by increasing human and livestock populations surrounding these areas (ZPWMA 2016).

According to the Service's CoP17 *Consideration of Proposals for Amendment of Appendices I and II*, international trade in lion products is emerging as an additional threat; however, the relative extent to which this threat has contributed to lion population declines is difficult to evaluate accurately (CITES 2016). According to ZPWMA (2016), the illegal local and international trade in lions and their products poses an insignificant risk to the species in Zimbabwe, as there are no records of people found in possession of illegally acquired lion specimens in Zimbabwe. It is not clear what the level of legal trade, if any, occurs within Zimbabwe.

The bulk of Zimbabwe's wildlife occurs within the Parks Estate which includes 11 national parks, 16 safari areas, 16 recreational parks, 6 sanctuaries, 12 botanical reserves and 3 botanical gardens, all spread across the country (Parks and Wildlife Act 2001 Chapter 20:14). Wildlife populations

also occur on the state Forest Areas, Communal CAMPFIRE areas and private conservancies dedicated to wildlife-based land use. According to ZPWMA (ZPWMA 2016), there are approximately 319,317 km^2 of land where some form of wildlife based land use is practiced in Zimbabwe. Lions occur permanently in 45% of this available range (c. 145,00km^2), with the majority occurring in national parks (96% of the all national parks) and safari areas (92% of all safari areas). Lions also occur permanently in 47% of the State forest areas and 66% of privately owned conservancies. The CAMPFIRE areas comprise approximately 247,000km^2 and lions occur in 36% of these areas. Lion are transient in CAMPFIRE, conservancy and resettled areas adjacent to the major protected areas, and move across the border into Zambia, Mozambique, South Africa, and Botswana.

Zimbabwe's main lion range includes the Hwange-Matetsi Ecosystem, Mid Zambezi Valley, Sebungwe, and South East Lowveld. The lion population estimates in Zimbabwe are determined primarily through carnivore spoor surveys, systematic lion collaring, and call-up surveys. According to ZPWMA's *Conservation Status of the African lion (Panthera leo) in Zimbabwe* July 2014 report, starting in 2015, lion spoor surveys will be done at two-year intervals in all wildlife areas, and lion call-up surveys will be done every three years in all major lion areas (ZPWMA 2014). The Service has not received confirmation that these surveys have been conducted since 2015.

ZPWMA (ZPWMA 2016) has estimated that the minimum number of lions that occur on approximately 51,642km^2 of land where reliable survey data are available is approximately 1,900 (range 1,800 – 2,000). The western portion of the country, consisting primarily of Hwange National Park and the surrounding safari areas, forest areas, communal areas and private conservancies, supports approximately 737 lions (or 38% of the overall population). The southern portion of the country, dominated by the two major conservancies (Save and Bubye) and Gonarezhou National Park supports approximately 896 lions (48%). These numbers are supported by several studies. Groom et al. 2014 used call-up surveys to obtain direct estimates of the lion population within Gonarezhou National Park and compared actual lion densities with potential density estimates. In this study, while lions were only seen at five percent of calling stations, this equated to a population estimate of 33 lions, which is consistent with spoor survey results conducted in June 2010 (Groom et al. 2014). A 2015 spoor count survey of Gonarezhou National Park revealed an estimated 125 lions within the park (ZPWMA 2016). From 2007 to present, annual track index surveys at the SVC have been conducted using a standardized methodology (Groom and Watermeyer 2015, as cited in du Preez et al. 2016). Prey availability models suggest that the carrying capacity for this lion population is approximately 271 lions (Hayward et al. 2007). In 2015, the estimated population was 284 lions (du Preez et al. 2016). The Rifa Safari Area was surveyed using camera trapping and spoor counts in 2015, which supported an estimated population of 68 lions. The central and northern portions of the country reportedly support an estimated population of 284 lions (15%). The 12-year (2000-2011) average lion density per 100km^2 is 2.8 in Hwange National Park, 6.0 for South Eastern Lowveld in the SVC, 9.0 in Malilangwe, and 0.8 in Gonarezhou National Park (ZPWMA Annual Report 2013, as cited in ZPWMA 2014).

To manage any population to ensure an appropriate population level and determine whether sport hunting is having a positive effect, it is vital to have sufficient data on population numbers and population trends on which to base management decisions. According to Riggio et al. 2013 (pg.32), and Bjorklund in Riggio et al 2013 (p.32), the minimum number estimated to constitute a viable population is 500 individuals. Hwange National Park, with an estimated population of 559, is the

only area within Zimbabwe that has a viable population as laid out by Riggio et al. 2013. However, the two regions that make up the largest percentage of the country's lion population (Western 38% and Southern 48%) have regional populations of 737 and 896, respectively. The areas within the Central and Northern regions of Zimbabwe, albeit smaller, encompass parks that are part of Transfrontier Conservation Areas, such as the Mana Pools region.

Lion Management in Zimbabwe: In response to discussions surrounding a possible up-listing of lion to Appendix I under CITES at the 13th Meeting of the Conference of the Parties (CoP13), and subsequent workshops involving lion range states, IUCN, ZPWMA, and other key stakeholders held a workshop to develop the *Conservation Strategy and Action Plan for the Lion (Panthera leo) in Zimbabwe* which was published by ZPWMA in 2006. The plan responds to regional and international standards set by Treaties such as CITES and the Convention on Biological Diversity (CBD), among others. The plan states, "it will guide the conservation and management of this top predator" which "addresses the needs of th[e] country." The Service is not aware of any additional or updated iterations of the plan since 2006; however, in their 2016 response, *Enhancement and Non-Detrimental Findings for Panthera leo in Zimbabwe*, ZPWMA provides updates on the each of the outputs and respective targets established under the 2006 *Conservation Strategy and Action Plan for the Lion (Panthera leo) in Zimbabwe* (ZPWMA 2016).

The 2006 plan identifies a vision that "…lions should be conserved and managed sustainably for their aesthetic, cultural, and ecological values, and the socio-economic development of Zimbabwe." The plan lays out three broad targets to achieve this objective:

- Ensure the persistence of key lion populations and other important populations including those of doubtful viability.
- Human and livestock loss reduced.
- Optimize wildlife conservation-related net benefits to local communities.

All three targets are stepped down to seven specific outputs with their own targets and activities to meet such targets. Although the plan does not identify a time period, some activities do, of which a period of 5 years is the most common. In response to inquiries from the Service, ZPWMA provided a summary of the progress made to implement the 2006 strategy.

While all three of the broad targets appear to serve a valuable role in lion management in Zimbabwe, three of the specific outputs are most relevant to determining if the implementation of the strategy enhances the propagation or survival of the species, as required by the ESA for the issuance of import permits. The first output, "lion populations, their habitats and wild prey effectively conserved and managed in collaboration with local stakeholders" has been broken down into a number of targets: establish a baseline survey and monitoring program; maintain and strengthen capacity for lion conservation, management, monitoring and research; identify and implement best management standards and practices for the hunting program; develop and implement co-management frameworks; and expand the geographic distribution range of lions. According to ZPWMA (2016), baseline surveys have been completed for the Parks Estate using monitoring protocols for key variables (populations, habitats, prey), and selected surveys have been undertaken in areas outside National Parks. Active carnivore research programs conducted by NGOs and research institutions, such as WildCRU, are taking place in various parts of the country; in addition, personnel have been trained in data collection and capture, management, lion aging and analysis. Adaptive age-based criteria for male trophy animals are in place and functioning. The

quota for a certain year is determined by a point system based off the hunts from the previous season. Therefore, ZPWMA is actively working toward meeting the target areas for this output.

The second output, "human-lion related conflicts minimized and, where possible, eliminated" has also been broken down into a number of targets: develop and establish databases on lion-human conflicts; Identify and implement methods to reduce and mitigate livestock losses and lion attacks on humans; and train and properly staff problem animal control (PAC) units to conduct rapid response and precisely target problem animals. According to information from ZPWMA (2016), approaches to mitigate livestock losses and lion attacks on humans are in the process of being tested and implemented in Hwange and methods to mitigate lion attacks on livestock are being implemented as appropriate at selected sites (e.g. Tsholotshe). Data on PAC reports for lion-related problems have been collated, and PAC units at ZPWMA field station and/or RDC levels have been partially established. In Matusadona, Hwange, and Gonarezhou regions, specific awareness and education packages on lion conservation and management have been developed and implemented. The information submitted in the ZPWMA update suggests that they have met one target, and are in the process of implementing the remaining two.

The third output, "(t)he costs and benefits of long-term lion management equitably distributed," is a socio-economic output to establish agreement and implementation of area-specific lion management plans with identified stakeholders in each wildlife region, and implement a transparent mechanism to equitably distribute lion-related income to identified stakeholders." The specific targets for this output are: complete an inventory of stakeholders directly affected by lion conservation, deliver appropriate training and capacity building to prioritized stakeholders, agree to and implement collaboratively developed area-specific lion management plans with identified stakeholder groups in each wildlife region within 5 years, and implement transparent mechanisms to equitably distribute lion-related/generated income to identified stakeholders (groups and/or communities). Current information from ZPWMA shows that they have identified key stakeholders and assessed the financial impacts of lion conservation and the magnitude of socio-economic impacts on each stakeholder group. Limited training has been undertaken for representative stakeholders in Hwange, Matusadona, and Gonarezhou. ZPWMA has also implemented an adaptive management program across four wildlife regions and are in the progress of developing and implementing area-specific lion management plans with identified stakeholder groups. According to ZPWMA, a Management Plan for Hwange has been approved. However, the Service does not have a copy of this plan. With these updates, ZPWMA has made progress toward this output's targets.

The strategy also identifies roles and responsibilities for a number of players in Zimbabwe's lion conservation efforts. According to the strategy, there is a national lion coordinator that is to coordinate all national activities on lion conservation, research, and management including census surveys, setting up monitoring needs and coordinating data on human-lion conflicts. The strategy goes on to identify roles for the field stations, wardens, ecologists and utilization units, which are responsible for ensuring compliance with hunting regulations and maintaining safari-hunting databases. In addition, the strategy identifies roles for CAMPFIRE, safari operators, and professional hunters to facilitate training and ensure compliance with hunting regulations.

The Conservation Strategy and Action Plan for the Lion in Zimbabwe (ZPWMA 2006) borrows language from the *IUCN SSC Conservation Strategy* (2006). It iterates areas in need of improvement regarding lion conservation in Zimbabwe, including standardized lion census methods and surveys, further mitigating human-lion conflicts, and maximizing benefits for rural

communities that live with lions. ZPWMA (2006) notes their intention to review and put in place criteria for age-based identification of male trophy animals, but do not mention if they will be reviewing possible combination strategies. As part of the 2006 lion conservation strategy for eastern and southern Africa, six objectives were established to secure and restore sustainable lion populations, which were housed under the following categories: management, mitigation, socio-economics, policy and land-use, politics, and trade. The strategy was intended to be implemented within 10 years (Macdonald 2016), and Zimbabwe gave an update on progress regarding these objectives in their *Enhancement and Non-Detrimental Findings for Panthera leo in Zimbabwe* (ZPWMA 2016) that also addressed outputs and targets laid out in their 2006 action plan.

Additionally, to mitigate human-lion conflict, the "Long Shields Guardian Programme" was initiated whereby communities are notified of movements of collared lions into their areas via cell phone, and then have the opportunity to take appropriate action, such as moving cattle. In 2013 alone, 1,850 warnings were passed to the "Long Shields." These actions may reduce the incidents of lions marauding livestock; however, retaliatory killing of lions still occur. Further, as is policy under The Parks and Wildlife Act of 2001, any lions that attack humans or livestock will be lethally eliminated (ZPWMA 2016). Between 2007 and 2013 a total of 1,113 conflict incidents were recorded in the Hwange area in which 915 head of stock were lost to lions.

Hunting and Utilization: Lions are infamously infanticidal (Schaller 1972, as cited in du Preez et al. 2016), which is often used as an argument against sport-hunting of the species (e.g. Packer et al. 2011), where it is feared that the removal of dominant males causes cub mortality that eventually results in lowered population recruitment and survival (Packer et al. 2009). Infanticide, however, may be less of an issue in terms of sport-hunting if age-appropriate males, past their prime and no longer territorial or with dependent cubs, are harvested (Whitman et al. 2004).

The minimum number of lions that occur in approximately 51,642km^2 of land in Zimbabwe, where reliable survey data are available, is estimated to be 1,917 (range 1,800 – 2,000), the majority of which occur in western and southern Zimbabwe. When taking this population estimate into consideration, trophy hunting harvests average 2.7% of adult male lions annually. This percentage has decreased since the establishment of age restrictions on lion hunting (ZPWMA 2016).

Trophy hunting of wildlife is permitted in safari areas, of which there are 16 in Zimbabwe (ZPWMA 2014). According to the Forest Act, Chapter 19:05, there are 24 gazetted indigenous forest areas in Zimbabwe; within these forest areas, lions may be hunted in the following forests: Fuller, Kazuma, Pandamasuwe, Ngamo, Sikumi, Gwayi, Sijarira, and Gwampa (ZPWMA 2014). In 2013, an adaptive quota management system for lion hunting based on the ages of lions hunted was agreed to in Harare, Zimbabwe, during a meeting hosted by ZPWMA and an independent non-governmental conservation organization (du Preez et al. 2016). After reviewing aging techniques, attendees at the July 2013 meeting in Harare, Zimbabwe, were confident that hunters could be expected to categorize lions as being below or above five years of age. In determining quotas for the following years, operators would be rewarded with increased quotas if they hunted animals of six years or older, would not be penalized if they hunted animals five years of age, but would have quotas cut if they hunted animals younger than five years old or if they failed to complete hunt returns (ZPWMA and Panthera 2014). In 2013, only 28% of lions hunted were five years old or older. In 2015, that figure rose to 77.3% (ZPWMA 2016). According to Hunter et al. (2013), an adaptive quota management system utilizing age-based criteria would not only aid in the prevention of over-harvesting lions, but would also prevent excessively conservative quotas. Further,

according to Miller et al. (2016), results indicate that age-based hunting is feasible for sustainably managing threatened and economically significant species such as the lion, but must be guided by rigorous training, strict monitoring of compliance and error, and conservative quotas. No single trait can be relied upon exclusively to precisely age lions. Rather, multiple traits must be examined in combination to cross-validate an individual's age and, according to Whitman et al. (2004), restricting hunting to individuals that are at least six years old is desirable from a biological perspective due to the reduced risk of the loss of pride males and infanticide of cubs associated with the harvest of such individuals (Whitman et al. 2004).

During 2013, operators were requested to submit hunt returns and photos as a trial run to get the adaptive quota system up and running. In 2014, operators were requested to do the same but were informed that the age of the lions hunted in 2014 would determine their lion quotas in 2015 (du Preez et al. 2016). In 2015, there was a marked increase in the age of lions hunted in Zimbabwe as a whole. The majority of lions hunted were on the cusp of 5-6 years of age but were not older than six years. National hunting offtakes for lions in Zimbabwe from 2013 to 2015 were 29, 42, and 47 respectively (Masterson 2016). It appears these do not include illegal forms of hunting offtake.

Previously, Zimbabwe set quotas for the hunting of female lions. Between 1998 and 2004, Zimbabwe maintained a mean quota of $0.3 \pm 0.1/100$ km^2 for female lions; during the same period, actual offtake was lower at $0.08 \pm 0.1/100$ km^2, or a mean of 30.6 percent of the quota actually harvested (Loveridge et al. 2007). However, females are the most productive portion of a population; if they are removed from a pride, there is inherent risk that dependent cubs will die and the overall breeding success of the pride will be reduced. Zimbabwe discontinued issuing quotas for female lions in 2011 (USFWS 2015). In 2011, Zimbabwe's quota was set at 101 lions; in 2014, it was reduced to 50 male lions following the implementation of age restrictions (Henschel 2015, pers. comm., as cited in USFWS 2015).

In setting adaptive lion quotas, Zimbabwe uses scientific information including spoor surveys, camera traps, and ranger-based sighting. In CAMPFIRE areas, incidences of human-lion conflict are also taken into consideration where survey information is not readily available, when determining quotas for those areas (ZPWMA 2014). The quota setting process involves all stakeholders, including the ZPWMA, landowners, safari operators, and CAMPFIRE managers and their representatives. During the annual quota-setting workshop, presentations are made by the proponents who then make proposals for quotas. Where it is felt that not enough information has been presented, however, a precautionary quota will still be issued (ZPWMA 2014). The Service is not aware of how precautionary quotas are treated after they are issued, or if there is a protocol for obtaining necessary information when a precautionary quota is put in place.

ZPWMA (2016) mentions seven concessions that are leased on five-year terms, and how these concessionaires pay a five-year "right to lease" fee, annual rental, fixed quota fee (payable if animals are shot or not) and a supplementary quota fee that allows additional animals to be bought as needed. It is unclear to what extent Zimbabwe still utilizes fixed quotas, as du Preez et al. claims fixed quotas are no longer being used by Zimbabwe, but a fixed quota fee is mentioned in ZPWMA (2016). It is also unclear how many animals concessionaires are able to "buy as needed," and how such requests may be accommodated without going over the national quota (ZPWMA 2016).

Between 1999 and 2004, data were collected in and around Hwange National Park that suggested that hunting surrounding the park was having a negative impact on the lion population. Therefore,

sport hunting of lions was suspended in the area surrounding the park between 2005 and 2009. Following the lifting of the moratorium, and by implementing stricter monitoring and hunting guidelines through the Hwange Lion Research Project, the overall Hwange lion population has continued to show a positive trend, and is now estimated at over 550 animals (ZPWMA 2015).

CAMPFIRE is the program through which the Zimbabwean Government has developed the management of wildlife resources to communal farmers. As of July 2014, there are at least 58 Rural Districts that have been granted the Appropriate Authority status to manage wildlife resources in their areas; however, according to *Enhancement and Non-Detrimental Findings for Panthera leo in Zimbabwe* (ZPWMA 2016), only 16 are actively engaged in some form of wildlife-based land use (ZPWMA 2016). Lions are found in communal areas that are adjacent to major protected areas, and lion hunting is allowed in CAMPFIRE districts (ZPWMA 2014). According to EcoWeb (2015), all income generated by trophy hunting in CAMPFIRE areas was distributed to communities (52%, when they are typically prescribed 55%), rural district councils (RDCs) (44%, when they are typically prescribed 41%), and the CAMPFIRE association (4%). Communities, rather than dividing income by households, typically invest in projects that benefit the communities as a whole, such as schools, clinics, and grinding mills. Councils use funding for patrols, monitoring of hunts, problem animal control, water, and fire management, while the CAMPFIRE association uses their funding to cover administrative costs and representation of the program (EcoWeb 2015).

As agreed upon at the 2013 lion management meeting in Harare, the CAMPFIRE areas in which lions occur are currently exempted from the age restrictions. This approach was adopted as a means of ensuring that impoverished communities obtain the opportunity to benefit from the presence of lions, recognizing the potential negative impacts the species has on the livelihoods of livestock farmers (ZPWMA 2016). According ZWPMA's 2016 response, between 2010 and 2015, lions accounted for 2% of the total income generated from hunts conducted on CAMPFIRE lands and trophy fees accounted for 74% of the total funds generated for CAMPFIRE. Further, U.S. hunters accounted for 51% of the funds generated from hunting in CAMPFIRE areas during the same period. While hunting is allowed in CAMPFIRE areas, it is unclear if American sport hunters conduct lion hunts in these areas; if so, the Service is not aware if sport hunters are exempted from the age restriction in this case, and how this exemption in CAMPFIRE areas is taken into consideration when setting quotas for other portions of the country.

According to the Revised CAMPFIRE Revenue Sharing Guidelines, which were incorporated into the Constitution of the CAMPFIRE Association in 2007, at least 55% of generated revenue from hunting should be devolved to producer communities, no more than 26%, and 15% for management and overhead at RDC level, respectively, and 4% as a levy to the CAMPFIRE Association. According to an undated document (but presumably produced in late 2014, since it references data from 2014 but does not include any references to 2015 data) produced by CAMPFIRE (CAMPFIRE report undated) at least 10 RDCs comply with the Revenue Guidelines.

According to *The Role of Trophy Hunting of Elephant in Support of the Zimbabwe CAMPFIRE Program – December 2016*, a report the Service received on December 17, 2016, the Reserve Bank of Zimbabwe, in collaboration with relevant stakeholders, has established the Tourism Receipts Accounting System (TRAS) that required all outfitters to submit returns listing the revenue generated for hunting activities. This system has been in place for several years, but required manual analysis of the data to extract information on hunting revenue. In January 2015, to account

fully for earnings in the hunting sector, the Reserve Bank of Zimbabwe, in collaboration with relevant stakeholders, introduced the Tourism Receipts Accounting System (TRAS2) a web-based system (TRAS2) that links Safari Operators, ZPWMA Authority, Taxidermists, Shipping Agents, International Marketing Agents, and Reserve Bank. Under this system, all authorized hunts are registered, allowing for the capture of hunting data, such as the origin of clients, value of trophies and hunts, and area hunted, to monitor hunting quota utilization and track hunted trophies. According to the December 2016 report, the Exchange Control Division of the Reserve Bank of Zimbabwe and the ZPWMA are now able to:

1. Assess regional price differentials of similar hunts and the reasons thereof;
2. Present TRAS2 system updates and reports to the users, including international marketing agents;
3. Engage with international marketing agents of sport hunting;
4. Obtain relevant insights on governing of the hunting sector; and
5. Come up with an effective mechanism to fully account for export proceeds from the hunting sector.

The TRAS2 information was utilized in *Enhancement and Non-Detrimental Findings for Panthera leo in Zimbabwe* (ZPWMA 2016) to provide a breakdown of the source of hunting income, and the amount of funds generated by trophy fees by land category, among other insights, and has proven the TRAS2 system's ability to obtain relevant insights on governing of the hunting sector.

Evaluation:

As stated earlier, the Service will evaluate any application in accordance with our threatened species permitting regulations at 50 CFR 17.32 and issuance criteria for threatened species permits (50 CFR 17.32(a)(2)). In evaluating each of these criteria based on information available to the Service, we have been able to determine that sport-hunted lion trophies taken in 2016 and 2017 would qualify for the issuance of the required import permit.

17.32(a)(2)(i): Whether the purpose for which the permit is required is adequate to justify removing from the wild or otherwise changing the status of the wildlife sought to be covered by the permit:

Zimbabwe's lion hunting industry generated 9% of all sport hunting revenue in 2015; 51% was contributed by U.S. hunters during 2010-2015 country-wide, and 90% of the sport-hunting market in BVC and SVC during 2005-2015. Based on the information available to the Service, the participation of communities in CAMPFIRE has heralded a reversal in wildlife declines on private land. When the benefits of CAMPFIRE were extended to RDCs, it further aided in the equitable distribution of benefits from trophy hunting to local communities, which incentivizes them to conserve the African lion. In the case of SVC, without the hunting industry, these wildlife areas, which have become conservation havens in the threat of human encroachment across much of Zimbabwe, would not be economically viable, and therefore would not exist.

There was conflicting information presented to the Service on how many lions were included in the quota in 2015. du Preez et al. (2016) reports a national lion hunting quota of 85 with 39 hunted;

ZPWMA (2016) reports that the national lion hunting quota in 2015 was 82 lions, with 49 hunted. When evaluating the lower quota with higher utilization reported by ZPWMA (2016), and taking into consideration the land area of the Parks Estate alone, Zimbabwe did not exceed the best management practice of 0.5 lions/1,000 km^2; the 2015 offtake would have accounted for 0.125 lions/1,000 km^2.

Zimbabwe also has taken into consideration other best management practices, including age-based criteria for an adaptive management strategy, and takes past performance of hunting organizations into consideration when determining future quotas.

Further, sport hunting was essential for the successful transition of SVC from cattle to wildlife (du Preez et al. 2016), in that it provided monetary benefits for the conservation of lions and local communities. BVC donates over 45 tons of meat from sport hunting to the local communities each year. This meat donation is worth over USD100,000 per year. BVC also supports several schools, clinics, and community projects in the three surrounding districts of Mwenezi, Maranda, and Jopempe. The local community sees a direct benefit from the wildlife in BVC, but is also empowered by job opportunities created both with these community projects, as well as on BVC (du Preez et al. 2016).

While Zimbabwe's hunting industry generated approximately 8 million in 2015, not all of this is connected to lion hunting or to U.S. hunters. However, lions are a key component of the hunting industry since they are part of the "Big 5" trophies and draw U.S. hunters to Zimbabwe. Based on the information available to the Service, the funds generated by hunting trophies contribute to the ZPWMA's ability to manage the country's lion populations as well as the success of CAMPFIRE. It appears that without the hunting industry, it would not be economically viable to maintain lions. Although U.S. hunter participation in lion hunts is not enough to make or break the industry, U.S. hunters have played a significant role in the industry in Zimbabwe, previously making up 51% of all hunting in Zimbabwe and 72% of lion hunts within the country. As such, the removal of their participation could have a long-term negative impact.

Further, through the *Strategy and Action Plan,* Zimbabwe has put into place mechanisms to adequately oversee the harvest of lions in Zimbabwe. With an annual harvest of approximately 85 lions, Zimbabwe is not exceeding the limits identified of 0.5 lions/1,000 sq. km. The objectives of the *Strategy and Action Plan* and the actions and monitoring activities that have been put into place to achieve these objectives should support the adaptive management approach that Zimbabwe has established for managing lions. The Service will continue to monitor the effectiveness of the Strategy and Action Plan, and revise our finding as appropriate.

Therefore, based on the information available to the Service. and provided that the reserve where the lion was taken was properly permitted and in compliance with national and local regulations, the purpose for which a permit being requested is adequate to justify removing lions from the wild or otherwise changing their status.

17.32(a)(2)(ii): <u>The probable direct and indirect effect that issuing the permit would have on the wild populations of the wildlife sought to be covered by the permit</u>:

The total area under wildlife-based land use and conservation in Zimbabwe amounts to 10.7 million hectares, and represents 27% of the total surface area of the country. Of this, 7.9 million

hectares, or 75% of all conservation land in the country, falls under safari hunting as the primary or only source of revenue. With the CAMPFIRE program, private landholders and RDCs are given the opportunity to benefit from the wildlife on their land, including lion, and incentivize them to conserve the species. Sport hunting of lions by U.S. hunters supports the programs in Zimbabwe that provide the opportunity for locals to see value in lions, which in turn conserve the species in the long-term.

A scientifically based quota is the number of a given species that can be removed from a specific population without damaging the biological integrity and sustainability of that population (WWF 1997). However, full implementation and enforcement of the age-based strategy could potentially cause the need for quotas to become irrelevant or eliminated (USFWS 2015). Age restrictions will naturally restrict offtake to a limited number of individuals that meet the age criteria (Loveridge et al. 2007, Whitman et al. 2004).

Based on the information provided to the Service, it is clear that Zimbabwe has made strides in their management of their lion populations. Although prior to 2011, Zimbabwe allowed the hunting of lionesses and males under 5 years old, they made significant changes to ensure their hunting program is sustainable. In 2011, Zimbabwe restricted the hunting of female lions. In 2013, they proposed an adaptive age-based quota-setting process. In 2015, the development TRAS2 allowed the country to assess regional price differentials of similar hunts and the reasons thereof; present TRAS2 system updates and reports to the users, including international marketing agents; engage with international marketing agents of sport hunting; obtain relevant insights on governing of the hunting sector; and come up with an effective mechanism to fully account for export proceeds from the hunting sector.

According to CITES trade data and Service records, from 2011 to 2016, there were 223 lion trophies imported to the U.S. from Zimbabwe. Best practice would be to import only male lions, as pointed out by Macdonald (2016), but Zimbabwe has already taken the initiative by placing a moratorium on lioness hunting. The fixed-quota concept, in which hunting quotas had to be paid for upfront before the hunting season begins, and results in poor quality trophies and young animals being hunted, has also been abandoned (du Preez et al. 2016). Zimbabwe appears to be transparent in their implementation of the age-based adaptive management strategy (USFWS 2015). The adaptive quota management system for lion hunting based on the ages of lions hunted has been accepted and embraced by all stakeholders. This adaptive quota management system has not only led to a reduced national lion hunting quota, but has also resulted in a significant increase in the age of harvested lions to a level that is considered to have a reduced ecological impact (du Preez et al. 2016).

Between 2005 and 2015, the U.S. market has represented over 90% for the sport-hunting market in both BVC and SVC. If this market was effectively lost due to an inability of prospective clients to import their trophies, it would become unviable to continue managing BVC as a wildlife area in its current form (du Preez et al. 2016). Across all CAMPFIRE districts, from 2010 to 2015, there was a total quota of 140 lions, with actual offtake equaling 45 animals. During this same period, U.S. sport hunters apparently accounted for 51% of Zimbabwe's sport hunting clients; trophy fees represented 74% of CAMPFIRE income, of which lions play a small role. In 2015, lion sport hunting generated USD753,000 in revenue, which accounted for about 9% of all sport hunting revenue in Zimbabwe that year (ZPWMA 2016).

Evaluating the information provided by the Zimbabwe government and other sources, it appears that the hunting program in Zimbabwe is addressing the three main threats that were identified by the Service when making the determination that the species was threatened with the possibility of extinction. The hunting areas are maintaining habitat for lions and ensuring that there is no further loss, provided that the hunting areas can remain economically viable. In order to maintain a viable population of lions, the parks, safari, and CAMPFIRE areas must maintain biodiversity and a sustainable prey base. Finally, Zimbabwe is actively working to reduce human-lion conflicts and the number of lions killed in retaliation for killing livestock. Therefore, the management of lions with in Zimbabwe and the limited hunting of lions contributes to the on-going survival of the species in Zimbabwe.

Provided that the off-take of lions continues to be monitored and the actions identified in the Strategy and Action Plan continue to be implemented, the participation of U.S. hunters in lion hunts would provide an indirect benefit to wild populations by helping to support the reserves where lions are found. Therefore, based on the information available to the Service, the probable direct and indirect effect that issuing an import permit for a legally hunted lion would have on the species would be positive.

17.32(a)(2)(iii): Whether the permit, if issued, would in any way, directly or indirectly, conflict with any known program intended to enhance the survival probabilities of the population from which the wildlife sought to be covered by the permit was or would be removed:

As stated above, Zimbabwe is monitoring and controlling the harvest of lions through permitting under their regulations and through the Strategy and Action Plan. The issuance of import permits for lions legally hunted under these authorities would not conflict with any programs intended to enhance the survival probability of the species in Zimbabwe. If import permits for sport hunted lion trophies from Zimbabwe were to be issued, it would work in favor of, not against, the principal acts governing lion conservation in Zimbabwe. Furthermore, sport hunting opportunities for hunters in CAMPFIRE districts would help local communities realize the value in conserving the African lion.

Therefore, based on the information available to the Service, the issuance of import permits for legally hunted lions does not conflict with known conservation programs and rules.

17.32(a)(2)(iv): Whether the purpose for which the permit is required would be likely to reduce the threat of extinction facing the species of wildlife sought to be covered by the permit:

With limited, controlled off-take of lions in a manner that would maintain sustainability, the legal hunting activities that U.S. hunters would be involved in would contribute to reducing the threat of extinction of lions. This off-take must be monitored to ensure that it is sustainable and that, to the extent possible, normal lion behavior and ecology are not negatively impacted. It appears that the permitting activities under Zimbabwe's laws and CITES, as well as the implementation of the adaptive age-based lion quota, and a continuation of implementation of the outputs in the *Strategy and Action Plan* will ensure the long-term survival of lions. The utilization of hunters to manage the populations on the reserves is an important element of the success of lion management in Zimbabwe.

Therefore, based on the information available to the Service, the issuance of import permits for legally hunted lions does not conflict with known conservation programs and rules.

17.32(a)(2)(v): The opinions or views of scientists or other persons or organizations having expertise concerning the wildlife or other matters germane to the application:

From reviewing comments made during the listing process for lions, as well as information obtained through personal conversations and literature, there is general agreement that hunting, done properly and well managed, would not have an adverse effect on lion populations. Numerous researchers have stated that, while they may not support hunting in general, they see that benefits can be received through a scientifically based hunting program for lions.

Based on the information available to the Service, there is general support by scientists and other persons or organizations having expertise concerning lions that the legal harvest of lions, and the subsequent import of these trophies, would not have an adverse effect on the species, but would further efforts to conserve the species in the wild into the future.

17.32(a)(2)(vi): Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application:

While, over the years, ZPWMA has failed to generate adequate revenue for its operations, U.S. sport hunters play a large role in the hunting industry of Zimbabwe. The Service anticipates that by granting the importation of sport-hunted lion trophies, there would be an increase in funds provided to Zimbabwe's conservation initiatives through this program by U.S. sport hunters. ZPWMA has also been forthcoming in involving relevant stakeholders as well as independent researchers and non-governmental organizations in determining best management practices.

Therefore, based on the information available to the Service, Zimbabwe has the proper expertise, facilities, and other resources to accomplish the objectives laid out in their *Strategy and Action Plan* to enhance the propagation and survival of the species, partly through the utilization of funds generated by U.S. hunters' participation in lion hunts throughout the country.

Conclusion

Given the current status of lions within Zimbabwe and the level of management and oversight provided to them, the Service is able to find that the harvest and import of sport-hunted trophies of lions within Zimbabwe meet the purposes of the ESA. As stated earlier, each application received by the Service for the import of a sport-hunted trophy lion from Zimbabwe will be evaluated on a case-by-case basis. The applicant must have hunted on a properly licensed hunting area within Zimbabwe. The Government of Zimbabwe must continue to implement the *Strategy and Action Plan* in the manner identified in the documents. The on-going adaptive management and limited off-take of lions is important to the survival of lions in Zimbabwe and the Service will reassess lion management within Zimbabwe and whether the importation of sport-hunted trophies enhance the survival of the species at the end of the 2018 hunting season or at which time substantive information becomes available to the Service in the interim.

Although the Service is able to make a finding that the management of lions within Zimbabwe meet the enhancement criteria under the ESA, there are certain documents and data the Service needs to evaluate in order to continue our current finding past the 2018 hunting season. The Service expects to be able to review data from the 2016, 2017, and 2018 hunting seasons to assess the lion populations and ensure that management efforts are enhancing the propagation and survival of the lion within Zimbabwe. Given that Zimbabwe's last management plan for lion was produced in 2006, the Service would like to see an updated plan established. Local management plans, such as the Management Plan for Hwange National Park will be sought. Although Zimbabwe has made progress on their 2006 *Strategy and Action Plan*, the Service will seek updates on further progress of the outputs or targets not yet accomplished. Lastly, the Service will also seek an update on the quota setting process. Specially, we will need further information on the establishment and implementation of precautionary quotas.

Therefore, with the information currently available to the Service, the Service is able to make a determination that the import of lions taken in Zimbabwe in 2016, 2017 and 2018 would meet the issuance criteria under 50 CFR 17.32. In accordance with the 4(d) rule for *P. l. melanochaita*, 50 CFR 17.40(r), the Service will review each application received for import of such specimens on a case-by-case basis and each application will also need to meet all other applicable permitting requirements before it may be authorized.

REFERENCES:

Bauer, H., Packer, C., Funston, P.F., Henschel, P. & Nowell, K. 2015a. Panthera leo. The IUCN Red List of Threatened Species: e.T15951A50658092.

Bauer, H., Chapron, G., Nowell, K., Henschel, P., Funston, P., Hunter, L.T.B., Macdonald, D.W., and Packer, C. 2015b. Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas. PNAS doi: 10.1073/pnas.1500664112

Bijlsma, R., and Loeschcke, V. (2012), Genetic erosion impedes adaptive responses to stressful environments. Evolutionary Applications, 5: 117–129. doi:10.1111/j.1752-4571.2011.00214.xCAMPFIRE (2015). An Overview.

Björklund, M. Conservation Genetics (2003) 4: 515. https://doi.org/10.1023/A:1024737317695

CITES (2016). Consideration of Proposals for Amendment of Appendices I and II. Seventeenth meeting of the Conference of the Parties. Web: https://cites.org/sites/default/files/eng/cop/17/prop/060216/E-CoP17-Prop-04.pdf

Craigie, I.D., Baillie, J.E.M., Balmford, A., Carbone, C., Collen, B., Green, R.E., and Hutton, J.M. 2010. Large mammal population declines in Africa's protected areas. Biological Conservation 143(9):2221–2228.

Creel, S., M'soka, J., Dröge, E., Rosenblatt, E., Becker, M., Matandiko, W. and T. Simpamba (2016). Assessing the sustainability of African lion trophy hunting, with recommendations for policy, doi: 10.1002/eap.1377.

du Preez, B., Groom, R., Mufute, O., and R. Mandisodza-Chikerema (2016). Zimbabwe Lion Conservation Research Report 2016: Sport-Hunting and Lion *Panthera leo* Conservation in Zimbabwe.

du Preez, B., Hart, T., Loveridge, A., and D. Macdonald (2015). Impact of risk on animal behaviour and habitat transition probabilities. Animal Behaviour 100, 22-37.

EcoWeb (2015). Campfire Hunting Income and Distribution.

Elliot, N. B., Valeix, M., Macdonald, D. W. and Loveridge, A. J. (2014), Social relationships affect dispersal timing revealing a delayed infanticide in African lions. Oikos, 123: 1049–1056. doi:10.1111/oik.01266.

Fryxell, J.M., Mosser, A., Sinclair, A.R.E and Packer, C. 2007. Group formation stabilizes predator–prey dynamics. Nature 449, 1041-1043.

Groom, R. J., Funston, P. J., and R. Mandisodza (2014). Surveys of lions *Panthera leo* in protected areas in Zimbabwe yield disturbing results: what is driving the population collapse? Oryx, 48(3): 385-393.

Hayward, M.W., O'Brien, J., and Kerley, G.I.H. 2007. Carrying capacity of large African predators: Predictions and tests. Biological Conservation 139(1):219–229.

Hunter, L., Lindsey, P., Balme, G., Becker, M., Begg, C., Brink, H., Chardonnet, P., Dickman, A., Edwards, C., Frank, L., Funston, P., Henschel, P., Ikanda, D., Kissui, B., Loveridge, A., Mesochina, P., Midlane, N., White, P., and Whitman-Gelatt, K. 2013. Urgent and Comprehensive Reform of Trophy Hunting of lions is a Better Option than an Endangered Listing; A Science-based Consensus.

IUCN Species Survival Commission (2012). Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0. IUCN SSC 2012.

IUCN SSC Cat Specialist Group (IUCN SSC) (2006). Conservation Strategy for the Lion *Panthera leo* in Eastern and Southern Africa.

Lindsey, P.A., Balme, G., Becker, M., Begg, C., Bento, C., Bocchino, C., Dickman, A., Diggle, R.W., Eves, H., Henschel, P., Lewis, D., Marnewick, K., Mattheus, J., McNutt, J.W., McRobb, R., Midlane, N., Milanzi, J., Morley, R., Murphree, M., Opyene, V., Phadima, J., Purchase, G., Rentsch, D., Roche, C., Shaw, J., Van der Westhuizen, H.,Van Vliet, N. and Zisadza-Gandiwa, P. 2013a. The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. Biological Conservation 160: 80-96.

Lindsey, P., Balme, G.A., Funston, P., Henschel, P., Hunter, L., Madzikanda, H., ... & Nyirenda, V. (2013b). The trophy hunting of African lions: scale, current management practices and factors undermining sustainability. PloS One 8(9), e73808.

Lindsey PA, Balme GA, Booth VR, Midlane N (2012). The Significance of African Lions for the Financial Viability of Trophy Hunting and the Maintenance of Wild Land. PloS One 7(1): e29332. https://doi.org/10.1371/journal.pone.0029332.

A. J. Loveridge, A. W. Searle, F. Murindagomo, et al. (2007). The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation, 134 (4), 548-558.

Macdonald, D. (2016). Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting.

Masterson, C. (2016). Position Statement: The Role of Hunting in Biodiversity Conservation and Livelihood Resilience in Zimbabwe.

Miller, J. et al. (2016). Aging traits and sustainable trophy hunting of African lions. Biological Conservation 201: 160-168.

Muller, L. (2016). Rifa Safari Area – Pro Safaris Africa.

Mutiga, Murithi (2016). Zimbabwe plans to sell elephants and lions to China to fund conservation. The Guardian. Web: https://www.theguardian.com/environment/2016/jan/06/zimbabwe-plans-to-sell-elephants-and-lions-to-china-to-fund-conservation.

Newmark, W. D. (2008). Isolation of African protected areas. Frontiers in Ecology and the Environment, 6: 321–328. doi:10.1890/070003.

Packer, C., Canney, S., Loveridge, A., Garnett, S.T., Zander, K.K., Balme, G., Bauer, H., Begg, C., Begg, K., Bhalla, S., Bonham, R., Brink, H., Burton, C., Caro, T.M., Clegg, B., Dloniak, S., Frank, L., Funston, P., Groom, R., Heath, B., Hill, T., Hunter, L., Delongh, H.H., Joubert, D., Kissui, B., Knocker, W., Leatham, B., Lindsey, P.A., Maclennan, S.D., MacNutt, T., Nicholls, K., Patterson, B., Plumptre, A., Salerno, J., Slotow, R., Sogbohossou, E., Stratford, K., Winterbach, C., Winterbach, H. and Polasky, S. 2013. Conserving large carnivores: dollars and fence. Ecology Letters 16(5): 635-641. DOI: 10.1111/ele.12091.

Packer, C., Brink, H., Kissui, B. M., Maliti, H., Kushnir, H. and Caro, T. (2011). Effects of Trophy Hunting on Lion and Leopard Populations in Tanzania. Conservation Biology, 25: 142–153. doi:10.1111/j.1523-1739.2010.01576.x

Packer, C., Whitman, K. Loveridge, A., Jackson III, J., and Funston, P. 2006. Impacts of Trophy Hunting on Lions in Eastern and Southern Africa: Recent Offtake and Future Recommendations. East and Southern African Lion Conservation Workshop Johannesburg, South Africa, 8-13 January 2006.

Packer, C., Pusey, A. E., Rowley, H., Gilbert, D. A., Martenson, J. and O'Brien, S. J. (1991). Case Study of a Population Bottleneck: Lions of the Ngorongoro Crater. Conservation Biology, 5: 219–230. doi:10.1111/j.1523-1739.1991.tb00127.x

Segelbacher, G., Cushman, S., Epperson, B., Fortin, M., Francois, O., Hardy, O., Holderegger, R., Taberlet, P., Waits, L., and S. Manel (2010). Applications of landscape genetics in conservation biology: concepts and challenges. Conservation Genetics (2010) 11:375-385.

Snyman. Lion (*Panthera leo*) social organization in a human affected landscape. 2010.

Traill, L., Brook, B., Frankham, R., Bradshaw, C. (2010). Pragmatic population viability targets in a rapidly changing world, Biological Conservation, Volume 143, Issue 1, 2010, Pages 28-34, ISSN 0006-3207, http://dx.doi.org/10.1016/j.biocon.2009.09.001.

USFWS (2015). Final ESA listing rule for *Panthera leo leo* and *P. l. melanochaita.* 80 Fed. Reg. 79999.

Whitman, K., Starfield, A., Quadling, H. and C. Packer (2004). Sustainable trophy hunting of African lions. 2004. NATURE(428): 175-178.

WildCRU (2015). Mana Pools National Park Predator Survey.

World Wildlife Fund (WWF) (1997). Quota Setting Manual: Wildlife Management Series.

Zimbabwe Parks and Wildlife Management Authority (ZPWMA) (2006). Conservation Strategy and Action Plan for the Lion (*Panthera leo*) in Zimbabwe.

Zimbabwe Parks & Wildlife (ZPWMA) and Panthera (2014). Age Restrictions of Lion Trophies and the Adaptive Management of Lion Quotas in Zimbabwe.

Zimbabwe Parks and Wildlife Management Authority (ZPWMA) (2014). Conservation Status of the African Lion (*Panthera leo*) in Zimbabwe.

Zimbabwe Parks and Wildlife Management Authority (ZPWMA) (2015). Budget Estimates for the Year 2015.

Zimbabwe Parks and Wildlife Management Authority (ZPWMA) (2016). Enhancement and Non-Detriment Findings for Panthera leo in Zimbabwe.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
International Affairs
5275 Leesburg Pike, MS: IA
Falls Church, VA 22041-3803

In Reply Refer To:
FWS/AIA/DMA

OCT 18 2017

Memorandum

To: The File

From: Chief, Branch of Permits

Subject: Enhancement for Lions Taken as Sport-hunted Trophies in Zambia – 2016, 2017, and 2018 Calendar Years.

After evaluating the available information from the Government of Zambia, other information available to the U.S. Fish and Wildlife Service (Service), and comments received from interested parties, the Service has determined that permits for the importation of sport-hunted trophies of wild lions (*Panthera leo melanochaita*), which are threatened under the ESA, taken in Zambia during the 2016, 2017, and 2018 calendar years **meet** the enhancement criteria under the Service's regulations at 50 CFR 17.32. Therefore, applications received for import of such specimens will be considered to have met this requirement. In accordance with the 4(d) rule for *P. l. melanochaita*, 50 CFR 17.40(r), the Service will review each application for import of such specimens on a case-by-case basis and each application will also need to meet all other applicable permitting requirements before it may be authorized. The Service will reassess the situation in Zambia towards the end of the 2018 season to determine if hunts conducted in 2019 and beyond continue to meet the enhancement criteria under 50 CFR 17.32.

Governance of the Lion in the United States:

On October 29, 2014, the Service published in the Federal Register a finding that listing the African lion subspecies (*Panthera leo leo*) as a threatened species under the ESA was warranted and proposed a rule under section 4(d) of the ESA to provide conservation measures for the African lion. 79 Fed. Reg. 64472. On December 23, 2015, after fully considering the comments from the public and the peer reviewers on the proposed rule, the Service published in the Federal Register the final rule in which the taxonomic classification of the Asiatic lion (previously classified as *P. l. persica* and listed as an endangered species under the ESA) was changed to *P.*

l. leo (Asia and western, central and northern Africa) and listed as an endangered species, and the *P. l. melanochaita* (southern and eastern Africa) subspecies was listed as a threatened species with a rule under section 4(d) of the ESA, which is set forth at 50 CFR 17.40(r) (USFWS 2015; 80 Fed. Reg. 79999). The effective date of this listing is January 22, 2016. Therefore, as of January 22, 2016, the lion subspecies *Panthera leo melanochaita*, whose range includes Zambia, is listed as threatened under the ESA and is regulated under section 4(d) special rule [50 CFR 17.40(r)].

Section 9 of the ESA and our implementing regulations at 50 CFR 17.21 and 50 CFR 17.31 set forth a series of general prohibitions that apply to all endangered and threatened wildlife, respectively, except where a 4(d) rule applies to threatened wildlife, in which case the 4(d) rule contains all the applicable prohibitions and exceptions. Under the 4(d) rule for *P. l. melanochaita*, all of the prohibitions under 50 CFR 17.31 apply to *P. l. melanochaita* specimens. These prohibitions, at 50 CFR 17.21 and 17.31, in part, make it illegal for any person subject to the jurisdiction of the United States to "take" (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or to attempt any of these) within the United States or upon the high seas; import or export; deliver, receive, carry, transport, or ship in interstate or foreign commerce, by any means whatsoever, in the course of commercial activity; or sell or offer for sale in interstate or foreign commerce any lion specimens. It also is illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken in violation of the ESA. Permits may be issued to carry out otherwise prohibited activities involving endangered and threatened wildlife species under certain circumstances. Regulations governing permits for endangered species, such as *P. l. leo*, are codified at 50 CFR 17.22. Regulations governing permits for threatened species, such as *P. l. melanochaita*, are codified at 50 CFR 17.32.

In sum, under paragraph 17.40(r)(1), all the prohibitions and exceptions under 50 CFR 17.31 and 50 CFR 17.32 apply to *P. l. melanochaita*. Accordingly, the Service may authorize the import of a sport-hunted lion trophy from Zambia, but only if it first makes a finding that permitting import of a trophy would enhance the survival of the species in the wild.

As we explained when finalizing the 4(d) rule for *P. l. melanochaita*, any person wishing to conduct an otherwise prohibited activity, including all imports of *P. l. melanochaita* specimens, must first obtain a permit under 50 CFR 17.32. As with all permit applications submitted under 50 CFR 17.32, the individual requesting authorization to import a sport-hunted trophy of *P. l. melanochaita* bears the burden of providing information in their application showing that the activity meets the requirements for issuance criteria under 50 CFR 17.32. In some cases, such as for import of sport-hunted trophies, it is not always possible for the applicant to provide all of the necessary information needed by the Service to make a positive determination under the ESA to authorize the activity. In such cases, the Service may consult with the range country and other interested parties to the extent practicable to obtain necessary information. The Service has the discretion to make the required findings on sport-hunted trophy imports of *P. l. melanochaita* on a country-wide basis, although individual import permits will be evaluated and issued or denied for each applicant. While the Service may make enhancement findings for sport-hunted trophy imports of *P. l. melanochaita* on a country-wide basis, the Service encourages the submission of information from individual applicants. We rely on the

information available to the Service and may rely on information from sources other than the applicant when making a permitting decision.

General considerations:

As we also explained when finalizing the 4(d) rule, our threatened species permitting regulations at 50 CFR 17.32 provide issuance criteria for threatened species permits (50 CFR 17.32(a)(2)), but do not specify what would constitute the enhancement of propagation or survival with regard to authorizing the import of parts or products of *P. l. melanochaita,* including sport-hunted trophies. Therefore, when making a determination of whether an otherwise prohibited activity enhances the propagation or survival of *P. l. melanochaita,* the Service examines the overall conservation and management of the subspecies in the country where the specimen originated and whether that management of the subspecies addresses the threats to the subspecies (*i.e.,* that it is based on sound scientific principles and that the management program is actively addressing the current and longer term threats to the subspecies). In that review, we evaluate whether the import contributes to the overall conservation of the species by considering whether the biological, social, and economic aspects of a program from which the specimen was obtained provide a net benefit to the subspecies and its ecosystem.

The Service will evaluate any application received that involves *P. l. melanochaita* in the context of enhancement of propagation or survival permitting in accordance with our threatened species permitting regulations at 50 CFR 17.32 and issuance criteria for threatened species permits (50 CFR 17.32(a)(2)). These include, in addition to the general permitting criteria in 50 CFR 13.21(b):

(i) Whether the purpose for which the permit is required is adequate to justify removing from the wild or otherwise changing the status of the wildlife sought to be covered by the permit;

(ii) The probable direct and indirect effect that issuing the permit would have on the wild populations of the wildlife sought to be covered by the permit;

(iii) Whether the permit, if issued, would in any way, directly or indirectly, conflict with any known program intended to enhance the survival probabilities of the population from which the wildlife sought to be covered by the permit was or would be removed;

(iv) Whether the purpose for which the permit is required would be likely to reduce the threat of extinction facing the species of wildlife sought to be covered by the permit;

(v) The opinions or views of scientists or other persons or organizations having expertise concerning the wildlife or other matters germane to the application; and

(vi) Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application.

In addition to these factors, particularly in relation to sport hunting, we find the *IUCN Species Survival Commission (SSC) Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0* (IUCN 2012), to provide useful principles, which, considered in conjunction with our threatened species issuance criteria, will aid the Service when making an enhancement finding for importation of sport-hunted trophies of *P. l. melanochaita.* This document sets out guidance from experts in the field on the use of trophy hunting as a tool for "creating incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources" (IUCN SSC 2012, p. 2) and recognizes that recreational hunting, particularly trophy hunting, can contribute to biodiversity conservation and more specifically, the conservation of the hunted species.

The SSC document lays out five guiding principles that, considered in conjunction with our threatened species issuance criteria, will aid the Service when making an enhancement finding for importation of sport-hunted trophies of *P. l. melanochaita:*

(a) *Biological sustainability:* The hunting program cannot contribute to the long-term decline of the hunted species. It should not alter natural selection and ecological function of the hunted species or any other species that share the habitat. The program should not inadvertently facilitate poaching or illegal trade in wildlife by acting as a cover for such illegal activities. The hunting program should also not manipulate the ecosystem or its component elements in a way that alters the native biodiversity.

(b) *Net Conservation Benefit:* The biologically sustainable hunting program should be based on laws, regulations, and scientifically based quotas, established with local input, that are transparent and periodically reviewed. The program should produce income, employment, and other benefits to create incentives for reducing the pressure on the target species. The program should create benefits for local residents to co-exist with the target species and other species. It is also imperative that the program is part of a legally recognized governance system that supports conservation.

(c) *Socio-Economic-Cultural Benefit:* A well-managed hunting program can serve as a conservation tool when it respects the local cultural values and practices. It should be accepted by most members of the community, involving and benefiting local residents in an equitable manner. The program should also adopt business practices that promote long-term economic sustainability.

(d) *Adaptive Management: Planning, Monitoring, and Reporting:* Hunting can enhance the species when it is based on appropriate resource assessments and monitoring (*e.g.*, population counts, trend data), upon which specific science-based quotas and hunting programs can be established. Resource assessments should be objective, well documented, and use the best science available. Adaptive management of quotas and programs based on the results of resource assessments and monitoring is essential. The program should monitor hunting activities to ensure that quotas and sex/age restrictions of harvested animals are met. The program should also generate reliable documentation of its biological sustainability and conservation benefits.

(e) *Accountable and Effective Governance:* A biologically sustainable trophy-hunting program should be subject to a governance structure that clearly allocates management responsibilities. The program should account for revenues in a transparent manner and distribute net revenues to conservation and community beneficiaries according to properly agreed decisions. All necessary steps to eliminate corruption should be taken and to ensure compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.

The Service's approach to enhancement findings for the importation of sport-hunted trophies of *P. l. melanochaita* is consistent with the purpose and intent of the ESA. Before we will authorize the importation of a sport-hunted trophy, we must determine that the trophy hunting program is managed to ensure the long-term survival of the species. In many parts of the world, wildlife exists outside of protected areas and must share the same habitat and compete with humans living in these areas for space and resources. If communities that share these resources with wildlife do not perceive any benefits from the presence of wildlife, they may be less willing to tolerate the wildlife. However, under certain circumstances, trophy hunting can address this problem by making wildlife more valuable to the local communities and encourage community support for managing and conserving the hunted species, as well as other species.

When evaluating whether the importation of a trophy of *P. l. melanochaita* would be authorized pursuant to 50 CFR 17.32, in accordance with our threatened species issuance criteria, we will examine how a country's management program for lions addresses the three main threats that have led to the decline of the subspecies: habitat loss, loss of prey base, and human-lion conflict. When examining a management program and whether trophies taken as part of that program meet the issuance criteria, we study a number of factors. Some of the factors we consider include whether the program is based on sound scientific information and identifies mechanisms that would arrest the loss of habitat or increase available habitat (*i.e.*, by establishing protected areas and ensuring adequate protection from human encroachment). We consider whether the management program actively addresses the loss of the lion's prey base by addressing poaching or unsustainable offtake within the country. A component of a management plan from which trophy imports would meet the issuance criteria would be whether there are government incentives in place that encourage habitat protection by private landowners and communities and incentives to local communities to reduce the incursion of livestock into protected areas or to actively manage livestock to reduce conflicts with lions. We examine if the hunting component of the management program supports all of these efforts by looking at whether hunting concessions/tracts are managed to ensure the long-term survival of the lion, its prey base, and habitat. Hunting, if properly conducted and well managed, can generate significant economic benefits that may contribute to the conservation of lions. In looking at whether we are able to authorize the import of a trophy under the issuance criteria of 50 CFR 17.32, we will examine if the trophy hunting provides financial assistance to the wildlife department to carry out elements of the management program and if there is a compensation scheme or other incentives to benefit local communities that may be impacted by lion predation. We will also consider how a U.S. hunter's participation in the hunting program contributes to the overall management of lions within a country.

Management programs for *P. l. melanochaita* are expected to address, but are not limited to, evaluating population levels and trends; the biological needs of the species; quotas; management practices; legal protection; local community involvement; and use of hunting fees for conservation. In evaluating these factors, we will work closely with the range countries and interested parties to obtain the information. By allowing entry into the United States of *P. l. melanochaita* trophies from range countries that have science-based management programs, we anticipate that other range countries would be encouraged to adopt and financially support the sustainable management of lions that benefits both the species and local communities. In addition to addressing the biological needs of the subspecies, a scientifically based management program would provide economic incentives for local communities to protect and expand *P. l. melanochaita* habitat.

Basis for Finding for lions taken in Zambia:

On February 2, 2016, the Service sent a letter to Zambia's Wildlife Authority with a list of questions that would aid the Service in evaluating the overall conservation and management of the species in Zambia and whether that management addresses the three main threats that have been identified as contributing to the decline of the species: habitat loss, loss of prey base, and human-lion conflict. Additionally, in the letter the Service referenced the IUCN Species Survival Commission (SSC) Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0 (IUCN SSC 2012), as it provides useful principles, which when considered in conjunction with the Service's permit issuance criteria, would aid when making the required enhancement finding for importation of sport-hunted trophies.

In response to our February 2, 2016, letter, documentation outlining the status of lions in Zambia was provided by Zambia's Department of National Parks and Wildlife (DNPW), herein referred to as DNPW (DNPW 2016). Information obtained from Zambia's DNPW, along with the Service's own final rule on the lion listing under the ESA, relevant information obtained separately through open sources such as IUCN documents, and relevant information contained in comments received from interested parties, were the basis of this finding.

Governance of Lions in Zambia

The responsibility for implementing wildlife conservation laws in Zambia dates back to the 1930s or 1940s with the establishment of the Department of Tsetse, Fisheries, and Wildlife. In the late 1950s, this agency became the Department of Game and Fisheries and operated under this designation until the mid-1970s, when it became the Department of National Parks Wildlife Service (DNPWS) who was responsible for the protected area network. In 1999, the Government of Zambia transformed this agency into Zambia's Wildlife Authority (ZAWA), creating a semi-autonomous agency responsible for the management and protection of this network, with statutory powers derived through the Zambia Wildlife Act No. 12 of 1998. However, this agency, due partly to its semi-autonomy, had a low funding capability, relying primarily on revenue from tourism, which also included sport hunting. Between 1999 and 2005, ZAWA struggled with their law enforcement capabilities due to inadequate resources. The costs associated with transforming DNPWS to ZAWA continued to affect the financial and staff

allocations for law enforcement activities. Large sums of money that could have been utilized by law enforcement were apparently channeled into tasks involved in the transformation process.

Since 2005, in partnership with the Zambia Lion Project (ZLP), ZAWA (now DNPW) established a voluntary program to assess and age lions taken as trophies (DNPW 2016). From 2006 through 2012, DNA samples were taken from teeth of both live and trophy lions in order to estimate the age of lions taken as trophies (DNPW 2016). The results from these past sampling efforts helped demonstrate the performance of the hunting sector during this time. It has also provided a baseline for comparing future performance.

By 2010, Zambia developed a ten-year Conservation Strategy and Action Plan for the African lion. Since the approval of this strategy, research has begun and management actions have been taken to address local community benefits, human-lion conflict, land use planning and zoning, trade, and monitoring (DNPW 2016). Some of the lion-related studies that were initiated are the Zambia Carnivore Programme (ZCP), Kafue Lion Project, and Zambia Lion Project (ZLP) (DNPW, 2106). The development of this strategy also led to the employment of 12 ecologists, with three committed to spending 70% of their work time on lion-related issues (DNPW 2016).

In 2015, ZAWA was disbanded and reincorporated as a government department, the Department of National Parks and Wildlife (DNPW). In addition, the Zambia Wildlife Act No. 12 of 1998 was repealed. However, the Wildlife Act No. 14 of 2015 (Wildlife Act) is still the principle legislation guiding the management of wildlife in Zambia through a system implemented and enforced by DNPW with assistance from stakeholders (DNPW 2016).

The Wildlife Act is administered by DNPW under the Ministry of Tourism. DNPW is headed by a Director, with assistant directors who command 4 elements of the department: Principal Warden-Operations Wildlife Law Enforcement Unit, Principal Warden-Conservation Unit, Principal Engineer Infrastructure Development Unit, and Principal Natural Resource Management Officer Community-based Natural Resource Management Unit. *The Wildlife Law Enforcement Unit* is comprised of 1,250 Wildlife Police Officers who are responsible for investigating and enforcing wildlife crimes within 236,376 km^2 of wildlife area (average 189 km^2 per officer). The Zambian government has also committed to adding an additional 850 officers by 2018 (600 new officers were reportedly added in 2016). *The Wildlife Conservation Unit* is responsible for mitigating human-wildlife conflict, facilitating wildlife officer trainings, regulating private wildlife estate operations, managing ecosystems, managing landscape conservation of certain species, and both developing and implementing park regulations. *The Infrastructure Development Unit* is responsible for construction and maintenance of infrastructures and machinery within protected areas. *The Community-based Natural Resource Management Unit* is responsible for co-managing Game Management Areas (GMAs) with local communities. Duties include providing technical support to Community Resource Boards regarding the management of human-natural resources in GMAs and open areas. This unit facilitates the election of the Community Resources Board members and the election of Village Action Groups. Responsibilities also include monitoring the use of funds disbursed to Community Resources Boards and training village scouts and Community Resources Board members.

The lion is a protected species under the Wildlife Act. It is a criminal offense to hunt, kill, capture, or possess a lion without a license. The lion is also protected under private wildlife estate legislation and statutory instruments implemented with the (now repealed) Wildlife Act of 1998 and carried over to the Wildlife Act. Additionally, in 2016, four new statutory regulations were reportedly enacted to address various aspects of lion management to complement the operation of the new Wildlife Act. They included the Zambia wildlife regulations for granting of hunting concessions, lion sport hunting, keeping of big cats in captivity, and conducting ecological or research wildlife assessments (DNPW 2016).

In addition to Zambia's domestic laws, it is also a Party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The lion is listed in Appendix II of the Convention. As an Appendix-II species, certain criteria must be met before such species can be exported, including a findings from the exporting country's CITES Management Authority that the specimen was legally acquired and the country's Scientific Authority that the export will not be detrimental to the survival of the species in the wild. In their reply to our inquiry, Zambia provided a copy of their May 5, 2016, non-detriment finding for lions. This finding states that "(t)he CITES Scientific authority of Zambia has considered the population of lion in Zambia; the quota-setting system and current precautionary quota of only 24 lions; the newly implemented age-based harvest policy; the limited offtake; the adaptive management of lion; and the substantial revenues generated for DNPW operations, anti-poaching, and community development." They further explain that their positive finding was based on three pillars that include a "precautionary" quota, age-based harvesting, and community benefits.

Current Lion Status in Zambia

Lion Range:

According to DNPW, the lion range in Zambia covers about 63% of Zambia's protected areas, which is about 145,000 km^2 (DNPW 2016). Historically, lions occurred in the West Lunga complex, although, recently, populations have not been found in this complex (DNPW 2016). The majority of lions are found in three main clusters throughout Kafue, Luangwa, and the Lower Zambezi region. Luangwa and Lower Zambezi are connected through GMAs. Smaller populations of lions are also present in Liuwa Plains, Sioma Ngwezi, Nsumbus, and the Lavushi Manda National Parks. In addition, Kazungula and Siavonga open areas have lion populations that roam between Zambia and other countries (DNPW 2016).

The 2016 IUCN Red List Assessment stated that lions are now extinct in 15 countries in Africa (including Western Sahara, which is technically a disputed territory), are possibly extinct in another seven countries, and now occur in only 24 countries (Macdonald 2016). The latest IUCN estimates suggest a population of 23,000 - 39,000 lions throughout their current range on the African continent (IUCN 2016), representing a decline of at least 43% between 1993 and 2014. Lions are now considered to have been extirpated from at least 92% of their historic range (Macdonald 2016). Therefore, in assessing the population of lions in Zambia, we must also consider the significance of the diminishing total population of lions remaining in the wild. This is in part because the Southern and Eastern African lion populations include Zambia (DNPW 2016). DNPW presented a study conducted by the Zambia Lion project (ZLP) in which DNA

analysis of Zambian lions was undertaken during 2004 - 2012. The study concluded that Southern African and East African lions were integrated among the Zambian lions. The study also determined that the genetic diversity of Zambian lions is much greater than comparable areas in Southern and Eastern Africa.

Population Status:

Data provided by Macdonald (2016) indicate that Zambia contains approximately 1,200 free-ranging lions in an estimated range of 135,000 km^2 (approximately 10,000 km^2 less range than identified by the Zambian government). DNPW explains that previous lion estimates were determined, in large part, through expert opinion (DNPW 2016). They also confirm that no intensive research has been conducted in the corridor area, consisting of West Petauke, Chisomo and Luano GMAs, and surrounding Open Areas (DNPW 2016).

In addition to the population status determined by Macdonald (2016), the Zambian Carnivore Programme (ZCP) studied the population of lions in Zambia. In 2013, the ZCP monitored 13 prides and 13 coalitions, comprised of 141 lions with 3 adjacent sites of 20 lions each, totaling over 200 lions. In 2014, the ZCP monitored 15 prides and 13 coalitions, with a total of 166 individual lions. In 2015, the ZCP's partial data indicated that 15 prides and 15 coalitions of lions exist throughout Zambia.

In acknowledging their need for more complete and current lion population data, DNPW has begun working with partners on monitoring studies in the Luangwa and Kafue ecosystems. Surveys were conducted in the later part of 2016 (DNPW 2016). The Service has not seen the results, but will request them for consideration of future enhancement determinations. In addition, dependent on funding availability, DNPW has identified that a survey would be conducted of the corridor between South Luangwa National Park and Lower Zambezi National Park and the GMAs surrounding the eastern part of North Luangwa National Park.

A report by the Democratic staff of the House Committee on Natural Resources concludes that Zambia lion populations may show signs of stabilizing or even recovery, but strict controls on additional mortality are necessary to prevent further decline (Grijalva 2016).

Threats:

Habitat Loss, Population Growth, and Human-Lion Conflicts:

Lion populations throughout Africa have decreased in correlation with their habitat and currently only 10 stable populations with more than 500 lions still exist throughout the continent of Africa (Creel *et al.* 2016). Africa has the fastest human population growth rate in the world, with projections estimating a population tripling across 27 African states by 2100, leading to a continental estimate of 4 billion. Eight lion range states are estimated to have a five-fold increase in human population by 2100 (Macdonald 2016) and Zambia has not steered clear of Africa's population and development growth (DNPW 2016). Human population growth has increased in Mfuwe, the gateway town to South Luangwa National Park, largely due to increased infrastructure development and an increasing number of economic opportunities created through tourist lodges (DNPW 2016). Habitat loss, population growth, human-lion conflicts, poverty,

poaching, diseases, uncontrolled hunting, and the importation of captive-bred lions into Zambia are all threats to the long-term survival of lion populations in Zambia.

DNPW stated that human-lion conflicts are not uncommon in Zambia. From the years 2008 through 2015, a total of 327 livestock animals were recorded as being killed by lions; since 2002, at least 70 lions were reported killed as a result of human lion conflicts (DNPW 2016). The number of Zambian lions killed as a result of human-lion conflict is shown in the table below.

Year	Lions Killed
2002	2
2003	4
2004	1
2005	0
2006	5
2007	8
2008	2
2009	5
2010	3
2011	8
2012	5
2013	10
2014	14
2015	1
2016	2

Poverty, Poaching, and Disease:

Prey base depletion is partly linked to habitat loss, but more importantly to poaching and bush meat trade (Becker *et al.* 2013). Poaching of lions for the trade in bones and other body parts for traditional medicine is an emerging threat within Africa (Macdonald 2016). Within Zambia, another more widely occurring threat believed to be facilitated by high levels of poverty is poaching of lions for bush meat (DNPW 2016). DNPW acknowledges that bush meat poaching occurs widely in Zambia (DNPW 2016). They also acknowledge that the amount of illegal use of lion parts in Zambia is currently unknown (DNPW 2016). However, DNPW has indicated it will establish an investigation into the illegal trade and use of lion parts.

Zambia has addressed the need to monitor the health of their lions by creating the Infrastructure Development Unit (IDU). The IDU subsequently established a veterinary unit of DNPW whose responsibility is to regularly sample lion specimens for diseases. This unit also assists law enforcement officers in the treatment of injured lions due to illegal activities such as snaring (DNPW 2016).

Trophy Hunting:

Di Minn *et al.* (2016) estimated that 37.8% of Zambia is covered by terrestrial protected areas, with 21.3% in Open Game Ranches. According to a 2012 article, lion hunting in Africa generates 5–17% of gross trophy hunting income on national levels with the proportional significance highest in Mozambique, Tanzania, and Zambia (Lindsey *et al.* 2012). A more recent paper published by Macdonald, however asserted that Zambia generated very little revenue from trophy hunting (Macdonald 2016). It should be noted, however, that Macdonald based the paper on data obtained in the years before 2016 (the moratorium was between 2013 and 2015) and the formation of DNPW and newer regulations were not implemented until after Zambia imposed a moratorium on lion hunting for the years 2013 through 2015. According to DNPW, Zambia's total hunting revenue (all hunting, not just lions) accounted for 32% of the revenue that ZAWA (now DNPW) received during the years 2010 through 2012 (DNPW 2016). They also affirm that the average revenue generated for hunting in Zambia was reduced to 4% during the lion hunting moratorium in 2013 and 2014 (DNPW 2016).

IUCN has only examined the lion population in Luangwa, Zambia. Their findings indicate that trophy hunting in Luangwa contributed to a decline in the lion population by 28% between 1993 and 2014 (Macdonald 2016). However, this assessment was done prior to Zambia's 2013-2015 hunting ban and therefore, it will need to be re-assessed now that Zambia's lion hunting ban has been lifted and new regulations have been implemented.

Importation of Captive-bred lions:

Captive-bred lions from South Africa and Zimbabwe are being imported into Zambia for lion walks (DNPW 2016). DNPW believes that the importation of captive-bred lions is a result of a growing photo tourism market in the Livingstone area of Southern Zambia (DNPW 2016). Since 2008, a total of 54 captive-bred lions have been imported into Zambia, but the Zambian government has imposed a condition that the captive-bred lions will not be introduced into the wild (DNPW 2016). In order to ensure that Zambia's captive-bred lions do not negatively impact their wild lion populations, Zambia is currently working on the preparation of a statutory instrument that will regulate the importation and captive uses of lions. Other than for temporary veterinary purposes, the holding of, breeding, and commercial use (i.e. walking and petting) of captive-bred lions will be banned (DNPW 2016). Lions that are currently held in captivity will be required to be castrated or spayed and eventually all commercial uses of captive-held lions will be phased out (DNPW 2016). DNPW, states that "particular care will be taken to avoid the dumping of captive-held cats into wild areas for any reason, especially for hunting or 'release' as means for the owners to avoid the penalties or costs associated with the authorized disposition of their animals (DNPW 2016)."

Partners/NGOs:

DNPW has partnered with several NGOs in an effort to obtain lion population survey data and other lion-related research studies. The Zambia Lion Project (ZLP) has conducted research on the presence/absence of lion surveys throughout Zambia (DNPW 2016). They have also assisted with DNA collection studies. The Zambia Carnivore programme (ZCP) has been documenting population trends and demographic vital rates of lions in the key areas of South Luangwa National Park, Kafue National Park, and Liuwa Plain National Park. Through their research

efforts, the ZCP has also contributed to aerial support that has assisted DNPW with enforcement actions.

Although their research focus has been on elephants, the Frankfurt Zoological Society has been active in North Luangwa ecosystem for over 20 years. Conservation South Luangwa (CLS) has been active in South Luangwa National Park and surrounding GMAs. Game Rangers International has been active in the Kafue ecosystem since 2010. Conservation Lower Zambezi (CLZ) is also active in the Lower Zambezi national park and surrounding GMAs.

Supplemental revenue sources are also gained with the support of several NGOs. NGOs can provide functions that include anti-poaching units and / or aerial support. One such example is the Frankfurt Zoological Society (FZS), which has been active in North Luangwa National Park for over 20 years. FZS established a partnership with DNPW in order to help preserve black rhino and elephant populations through the establishment of The North Luangwa Conservation Programme (NLCP).

Lion Management in Zambia

History of Lion trophy exports:

During 2008 - 2012, DNPW authorized the export of 289 lion trophies (50, 40, 89, 37, and 73 respectfully). During 2013 - 2015, the Zambian government established a lion hunting moratorium (some trophies apparently taken before the moratorium were exported during this time, however). The moratorium was established to allow time to restructure Zambia's governance of lions and to allow a period of time for lion recovery (DNPW 2016). Data comparing the lion population status before and after the moratorium are currently unavailable; hence, the success of the moratorium cannot be fully assessed.

Lion Hunting and Concessions:

Zambia lion hunting occurs in *Game Management Areas (GMAs)* and *Open Game Ranches (OGRs)*. OGRs are unfenced private lands reserved for the wildlife conservation management of an individual or local community. They are buffered by GMAs. DNPW issues annual non-resident hunting quotas to the OGRs in exchange for managing the wildlife; although all animals remain the property of the State (DNPW 2016).

All 20 of Zambia's national parks are surrounded by GMAs, but currently, lion hunting only occurs within hunting blocks located in the GMAs that surround the National parks in the Luangwa, Kafue, and Lower Zambezi ecosystems. GMAs are primarily designated for safari (tourist) and resident hunting, but some GMAs also include photographic tourism. All GMAs allow settlement. There are 36 GMAs in Zambia covering 177,404 km^2 (DNPW 2016). Most, but not all, GMAs have General Management Plans outlining basic management practices. Community-Based Natural Resource Management (CBNRM) is implemented within GMAs through Community Resource Boards (CRBs) (DNPW 2016). The CRBs focus on the economic and social well-being of local communities. There are currently 75 registered CRBs within Zambia that employ approximately 750 community scouts and 79 support staff.

DNPW, in consultation with the local community, is mandated to grant hunting concessions within specific hunting blocks within GMAs. Hunting concessions must be registered in Zambia, have a tourism enterprise license, have a valid tax clearance certificate, provide proof that the company is not bankrupt, and they must meet any additional conditions set by an evaluation committee (DNPW 2016). Leases are stated to range from 7 - 15 years, with the length of lease time dependent on the abundance of species classified within the individual hunting block (DNPW 2016). Prime hunting blocks have greater species abundance and are generally awarded shorter lease agreements in comparison to secondary hunting blocks. Secondary hunting blocks are generally given longer lease periods in an effort to provide incentives for the concessionaire to invest greater resources, allowing wildlife populations to increase before offering hunting (DNPW 2016).

Hunting block concessions are awarded through a bid process in accordance with the Zambia Public Procurement Act No 12 of 2008. Bids are taken from companies through a "two envelop system." The bids consist of a technical proposal and a financial proposal being placed in separate clearly marked envelopes. The technical bid is required to be evaluated by criteria outlined in Zambia's Wildlife Act before the envelope containing the financial bid is opened. Financial envelopes will only be opened for bidders that received meet a specific technical expertise (e.g., a score of over 80 on the established criteria). The lease is awarded to the bidder that qualified with a minimum technical rating of 80 and whom submitted the highest financial bid (DNPW 2016).

Successful bidders must address statutory obligations to communities and provide enforcement contributions when developing Concessionary Agreements. Concessionary Agreements are developed through a partnership between the communities, safari operators, professional hunters, and DNPW. As such, a hunting concession agreement is not valid without the signature of the Chief(s) or CRB associated with the hunting block (DNPW 2016). Concessionaires are required to use collected fees to support resource protection by providing community scouts, vehicles, fuel, patrols, and equipment. They must provide infrastructure development to local communities and also offer resource monitoring and fire management. Some concessionaires further benefit community development by supporting the employment of teachers and nurses, purchasing ambulances, building classrooms and clinics, and providing houses for teachers and health personnel. Moreover, they are mandated to provide 50% of the meat from hunted animals to the local community. Concessionaires are evaluated annually and those that do not comply with their obligations can have their concession terminated before the end of the agreement's term (DNPW 2016).

Hunting Quotas:

From 2005 - 2012, Zambia had quotas that totaled 683 lion in 21 GMAs and 5 OGRs, with the highest annual quota set at 117 lions and the lowest at 55 lions (DNPW 2016). The quotas were generally based on the previous year's lion quotas and, in some cases, the quotas were a fixed part of a concession agreement (DNPW 2016). However, DNPW did not completely identify the basis for these quotas or how they were distributed. Currently, quotas are based primarily on lion populations determined through aerial surveys (DNPW 2016). However, information obtained from ground counts, patrol sightings, local and expert opinion, and hunting monitoring

is also used. CRBs use the information they have collected to determine what the GMA quota should be. Their proposal is submitted to DNPW for approval. Once a proposal is received, DNPW accepts feedback from field staff and safari hunting outfitters, as well as the hunting guidelines (below), before the quotas are approved by the Wildlife Conservation and Management Unit and distributed by their Licensing Unit. The quotas are then distributed to the CRBs and hunting companies. DNPW is required to share the approved quotas with other government agencies, including the Auditors General Office and Anti-Corruption Commission. For 2016, Zambia established a quota of one lion per hunting concession, for a total quota of 24 lions (2 hunted on OGRs and 22 hunted in GMAs). Quotas are set for individual hunting blocks within the GMAs.

Hunting Guidelines:

The Zambia's Conservation Strategy and Action Plan for the African lion was developed in 2010 and designed with a 10-year plan (DNPW 2016). The purpose of the plan is to gain stakeholder participation while using adaptive management practices when addressing concerns regarding scientific management, habitat protection, and human-lion conflicts. Based on the principles of the Action Plan, following the three-year moratorium, in 2016, DNPW consulted independent lion experts and held a workshop that resulted in the creation of hunting guidelines (DNPW 2016). The guidelines are considered part of an adaptive process to manage lion hunting in Zambia. DNPW is in the process of transforming the guidelines into a statutory law that will include provisions for monitoring lion hunting through an age-based system (DNPW 2016). The lion hunting guidelines include, but are not limited to, the following recommendations:

1. No hunting of female lions.
2. No hunting of any lion born or held in captivity.
3. No use of pre-recorded sounds in lion hunting.
4. No lion hunting on fenced game ranches.
5. Lions should only be hunted in Prime and Secondary areas and Open Game Ranches known to be rich in lion and prey.
6. Establishment of a place for trophy measurements of hunted lions for exports should be established.
7. DNPW shall establish a lion aging evaluation committee that will include representatives from the Professional Hunters Association, the Safari Operator Association, the Wildlife Producers Association, and officers from DNPW that are nominated by the director. Prior to issuing CITES permits, the committee shall meet once a year to establish the age of hunted lions.

DNPW has established age-based categories that divide lion hunting into four age-based categories: Category 1 consists or male lions between five and six years old and above; Category 2 consists of male lions older than four years old, but younger than five years old; Category 3 consists of male lions that are younger than four years old; and Category 4 consists of male lions seven years old or older. DNPW has determined that only male lions that are five years and older should be hunted. However, DNPW may authorize the export of Category 2 male lions so as not to penalize the hunter. Lions that are less than four years old will be confiscated and may not be exported. In cases where lions under five years old are taken, however, the professional hunter and the safari outfitter may be penalized (Becker 2017 per. comm.).

Wildlife officers must also accompany hunters on all hunts (DNPW 2016). The officer is responsible for recording hunt activities on specified forms such as the Safari Hunting Monitoring form and Trophy Measurement form. The officer endorses licenses to ensure that they are not used more than once and the officer also ensures that all harvested trophies are registered (DNPW 2016).

Hunting-generated Revenue:

DNPW receives revenue by charging GMA fees per lion hunt. They also receive funds from annual professional hunter fees, certificate of valuation of trophies fees, certificate of ownership of trophies fees, permit fees, handling fees, and CITES security stamp fees. Hunting license fees in Zambia are statutory. The foreign hunter looking to take a lion must pay the fee directly to the outfitter, with the minimum amount currently set at $4,200. DNPW collects these fees from the outfitter/concession and does not deal with the foreign hunter directly. Therefore, the outfitter may choose to charge the foreign hunter any amount greater than $4,200. The revenue generated from license fees (also referred to as Animal fees by DNPW) is mandated to be shared with CRBs under the Zambia Wildlife Act No. 14 of 2015. The fees are shared with CRBs and DNPW as follows:

License fees (animal fees):

- 5% of funds go to the CRB chief/leader.
- 45% of funds go to CRB community funds.
    - According to Zambia's "Guideline on the use of Community funds accrued from wildlife management", 45% of these community funds should go to wildlife protections and patrols, 35% should go to community projects such as constructing clinics, roads, schools, and wells, and 20% of the funds should go towards CRB administration costs.
- 50% of funds go to DNPW (mandated under the Zambia Wildlife Act No. 12 of 1998 and continued in the Wildlife Act) in the form of conservation funds, including, but are not limited to: scout/wildlife officer salaries, resource protection, consultancy and legal fees, animal surveys, staff training, administrative and operational expenses, repair and maintenances, and other conservation expenses.

According to Zambia's hunting guidelines, hunts involving lions are required to be a minimum of 16 days (DNPW 2016). A daily conservation fee of $150 per hunter and $100 per observer is collected for monitoring purposes (DNPW 2016). These daily hunt fees typically cover combined hunt packages that include hunting lion, along with other species such as hippos and impalas. The fees are allocated by percentages to CRBs and DNPW as follows:

Daily fees (Concession fees):

- 5% of funds go to the CRB chief/leader.
- 15% of funds go to CRB community funds.
    - Based on recommended guidelines, 45% of these community funds go to wildlife protections and patrols, 35% goes to community projects such as constructing

clinics, roads, schools, and wells, and 20% of the funds go to CRB administration costs.

- 80% of funds go to DNPW in the form of conservation funds, including, but are not limited to: scout/wildlife officer salaries, resource protection, consultancy and legal fees, animal surveys, staff training, administrative and operational expenses, repair and maintenances, and other conservation expenses.

Hunting fees for all species accounted for 32% of revenues that DNPW received during 2010 - 2012. However, that amount was reduced to about 4% during the 2013 and 2014 moratorium (DNPW 2016). Safari hunting also creates other revenue for Zambia, through activities such as tipping, eating in restaurants, staying at lodges, purchasing souvenirs, and paying for taxidermy.

Evaluation:

As stated earlier, the Service will evaluate any application in accordance with our threatened species permitting regulations at 50 CFR 17.32 and issuance criteria for endangered species permits (50 CFR 17.32(a)(2)). In evaluating each of these criteria on the basis of information available to the Service, we have been able to determine if the import of sport-hunted lions from Zambia would meet the Service's enhancement criteria necessary to issue the required import permit.

17.32(a)(2)(i): Whether the purpose for which the permit is required is **adequate to justify removing from the wild** or otherwise changing the status of the wildlife sought to be covered by the permit:

In evaluating this criterion, the Service assesses whether the hunting program established for lions has demonstrated the ability to contribute toward positive conservation outcomes that mitigate or improve the status of lions throughout their range within Zambia, while addressing the main threats of habitat loss, human-lion-livestock conflict, and prey depletion.

The IUCN's 2012 Guiding principles on trophy hunting support the concept that hunting can provide a conservation benefit if it is part of a governance system that provides both implementation and enforcement at a level that adequately supports conservation. The Service also believes that conservation hunting can assist the wild lion populations if managed well. Lion hunting, if managed properly, could meet the Service's enhancement criteria under the Act. There must be adequate information and data clearly showing that removing lions from the wild for trophy hunting will be done at a level and with sufficient oversight such that it improves the current status of lions in the wild (50 CFR 17.32).

Zambia has demonstrated their desire to maintain the long-term conservation of their lion population with their 2013-2015 moratorium on lion hunting. When the Zambian government realized that population numbers were declining to an unstainable level, they applied the moratorium for 3 years, until they determined that their lion population increased enough to tolerate a limited offtakes (DNPW 2016).

As mentioned in the sections above, the Zambian government has clarified that they have established block quotas by surveying lion populations through a combination of aerial surveys and information obtained from ground counts, patrol sightings, local and expert opinion, and hunting monitoring. However, because surveys are continually being carried out on the current population status of lions in Zambia, future analysis may need to be conducted in subsequent years. Therefore, the Service will need to continue to monitor the effectiveness of new lion surveys that contribute to determining the population status of lions in correlation with hunting block quotas.

The difference in male turnover between hunting/non-hunting periods is apparent from cub survival rate. Macdonald (2016) reports that in the absence of hunting, 80% of cubs survived to one year of age, during the trophy hunting period, only 66% of cubs survived to one year of age. The principle behind restricting trophies to older males is that their tenure in the pride should have been long enough to raise at least one generation of cubs to adulthood. However, lion experts have come to varying conclusions regarding the minimum age recommended for sustainable lion hunting. Creel *et al.* (2016), not only state that the minimum hunting age should be 7-8 years old, but they also conclude that age-restricted harvesting is not sufficient to yield sustainability by itself. However, other experts believe that the sustainable age of lions is five years and older, provided that proper identification/aging can occur before the animal is harvested. Nonetheless, lion experts are in consensus that hunting lions younger than five years old may not be sustainable. Zambia's recommended hunting guidelines are in line with the minimum age of five-year-old lions, but the Service is concerned that allowing for the export of lions under this age (Zambia allows export of four-year-old lions, but not less than four years old) may not be sustainable. Zambia will need to closely monitor the number of exports of "under age" trophies to determine if there are sufficient disincentives to discourage taking such animals.

The Zambian government has done a good job of identifying how resources from hunting-generated revenue would be shared with communities. The local communities receive funds from concessions and license (animal) hunting fees. As outlined in the license fee distribution above, 35% of the funds allocated to CRBs help support community projects such as constructing clinics, roads, schools, and wells, thereby providing incentives for the local community to ensure the long-term conservation of the lions. In addition, 45% of the CRB license fees go to wildlife management, including resource protection and patrols.

Zambia's human population growth has contributed to conflicts within the GMAs. As clarified in detail on pages 17 and 18 of this document, DNPW contributes 50% of the license fees (animal fees) and 20% of the Concession fees to local communities. These financial benefits received from living in a GMA have provided incentives for newcomers to illegal squat in the GMAs looking to capitalize on the financial benefits. Consequently, the illegal squatting has caused enough conflict with local people to trigger action to be taken by the Zambian government. In August of 2015, over 2,000 squatter households within the Mumbwa GMA were evicted so that the registered local communities could receive the full benefits of living within a conservation area (DNPW 2016). The long-term results of the eviction will need to be addressed in future analysis of Zambia's trophy hunting.

Therefore, based on the information available to the Service and provided that hunted lions are properly permitted and in compliance with national and provincial regulations, we conclude that the purpose for which a permit being requested is adequate to justify changing the status (i.e., exporting trophy lions) of animals taken in accordance to Zambian laws and regulations.

17.32(a)(2)(ii): The probable direct and indirect effect that issuing the permit would have on the wild populations of the wildlife sought to be covered by the permit:

As described in the lion status above, Zambia has taken great strides to address the major threats facing lions through their hunting program and updated regulations. In 2010, Zambia developed a ten-year Conservation Strategy and Action Plan for the African lion. Since the establishment of the Action Plan, the Zambian government has cooperated with partners to implement the strategy (DNPW 2016). Monitoring, local community benefits, human lion-conflict, and land use planning are only some of the benefits of the Action Plan (DNPW 2016). The development of the Community-Based Natural Resource Management Unit has helped facilitate Zambia's economic and social well-being by providing technical support to CRBs, training of village scouts and CRB members, and monitoring the use of funds disbursed to the CRBs. An investigative unit also carries out investigations related to wildlife crimes. Furthermore, the President of the Republic of Zambia has also directed the Defense san security wings in the country to join in the fight against poaching.

Provided that the off-take of wild lions continues to be monitored, that most, if not all, trophy lions are five years of age or older that quotas continue to be conservative, and the lion management recommendations continue to be implemented, the participation of U.S. hunters in lion hunts would provide an indirect benefit to wild populations by helping to support the reserves where lions are found. Therefore, based on the information available to the Service, the probable direct and indirect effect that issuing an import permit for a legally hunted lion would have on the species would be positive.

17.32(a)(2)(iii): Whether the permit, if issued, would in any way, directly or indirectly, conflict with any known program intended to enhance the survival probabilities of the population from which the wildlife sought to be covered by the permit was or would be removed:

We are not aware of any programs intending to enhance the survival of lions in Zambia that would conflict with Zambia's management plan. However, we are aware of the Zambian Carnivore Programme (ZCP), which is a non-profit Zambian registered trust that is dedicated to conserving large carnivore species and the ecosystems they reside in. The program works to build capacity within local Zambian organizations and government bodies for the sustainable conservation of large carnivores and herbivores, their ecological functions, and their habitats. Therefore, provided efforts remain in place to work with ZCP to ensure that its research and monitoring efforts are not impacted by the hunting program, there does not appear to be any conflicts that would arise if import permits were to be issued for wild lion trophies.

17.32(a)(2)(iv): Whether the purpose for which the permit is required would be likely to reduce the threat of extinction facing the species of wildlife sought to be covered by the permit:

In evaluating this criterion, the Service assesses whether the hunting program established for lions is subject to a governance structure that clearly allocates management responsibilities and supports regulatory pathways in support of positive conservation outcomes. Zambia's lion management program is based on a precautionary quota, an age-based harvest with monitoring off-takes, and direct community benefits (DNPW 2016).

Currently, per Zambia's approved budget, DNPW retains all revenue from sport hunting. 50% of animal fees and 80% of concession fees are allotted to DNPW as conservation funds. This funding source is vital to lion conservation because it supports on-the-ground conservation, protected area management, and enforcement efforts. Additionally, 45% of animal fees and 15% of concession fees go to communities where the hunts take place. As long as communities continue to benefit from the sport hunting of lions through job opportunities, funded community projects, and sharing of meat derived from hunting, they may have the incentive to protect it.

With limited, controlled off-take of lions in a manner that would mimic natural processes and continued community support, the legal hunting activities of U.S. hunters would contribute to reducing the threat of extinction of lions. However, this off-take must be monitored to ensure that it is sustainable and that, to the extent possible, normal lion behavior and ecology is not negatively impacted. The utilization of hunters to manage the lion populations in GMAs and OGRs is an important element of the success of lion management in Zambia.

Therefore, based on the information available to the Service, the purposes for which import permits would be issued would likely reduce the threat of extinction facing lions in Zambia.

17.32(a)(2)(v): The opinions or views of scientists or other persons or organizations having expertise concerning the wildlife or other matters germane to the application:

As with any discussion of hunting, there are numerous opinions on the impact that hunting has on a species. From reviewing comments made during the listing process for lions, as well as information obtained through personal conversations and literature, there is a general agreement that hunting, done properly and well managed, would not have an adverse effect on lion populations. Mimicking natural processes within the management program, such as maintaining pride hierarchy for as long as possible by leaving the alpha male in place, will better ensure the long-term survival of the species. Numerous researchers have stated that, while they may not support hunting in general, they see that benefits can be obtained through a science-based hunting program for lions. There have been a large number of comments from some NGOs and the public opposing hunting any lions, but particularly captive-bred lions. This opposition, however, is primarily based on the perceived ethics of hunting. While these comments are an indication of concerns from some members of the public over hunting, they are not germane to our review process.

Therefore, based on the information available to the Service, there is general support for scientists and other persons or organizations having expertise concerning lions that the legal well managed, science-based harvest of lions, and the subsequent import of these trophies, would not have an adverse effect on the species, but would further efforts to conserve the species in the wild into the future

17.32(a)(2)(vi): Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application:

Examining whether adequate resources exist, the Service relied primarily on information provided by Zambia (DNPW 2016). The long-term survival of lions in Zambia is directly tied to the economic and ecological success of the country. When ZAWA became a semi-autonomous agency, they struggled with funding to provide for adequate staffing and fulfillment of lion conservation objectives. However, after transforming back to a government agency, DNPW (formerly ZAWA) has been able to ensure that staff are adequately resourced and paid by Zambia's government, while retaining funding generated from sport hunting, as per the approved budget for the country. This ability to deliver on conservation objectives may improve even further with funding provided by U.S. sport hunters.

Therefore, based on the information available to the Service, the applicants that are engaged in legal, authorized hunting and that abide by management practices in accordance with national and provincial regulations, have the expertise, facilities, or other resources available to them to successfully accomplish the objective their application; i.e., the long-term survival of lions in Zambia.

Conclusion

Given the current status of lions within Zambia and the level of management and oversight provided to lions, it appears that trophy imports provide a benefit to lion populations. The on-going adaptive management and limited off-take of lions is important to the survival of lions in Zambia and the Service will continue to monitor the situation to determine if any revision to this finding is required.

Therefore, with the information currently available that would enable the Service to make such a finding in accordance with the general considerations laid out above, the Service is able to make a determination that the import of lions taken in Zambia during the 2016, 2017 and 2018 hunting seasons, and in compliance with Zambian laws and regulations, would meet the issuance criteria under 50 CFR 17.32. As stated above, however, there are areas where additional information will be needed in the future to monitor if Zambia's hunting program provides adequate benefits to its lion population. Therefore, until additional information becomes available that would affect this finding, the Service **is able to authorize the import of wild and wild-managed lion trophies from Zambia**. In accordance with the 4(d) rule for *P. l. melanochaita*, 50 CFR 17.40(r), the Service will review each application received for import of such specimens on a

case-by-case basis and each application also needs to meet all other applicable permitting requirements before it may be authorized.

REFERENCES:

Creel S, M'soka J, Droge E, Rosenblatt E, Becker M, Matandiko W, and Simpamba T. May 2016. Assessing the sustainability of African lion trophy hunting, with recommendations for policy, doi: 10.1002/eap.1377.

Dickman A, Johnson PJ, Kesteren FV, and Macdonald DW. 2015. The moral basis for conservation: how is it affected by culture? Frontiers in Ecology and the Environment, 13: 325–331. doi:10.1890/140056

Di Minn, E, Leader-Williams, N, and Brandshaw C JA. 2016. Banning Trophy Hunting will Exacerbate Biodiversity Loss. Trends in Ecology & Evolution, February 2016, Vol. 31, No.2.

Grijalva RM, Natural Resources Committee Democrats. June 2016. Missing the Mark: African trophy hunting fails to show consistent conservation benefits, a report by the Democratic staff of the House Committee on Natural Resources.

IUCN Species Survival Commission, 2012. Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0. IUCN SSC 2012.

IUCN, April 2016. Informing decisions on trophy hunting; A Briefing Paper for European Union Decision-makers regarding potential plans for restriction of imports of hunting trophies, Briefing Paper / Trophy Hunting and Briefing Paper / Trophy Hunting / Annex – Case Studies.

Lindsey PA, Balme GA, Booth VR, and Midlane N. 2012. The Significance of African Lions for the Financial Viability of Trophy Hunting and the Maintenance of Wild Land, PLOS One http://dx.doi.org/10.1371/journal.pone.0029332.

Loveridge AJ, Searle AW, Murindagomo F, and Macdonald DW. 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation, Volume 134, Issue 4, February 2007, Pages 548-558.

Macdonald D. November 2016. Report on lion conservation with particular respect to the issue of trophy hunting, University of Oxford, Conservation Research Unit.

Packer C. 2015. Lions in the Balance: Man-Eaters, Manes and Men with Guns. Chicago University Press.

Miller J RB, Balme G, LindseyPA, Loveridge AJ, Becker MS, Begg C, Brink H, Dolrenry S, Hgirunt JE, Jansson I, Macdonald DW, Mandisodza-Chikerema RL, Cotterill AO, Packer C, Rosengren D, Stratford K, Trinkel M, White PA, Winterbach C,

Winterbach H EK, and Funston PJ. 2016. Aging traits and sustainable trophy hunting of African lions, Biological Conservation 201 (2016) p. 160–168.

Simasiku P, Simwanza HI, Tembo G, Bandyopadhyay S, and Pavy J-M. June 2008. The impact of Wildlife Management Policies on Communities and Conservation in Game Management Areas in Zambia; Message to Policy Makers, Natural Resources Consultative Forum.

USFWS (2015). Final ESA listing rule for *Panthera leo leo* and *P. l. melanochaita.* 80 Fed. Reg. 79999.

Zambia Department of National Parks and Wildlife (DNPW). May, 5th, 2016. Enhancement and Non-Detriment Finding for African Lion sport Hunting in Zambia Completed by the Department of National Parks and Wildlife (DNPW).

OPEN ACCESS Freely available online

PLOS ONE

Underperformance of African Protected Area Networks and the Case for New Conservation Models: Insights from Zambia

Peter A. Lindsey[1,2]*, Vincent R. Nyirenda[3], Jonathan I. Barnes[4], Matthew S. Becker[5,6], Rachel McRobb[7], Craig J. Tambling[8], W. Andrew Taylor[9], Frederick G. Watson[6,10], Michael t'Sas-Rolfes[11]

1 Panthera, New York, New York, United States of America, **2** Mammal Research Institute, Department of Zoology and Entomology, University of Pretoria, Pretoria, Gauteng, South Africa, **3** Zambia Wildlife Authority, Chilanga, Lusaka, Zambia, **4** Design & Development Services, Windhoek, Namibia, **5** Department of Ecology, Montana State University, Bozeman, Montana, United States of America, **6** Zambian Carnivore Programme, Mfuwe, Zambia, **7** South Luangwa Conservation Society, Mfuwe, Zambia, **8** Centre for African Conservation Ecology, Department of Zoology, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa, **9** Centre for Veterinary Wildlife Studies, Faculty of Veterinary Science, University of Pretoria, Pretoria, South Africa, **10** Division of Science and Environmental Policy, California State University Monterey Bay, Seaside, California, United States of America, **11** Cape Town, South Africa

Abstract

Many African protected areas (PAs) are not functioning effectively. We reviewed the performance of Zambia's PA network and provide insights into how their effectiveness might be improved. Zambia's PAs are under-performing in ecological, economic and social terms. Reasons include: a) rapidly expanding human populations, poverty and open-access systems in Game Management Areas (GMAs) resulting in widespread bushmeat poaching and habitat encroachment; b) underfunding of the Zambia Wildlife Authority (ZAWA) resulting in inadequate law enforcement; c) reliance of ZAWA on extracting revenues from GMAs to cover operational costs which has prevented proper devolution of user-rights over wildlife to communities; d) on-going marginalization of communities from legal benefits from wildlife; e) under-development of the photo-tourism industry with the effect that earnings are limited to a fraction of the PA network; f) unfavourable terms and corruption which discourage good practice and adequate investment by hunting operators in GMAs; g) blurred responsibilities regarding anti-poaching in GMAs resulting in under-investment by all stakeholders. The combined effect of these challenges has been a major reduction in wildlife densities in most PAs and the loss of habitat in GMAs. Wildlife fares better in areas with investment from the private and/or NGO sector and where human settlement is absent. There is a need for: elevated government funding for ZAWA; greater international donor investment in protected area management; a shift in the role of ZAWA such that they focus primarily on national parks while facilitating the development of wildlife-based land uses by other stakeholders elsewhere; and new models for the functioning of GMAs based on joint-ventures between communities and the private and/or NGO sector. Such joint-ventures should provide defined communities with ownership of land, user-rights over wildlife and aim to attract long-term private/donor investment. These recommendations are relevant for many of the under-funded PAs occurring in other African countries.

Citation: Lindsey PA, Nyirenda VR, Barnes JI, Becker MS, McRobb R, et al. (2014) Underperformance of African Protected Area Networks and the Case for New Conservation Models: Insights from Zambia. PLoS ONE 9(5): e94109. doi:10.1371/journal.pone.0094109

Editor: Danilo Russo, Università degli Studi di Napoli Federico II, Italy

Received October 15, 2013; **Accepted** March 12, 2014; **Published** May 21, 2014

Copyright: © 2014 Lindsey et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Funding: The funding for this research was provided by the Wildlife Producers Association of Zambia. CJT was funded with a Claude Leon Fellowship. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: JB is employed by Design and Development Services. PL was employed as a consultant during the research which provided the data used to compile this paper. There are no patents, products in development or marketed products to declare. This does not alter the authors' adherence to all the PLOS ONE policies on sharing data and materials.

* E mail: plindsey@panthera.org

Introduction

Many African countries have designated generous proportions of their land surface as protected areas. Such protected areas vary greatly in their makeup, from strictly protected areas with no human settlement to areas that have resident communities where multiple uses of wildlife are permitted. African governments find it difficult to fund protected area networks adequately and are facing severe threats from poaching and human encroachment [1,2]. These problems are pronounced where human settlement is permitted or tolerated inside protected areas, as occurs in parts of Ethiopia, Mozambique, Tanzania and Zambia, for example [3,4].

Zambia has a vast wildlife estate encompassing 20 national parks (~64,000 km^2), 3 wildlife and bird sanctuaries (33.5 km^2), 36 GMAs (167,000 km^2) and several other protected area categories, comprising ~40% of the nation's land area [5] (Figure 1). Human settlement is not permitted in national parks, and land use is limited primarily to photo tourism. National parks have generally not suffered from human encroachment, but are subject to widespread poaching, regular uncontrolled burning (which sometimes emanates from areas outside of the park boundaries) and in some cases, informal mining [6]. With the exception of Lusaka and Mosi oa tunya national parks, no protected areas in Zambia are fenced and most are simply demarcated with cut lines or rivers, and in some cases, beacons.

GMAs were established as buffer zones for national parks and have been used primarily for trophy hunting in recent years [7]. Unlike in the national parks, settlement is permitted in GMAs and there are large and expanding human populations in many of them, which is accompanied by widespread habitat loss. Habitat destruction is exacerbated by shifting agriculture, charcoal production and in some cases, mining [7,8,9]. In both national parks and GMAs, wildlife is under severe pressure from poaching, both for bushmeat and for trophies such as ivory [10].

In the 1980s, there was recognition of a need for greater community participation in wildlife based land uses in GMAs [8]. In the early 1980s, subsidiary legislation was introduced to partially decentralize authority over wildlife to communities [8]. The Zambia Wildlife Act of 1998 provided for establishment of ZAWA as a parastatal responsible for managing protected areas [9]. The Wildlife Act identified Community Resource Boards as the institutions for communities to co manage and benefit from

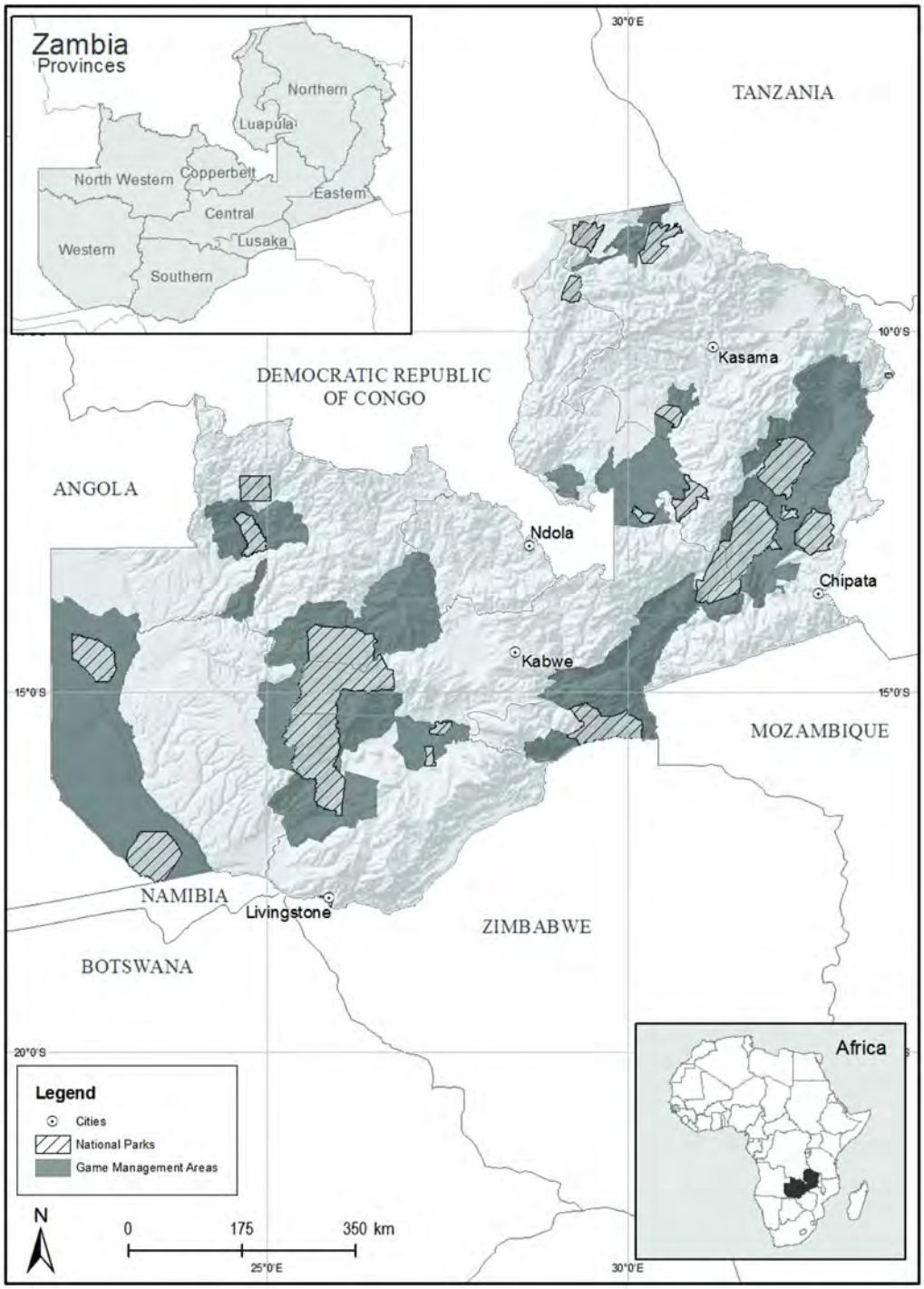


Figure 1. The Zambian protected area network.
doi:10.1371/journal.pone.0094109.g001

wildlife in GMAs [9] though no mechanisms were created to enable communities to benefit from wildlife in national parks.

Wildlife based land uses in the PA network have potential to improve livelihoods significantly for communities. People in GMAs are poorer and less educated than the national average, and GMAs have low agricultural potential and offer few alternative livelihood opportunities [11]. Trophy hunting in the GMAs has potential to generate significant incomes for commu nities if wildlife populations are allowed to recover and systems are put in place to ensure equitable benefit sharing and best practices [12]. Similarly, national parks have potential to benefit rural communities through tourism related employment and business opportunities. The PA network as a whole has enormous potential to contribute to rural and national economic growth by providing the basis for development of a major tourism industry [13]. However, wildlife populations are waning in many GMAs and national parks, and incomes from both trophy hunting and photo tourism are limited to fractions of the GMAs and national parks [7]. In addition, mechanisms to enable communities to benefit legally from the PA area network are limited. Consequently the PA network is under performing in ecological, economic and social terms.

There have been several attempts by the Zambian government to address the underperformance of the protected area network. For example, in 2006, the Zambian Government embarked upon a reclassification programme for protected areas [5] and in early 2013, a moratorium was imposed on hunting in GMAs. In addition, two protected areas have been added to the estate in recent years: the ~50 km^2 Lusaka National Park and the 5,104 km^2 Mukungule GMA. However, key challenges with regards to the functioning and effectiveness of Zambia's PA network remain.

In this paper we provide evidence of the under performance of the Zambian protected area network, give reasons for that performance and suggest interventions needed to make the system more effective in ecological, economic and social terms. These recommendations have relevance for the PA networks of many other African countries.

Results and Discussion

Ecological Indicators of Protected Area Performance

Human encroachment of protected areas in Zambia is worse than in most other African countries [14], and ~2,500 3,000 km^2 of land are deforested annually [15]. Human population growth rates in GMAs (2.49±0.18%) are higher than elsewhere (2.31±0.24%, T test 0.577, d.f. 70, p 0.566) [16]. Almost 40% of the total area of GMAs is now comprised of human modified habitat (c.f. 71.2% outside of the protected area network) [6]. By contrast, habitat loss in national parks is limited (2.1%) (Table 1). The rate of habitat loss in GMAs (0.69% conversion per year) is faster than in national parks (0.05%) or outside protected areas (0.51%) (Table 1, Figure 2, [6]). Extrapolating from [6]'s sample area (Table 1, Figure 2), ~82 hectares of habitat are lost per daylight hour in GMAs on a national level. Human encroachment in GMAs is advancing from main roads towards national parks at a rate of up to 2 km per year ([6]). In some protected areas, and most notably Lukusuzi National Park [17], mining activity is evident and has potential to affect wildlife populations adversely through habitat degradation and bushmeat poaching [18]. In addition to habitat loss, human encroachment undermines the buffer zone role of GMAs for national parks, jeopardizes ecological connectivity among PAs and the concept of transfrontier conservation areas ([6]).

Table 1. Estimates of the extent and rate of habitat conversion in GMAs (from natura to human-modified habitat), nationa parks and and outside the protected area network in Zambia (taken from data extracted from [6]).

		~1970		~1985		~2010		~1970–~1985		~1980–~2010	
Land type	Total in study area (km^2)	Area human (km^2)	% human	Area human (km^2)	% human	Area human (km^2)	% human	Increase per year (km^2)	% increase per year	Increase per year (km^2)	% increase per year
Who e study area	159805	58926	36.9%	60935	38.1%	80157	50.2%	134	0.08%	769	0.48%
NPs	27098	252	0.9%	257	1.0%	571	2.1%	0	0.00%	13	0.05%
GMAs	47430	9468	20.0%	10616	22.4%	18744	39.5%	77	0.16%	325	0.69%
Non-NP, Non-GMA	85277	49206	57.7%	50061	58.7%	60841	71.3%	57	0.07%	431	0.51%
Luangwa Va ey GMAs	26502	6815	25.7%	6190	23.4%	8878	33.5%	−42	−0.16%	108	0.41%
Southern Kafue GMAs	20928	2652	12.7%	4427	21.2%	9866	47.1%	118	0.57%	218	1.04%

doi:10.1371/journa .pone.0094109.t001

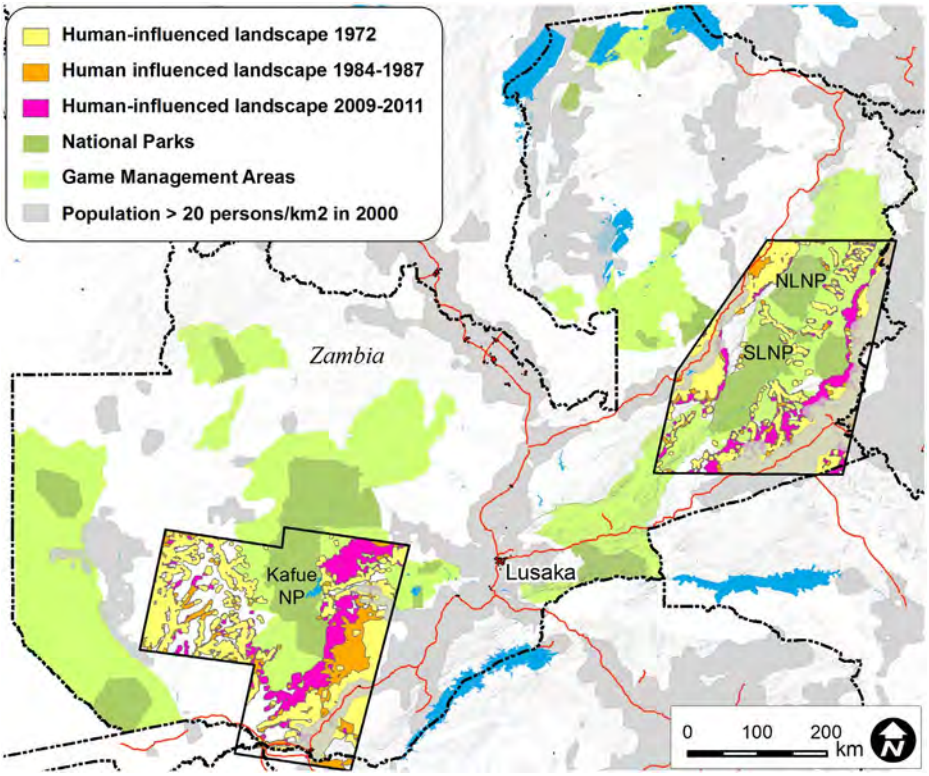


Figure 2. The extent of human encroachment of natural habitat in two focal areas in Zambia extracted from [6]**.**
doi:10.1371/journal.pone.0094109.g002

Data from aerial censuses indicate that wildlife populations in Zambian protected areas are relatively low (Table 2): ~169,000 wild ungulates occur in the ~61,000 km^2 of Zambian national parks for which data are available (excluding species of the size of a bushbuck or smaller and hippos) and ~143,000 in the ~160,000 km^2 of GMAs for which data were available. By contrast, ~63,000 ungulates occur on <6,000 km^2 of game ranches in Zambia [19]. Country level population data for wildlife in other countries are scarce, but to provide a coarse comparisons, 1.8 2.8 million wild ungulates occur on 287,000 km^2 of Namibian wildlife ranches ~841,000 ungulates occurred on 27,000 km^2 of Zimbabwean game ranches prior to the land seizures [20] and ~215,000 ungulates occur in the ~20,000 km^2 Kruger National Park in South Africa [21,22].

The biomass of large wild ungulates is lower in GMAs (mean 212±59 kg/km^2) and national parks (791±240 kg/km^2) than in extensive game ranches (2,424±305 kg/km^2) (which are devoid of human settlement and rely primarily on trophy hunting for income) (Figure S1a) [19]. The diversity of wild ungulates is also lower in GMAs (4.7±0.58 species) and national parks (7.2±0.9 species) than on extensive unfenced game ranches 11.1±0.86 species) (Figure S1b) [19]. The higher biomass and diversity on private ranches is likely to be primarily due to the availability of greater resources for anti poaching than in state protected areas. These findings reinforce the suggestion that trophy hunting need not have a negative impact on wildlife populations given appropriate land tenure arrangements [23].

Combining data from GMAs, national parks and extensive game ranches, wildlife ungulate biomass was negatively related to the presence of human settlement (in areas with settlement mean biomass was 268±70.8 kg/km^2 c.f. 1,755±281 kg/km^2), as was wild ungulate diversity (5.20±0.61 species c.f. 9.68±0.7) (F Ratio 26.2, d.f. 2, p<0.001). Wild ungulate biomass was positively related to investment by the private sector/NGOs (in areas with such support, mean biomass was 1,592±222 kg/km^2 c.f. 233±113 kg/km^2 in areas without such investment, as was wild ungulate diversity (9.1±0.71 species c.f. 5.0±0.65) (F Ratio 37.0, d.f. 2, p<0.01) (Figures S2a, S2b).

Observed biomasses of large mammals in Zambian protected areas were lower than potential maximum carrying capacities by 93.7% in GMAs and 74.1% in national parks (Figures 3a, 3b). Wildlife densities are suppressed in some of Zambia's 'flagship' national parks and GMAs. For example, biomasses in Kafue, South Luangwa and Lower Zambezi national parks are 29%, 16% and 23% of potential carrying capacity, whereas that in Lupande GMA (which has in the recent past been categorised as a 'super prime' concession), stands at 11% of carrying capacity. Depressed prey populations means that predator populations are almost certainly also occurring well below historic densities.

Population trend data are generally not available for Zambian protected areas. An exception is the Luangwa ecosystem, where the biomass of wildlife declined significantly in all five GMAs and four national parks during 2011 2012, and 80% of species showed declining trends during 2009 2012 [24]. By contrast, in Liuwa Plains (co managed by African Parks/ZAWA since 2003), wildlife populations have recovered and large mammal biomass (excluding hippos and species of bushbuck size and smaller) increased from 966 kg/km^2 in 2003 to 1,921 kg/km^2 in 2013 [25].

Declining wildlife populations in GMAs have been reflected in changes to the way ZAWA classifies GMAs. In 2008, 24 GMAs were classified as depleted or secondary whereas in 1997, only 16 were categorized as such [7].

Table 2. Estimated wildlife populations in National Parks (data available for 61,462 km^2 of the ~64,000 km^2), Game Management Areas (GMAs, data available for 159,654 km^2 of the ~167,000 km^2) and game ranches (5,829 km^2) in Zambia (excluding species of bushbuck size and smaller, and hippopotamuses for which count data were not available) (data taken from [19]).

Species	National parks	GMAs	Game ranches	Total
Lechwe	9,737	75,808	1,513	87,058
Impala	27,820	13,507	27,998	69,325
Wildebeest	47,815	4,069	630	52,514
Buffalo	21,301	15,938	2,107	39,346
Puku	16,838	7,529	4,904	29,271
Elephant	10,830	8,094	1,710	20,634
Sable	8,172	4,895	3,682	16,749
Zebra, plains	8,375	1,050	2,060	11,485
Waterbuck	5,254	2,333	2,987	10,574
Kudu	1,908	1,976	6,287	10,171
Hartebeest	4,429	3,952	2,051	10,432
Roan	2,384	1,632	1,647	5,663
Reedbuck	1,137	852	2,735	4,724
Eland	1,069	237	1,558	2,864
Tsessebe	990	88	410	1,488
Giraffe	579	178	321	1,078
Sitatunga	40	369	328	737
Nyala	0	0	95	95
	168,678	142,507	63,023	374,208

doi:10.1371/journal.pone.0094109.t002

Economic Indicators of Park Performance

Zambia attracts fewer tourists than other African countries known for wildlife: South Africa (~9.2 million), Botswana (~2.3 million), Zimbabwe (~2.2 million), Kenya (~1.8 million), Mozambique (~1.6 million), Tanzania (~1.25 Million), Namibia (~1.1 million), Zambia (~0.9 million) (www.wttc.org, accessed July 2013). In 2005 (when the latest data on tourist visitation to parks were available), just 59,350 tourists visited Zambia's national parks and 95% of those visited just five parks (Kafue, South Luangwa, Mosi oa Tunya, Lower Zambezi and Lochinvar): the remaining 15 parks comprising ~32,000 km^2 attracted just 1,384 tourists [26,27]. Most national parks thus fail to attract enough tourists to support viable photo tourism [27]. Earnings from national parks and GMAs in Zambia are low. Photo tourism generated USD9.1 million for ZAWA in 2011 (USD142/km^2) and UDD9.4 million in 2012 (USD146/km^2) (ZAWA unpublished data). The majority of those earnings (96.9%, USD154/km^2) were from four parks (South Luangwa 44.4%, Mosi o tunya 23.7%, Kafue 14.7% and Lower Zambezi 14.1%), which comprise 36,681 km^2 (57.3%) of the national parks network (ZAWA unpublished data). The remainder of the parks generated just USD182,229 (USD6.7/km^2) due to the relative (or actual) absence of tourism operators. Photo tourism operations exist in only 10 of 36 GMAs [7] and in a marginal capacity given they currently are unable to bid for concessions in GMAs. Photo tourism operations in GMAs are generally limited to lodges on national park boundaries with little investment or activity in the GMAs.

From trophy hunting income, ZAWA only earned concession fees from ~51% of the GMA estate in 2012 (ZAWA unpublished data). ZAWA earned a total of USD4.34 million from trophy hunting and resident hunting respectively in 2012 (equating to USD26/km^2) (ZAWA unpublished data). We estimate that an additional USD16.1 million was earned by operators from trophy hunting in GMAs, yielding total earnings of USD97/km^2 (averaged across all GMAs including those not hunted, Table 3). Earnings per km^2 from trophy hunting (when excluding hunting areas that do not generate any income to allow for comparison with other countries) (US$291±116/km^2) are lower than most other SADC countries: Zimbabwe USD1,028/km^2; Tanzania USD424/km^2; Namibia USD378/km^2; Mozambique USD130/km^2, [28] (F Ratio 11.0, *d.f.* 1, p 0.001). Within Zambia, gross earnings per km^2 from trophy hunting in GMAs (USD97/km^2) are markedly lower than on extensive game ranches (USD878±226) (F Ratio 15.9, d.f. 1, p<0.001) [19]. Contrib uting to the low earnings from hunting in Zambia in 2012 was the fact that 19 leases for hunting concessions ended prior to the end of the hunting season, and resident hunting was halted by the Zambian government (ZAWA unpublished data).

Social Indicators

The primary benefit to communities from national parks is employment and the development of wildlife based economies around tourism hubs such as the growth point of Mfuwe, adjacent to South Luangwa National Park. Tourism generates an estimated 19,000 jobs in Zambia [27], though the proportion derived specifically from parks is not clear. In Mfuwe, ~900 jobs are created and such workers receive mean salaries of US$450/ month, ~3x the minimum wage (A. Coley, pers. comm.). Tourism related employment is significant because it can result in improved attitudes towards wildlife conservation [29]. Howev er, most parks generate virtually no employment for communities due to the lack or small scale of tourism operations.

In GMAs, benefits accruing to communities from trophy hunting include income generation for Community Resource

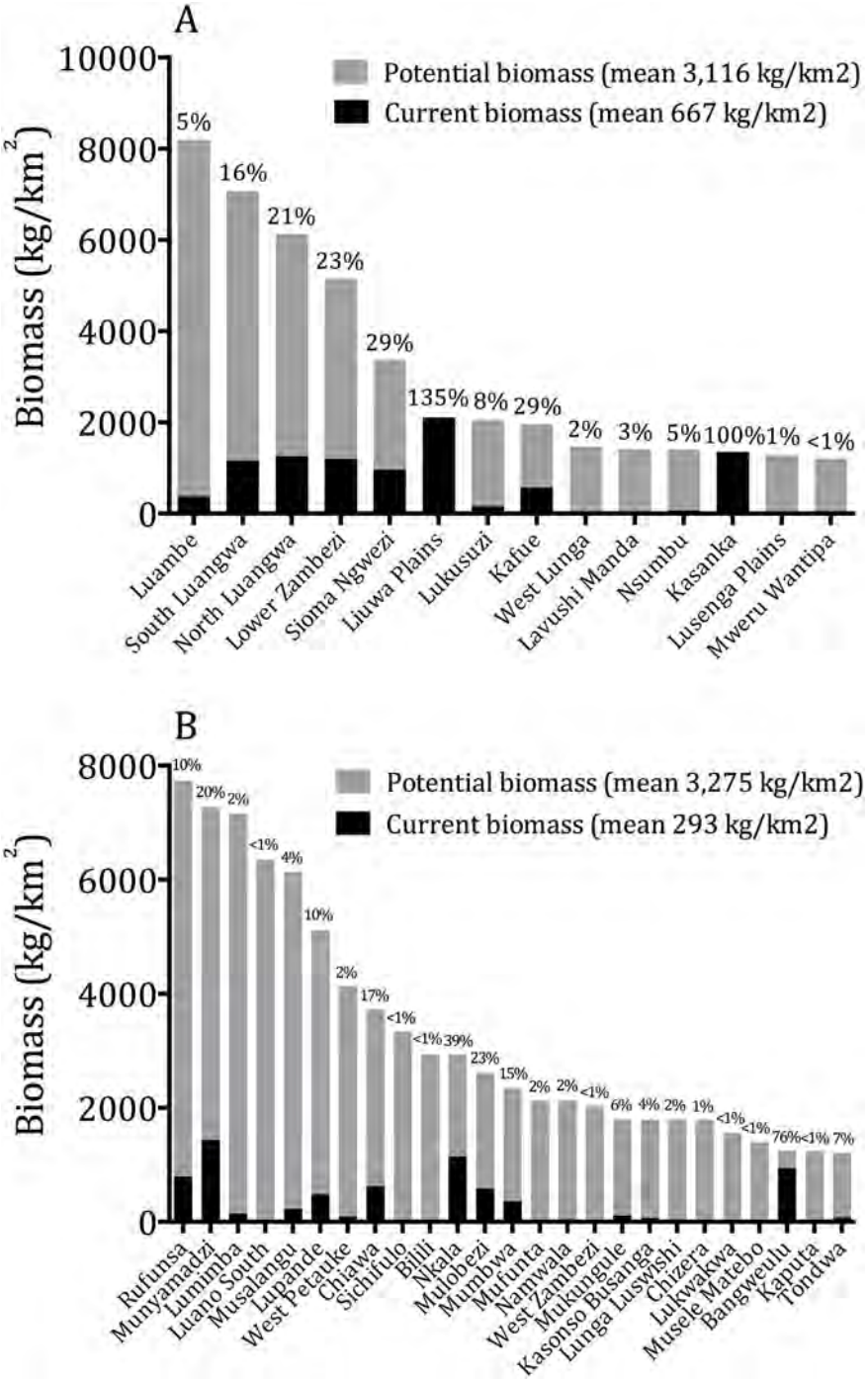


Figure 3. Observed large mammal biomass versus potential carrying capacity in Zambian (a) national parks and (b) GMAs.
doi:10.1371/journal.pone.0094109.g003

Boards, employment and in some cases, various forms of development assistance from hunting operators. In some GMAs, such as those in the Luangwa Valley and Bangweulu system, livelihood improvements associated with income from trophy hunting are significant [30]: families in the most wildlife rich GMAs are ~17% better off than those outside of the GMAs, and have a 7.8% higher chance of obtaining employment [8]. However, no earnings whatsoever are generated in half of the GMAs, and average earnings accruing to communities across all GMAs are low (USD11.9/km^2) (ZAWA unpublished data, Table 3). Concurrently, communities incur significant costs as a result of living with wildlife and ~50 people are killed annually by wild animals [31]. Overall, communities living in GMAs are 30% poorer than the national rural average [32].

Reasons for the Under-performance of Protected Areas

1. Community-related issues. There are no legal mecha nisms to enable communities to benefit financially from photo tourism in PAs. Furthermore, photo tourism is under developed and is practiced in a small fraction of the PA estate where the

Table 3. Gross earnings in USD from trophy hunting and non-resident hunting in Game Management Areas in 2012 (excluding land under 99 year lease within or near to GMAs) (NB that operators' net earnings are markedly lower than the gross income, due to the costs associated with paying concession and animal license fees to ZAWA, the costs of running and marketing safaris, and the costs of managing the concessions).

	Total	Operators*	ZAWA*	Community Resource Boards*	Chiefs*
Trophy hunting					
Concession fees	N/A	N/A	580,572	108,857	36,286
Animal license fees	N/A	N/A	1,697,878	1,528,090	169,788
Operators license fees	N/A	N/A	80,500	0	0
PH license fees	N/A	N/A	65,621	0	0
Daily rates	N/A	11,655,430	N/A	N/A	N/A
Trophy fees	N/A	4,506,987	N/A	N/A	N/A
Sub total	16,162,417	16,162,417	2,424,571	1,636,947	206,074
Resident hunting					
Total earnings	88,932	N/A	44,489	40,040	4,449
Non resident hunting earnings/km^2	0.6	N/A	0.3	0.3	0.0
Total earnings	16,251,349	16,162,417	2,469,060	1,676,988	210,522
Total earnings/km^2	97	N/A	14.8	10.0	1.3

*NB Operators were assumed to generate the total gross income from trophy hunting, from which the ZAWA and community income is derived. This income excludes that generated from extensive game ranches, which are on 99 year lease.

doi:10.1371/journal.pone.0094109.t003

resource and existing conditions are suitable. For example, photo tourism operations exist in only 10 of the 36 GMAs [7] and the existing legal framework does not require photo tourism operators to pay Community Resource Boards [9]. Consequently, commu nities are only able to derive legal benefits from wildlife via trophy hunting in GMAs and through employment in national parks and GMAs.

The Wildlife Act fails to recognize communities as the rightful owners of the land or wildlife in GMAs (in contradiction to the Lands Act of 1995, [33]). There are no mechanisms for specific communities to obtain exclusive rights over land in GMAs or over the wildlife resources therein. Consequently, mechanisms to prevent in migration of external communities into GMAs are weak. Immigration is likely fuelled by the availability of bushmeat, firewood and other natural resources, and in some cases, due to potential employment opportunities from tourism in adjacent national parks. Clearing of lands for settlement and shifting agriculture and tree cutting for charcoal production all contribute to habitat loss in GMAs [9,15]. Uncontrolled immigration means that land use planning is difficult to enforce [6] and creates an open access system whereby it pays communities to occupy land or kill wildlife before someone else does.

ZAWA collects revenues from trophy hunting and remits 20% of the concession fees to communities and 50% of animal license fees for wildlife shot as trophies in GMA [8]. ZAWA thus retains most of the income from hunting in GMAs even though the land is under customary tenure and belongs to the community. Wildlife based land uses are effectively heavily taxed, whereas livestock production, small scale agriculture and others are not (Table 3). Furthermore, income from wildlife is often paid late and as hand outs that do not create a clear link between conservation and earnings [9,30]. Earnings for communities from trophy hunting are lower than estimated earnings from illegal bushmeat hunting and create weak incentives for conservation [34].

Communities living in GMAs are also marginalized from the decision making relating to wildlife management. The concession agreements that are signed between ZAWA, hunting operators and Community Resource Boards on the leasing of GMAs favour ZAWA. ZAWA retain most of the income, delegate numerous responsibilities to other stakeholders, allocate minimal rights, are able to dismiss Community Resource Boards or to cancel the leases of hunting operators, and are not obliged to make their financial records available [11]. There is widespread resentment towards ZAWA, hunting and tourism operators (anon survey respondent, pers. comm.).

The make up and functioning of Community Resource Boards is also problematic. More affluent community members benefit disproportionately from trophy hunting [30]. There is a lack of appropriately educated or skilled community members to form Community Resource Boards, which limits their ability to negotiate effectively with ZAWA or operators [9]. Skills shortages are exacerbated by the fact that the Community Resource Boards are re formed each 2 3 years [35]. Furthermore, local chiefs can dismiss board members and 'village scouts' (community members employed by the community resource boards for anti poaching) at their discretion, making Community Resource Boards unstable. There are frequent financial irregularities associated with CRB income from wildlife and funding allocated to resource protection is inadequate [9]. The 850 village scouts employed throughout Zambia are poorly and irregularly paid, insufficiently trained or equipped and are too few in number to effectively patrol the vast GMA estate [11].

2. ZAWA-related issues. When ZAWA was formed in 2000, a key objective was to increase efficiency and financial self sufficiency [35]. ZAWA was meant to retain government support, but in practise funding was reduced to just 15% of operational budget. Including the ~USD4.6 million generated from trophy hunting, ZAWA's resources equate to USD20 60/km^2/year, which compares poorly with the USD358 USD455/km^2 required to manage protected areas effectively [36] ZAWA has a field staff complement of 1,179 to protect 231,000 km^2, which equates to 1/ 196 km^2 and compares poorly with the southern African regional

average of 1/40 km^2 [1]. As little as 8% of the ZAWA budget is spent on GMAs even though they generate >50% of ZAWA earnings and comprise >70% of land under their jurisdiction [7]. Furthermore, ZAWA is encumbered by large numbers of sick and poorly trained staff, and an increasing proportion of ZAWA funds have been accruing to head office (anonymous survey respondent pers. comm.). Consequently, field capacity is low when the threat to wildlife from the bushmeat trade and is unprecedented and that from ivory poachers resurgent [2,37]. Funding shortages mean that ZAWA's mandate of protecting the vast wildlife estate is impossible to achieve.

To rectify this situation, ZAWA have allocated partial responsibility for resource protection to Community Resource Boards and hunting operators with the effect that roles are blurred and none of the stakeholders contribute sufficiently. This is despite the fact that responsibility for anti poaching falls on ZAWA according to the Wildlife Act [11]. Technical support to Community Resource Boards from ZAWA is inadequate and communication between Community Resource Boards and ZAWA is limited [9].

Forced to generate their own funding, ZAWA rely on safari hunting in GMAs for ~45 67% of their revenue [11,35]. This reliance means that ZAWA are sometimes forced to make decisions to achieve financial survival at the expense of the wildlife they are mandated to conserve. For example, in 2003, ZAWA increased quotas and reduced the size of hunting blocks [7]. In addition, ZAWA have imposed high 'fixed quotas' (of 60 100%) whereby operators are forced to pay for animal license fees before commencement of hunting [7,11]. Such quotas create a perverse incentive, forcing operators to harvest wildlife regardless of sustainability. Due to lack of funds, there is a lack of monitoring of wildlife populations or of trophies. Trophy quotas are established arbitrarily, quota utilization is low (averaging 40%) and prior to the ban trophy quality was falling, implying that quotas were not sustainable [7]. Quotas of lions have been particularly excessive [38,39].

The requirement for ZAWA to generate their funds means that it is not in their best interests to devolve user rights over wildlife to communities in GMAs or to private landowners on extensive wildlife ranches (who are forced to pay license fees for animals hunted to ZAWA), as that would reduce income in the short term and create perceived competition [19]. A similar conflict arose when the Zimbabwe Parks and Wildlife Management Authority became a parastatal responsible for generating their own revenue [40]. In Zimbabwe, that shift resulted in a gradual shift towards centralized authority over wildlife and gradual reversal of the devolution that made the wildlife ranching industry in that country such a success [40].

Wildlife in GMAs is affected by several other forms of legal harvest including resident hunting conducted by Zambian citizens and residents. Resident hunting licenses cost ~1/3 the meat value of the animals hunted, and consequently resident hunters often shoot wildlife specifically to obtain meat to sell, and in many cases, quotas are exceeded (Table 4). Such abuses are made possible by inadequate supervision of resident hunts and corruption. Prior to the hunting ban, a varying amount of wildlife was also killed under 'special licenses' allocated on a discretionary basis by the Minister of Tourism and Arts [35]. Special licenses and non resident hunting licenses strip the value of wildlife and create minimal incentives for conservation by communities. The multiple forms of legal off take compound the effects of habitat loss, predation and poaching and confer heavy depletion of wildlife in most GMAs (Figure 3b).

3. Operator-related issues. In national parks, tourism operators are not required to conduct anti poaching and input is generally limited to sporadic provision of support for NGOs involved in resource protection [41]). In GMAs, the concession allocation system created disincentives for investment and good practice by hunting operators. Leases are granted for 10 years (or 15 for depleted blocks), which is not sufficient to encourage adequate investment in the area or to a sense of ownership of the areas [42]. Where wildlife populations are depressed, 15 years does not allow for sufficient time for operators to recoup the investments needed to allow wildlife populations to recover [43].

The hunting concession agreements (which outline commit ments to anti poaching and community outreach) are not effectively enforced [9]. Furthermore, operators typically vacate the hunting blocks during the rainy season, leaving their areas vulnerable to poachers. Some of the hunting blocks in GMAs are extremely large, and several operators complained that their size renders effective enforcement impossible. Some operators appear to invest a significant amount in anti poaching and others virtually nothing. However, there is no system to link past performance of hunting operators to the prospects of them obtaining an extension of a lease or a new area. Consequently, responsible operators are not adequately rewarded, and unscrupulous operators not adequately punished, reducing incentives for good practice and allowing abuses (including alleged over shooting of quotas by some operators) to continue [44]. In general, declining wildlife populations have resulted in falling incomes [7] and thus declining resources available protect the resource.

In early 2013, ZAWA imposed a moratorium on hunting in GMAs in response to alleged corruption in the tender process and due to concern over wildlife population trends. Consequently, hunting operators have vacated the GMAs, resulting in loss of their contribution to anti poaching and creating a vacuum in which illegal activities are more likely to proceed unhindered. Evidence from Kafue National Park suggests that the simple presence of operators has a significant deterrent effect for poachers [41]. Furthermore, there have been extended periods in 2013 when village scouts went without pay, and many likely relied on poaching for income (Anon survey respondent, pers. comm.). While government has subsequently stepped in to pay the salaries of village scouts, it is not clear as to how such payments will be sustained in the absence of hunting income. There have been few proposals from the photo tourism industry to take over GMAs in the wake of the hunting ban. The hunting moratorium is thus likely to fuel wildlife declines by reducing: anti poaching effort and presence in GMAs; working capital for ZAWA; and incentives for conservation by communities.

4. Other factors. There are multiple authorities in GMAs with jurisdiction over the management of different resources [35]. In addition, conflicting legislation precludes effective land use planning. For example, the wildlife act states that ZAWA is responsible for wildlife resources in the area, and by implication habitat, whereas the Local Government Act says that local councils are responsible for planning and development [35]. Consequently development related decisions are sometimes made in GMAs with little consideration of their impacts on wildlife or the potential for wildlife based land uses. Furthermore, chiefs are able to allocate land to private investors in the middle of GMAs without consulting Community Resource Boards [9].

Changes Needed to Improve the Functioning of the Protected Area Network

In this section we outline a number of key steps that we consider to be necessary to improve the functioning of the Zambian PA

Table 4. The price of citizen licenses for hunting in GMAs, the meat value of those species and the value of the meat relative to the price of citizen licenses.

	Citizens	Meat value*	Meat value relative to license fee
Buffalo	493	1398	3
Bushbuck	40	142	4
Bush pig	16	146	9
Duiker	32	40	1
Eland	592	1425	2
Hartebeest	158	355	2
Impala	40	150	4
Kudu	493	551	1
Oribi	59	33	1
Puku	69	159	2
Reedbuck	79	159	2
Warthog	79	185	2
Waterbuck	158	615	4
Wildebeest	158	593	4
Zebra	296	757	3
Average ± S.E.			3±0.75

*Assuming male animals are hunted, a meat price of USD4.3/kg (the price paid by Lusaka butchers for dressed meat) and assuming the mean mass of dressed carcasses presented by [72].

doi:10.1371/journal.pone.0094109.t004

network, many of which are likely to apply to PAs in various other parts of Africa.

1. Empowering communities to benefit more from the PA network. There is a need to develop systems to enable communities to benefit more from PAs so as to enhance their social and economic value. Potential models to for such community engagement are discussed in the next section.

2. Re-defining the role of ZAWA. The role of ZAWA should be re defined so that the organisation focuses primarily on national parks, and elsewhere plays more of a hands off coordinating role to facilitate the development of wildlife based land uses by community, private, and NGO partners. There is need for recognition from government that unless earnings are vastly higher than they have been in the past, the GMAs cannot be used to fund other parts of the PA network or to support ZAWA headquarters. If ZAWA continue to extract revenues from GMAs, then a commensurate reinvestment in law enforcement and wildlife management in those areas is required.

3. Greatly increasing funding from government for ZAWA. Drastically increasing government funding for ZAWA. Such funding should be seen as an investment in the development of the tourism industry rather than as a cost (as discussed further below). Even at current rates of funding for ZAWA, there is evidence of impressive returns on investment: in 2005, the government of Zambia received USD8 million from wildlife related tourism from an investment of just USD1 million [32]. The tourism industry in Zambia comprises just 5% of GDP compared to a global mean of 14%, and creates just 3.6% of national employment compared to a regional mean of 7.2% [13,45,46]. In addition, there has been relatively minimal capital investment in the tourism industry in Zambia (1.7% of GDP c.f. a regional average of 6.9%) [13]. There is thus major scope for growth in the Zambian tourism industry, particularly given projections of rapid increases in visitor arrivals to the SADC region [13]. To achieve that growth, however, there is a need for much greater investment in protecting the wildlife product.

4. Harnessing international willingness to pay for conservation. There is a need for greater international support for PA management in Zambia. The Zambian PA network constitutes ~40% of the country's land area, compared to a global average of 12% [47]. A developing country such as Zambia cannot reasonably be expected to pay for all of the costs of the maintenance of that global asset in addition to bearing the associated opportunity costs. Furthermore, tourism and trophy hunting (in the case of GMAs) may never generate enough income to cover the costs needed for effective protected area management. There are numerous potential avenues for harnessing international willingness to pay for wildlife conservation, including *inter alia*:

a) Encouraging co management agreements for PA management. In national parks, ZAWA could pursue the development of co management agreements with NGOs and the private sector to share the burden of PA management and attract additional technical capacity. Encouragingly, there has been an increasing trend towards development of such agreements in Zambia in recent years [5,48]. There are official co management agreements in place for five national parks and two GMAs (ZAWA unpublished data). In addition, there is significant NGO involve ment in resource protection in several other national parks (e.g. Kafue, South Luangwa, Lower Zambezi, Sioma Ngwezi, and Nyika) and 11 other GMAs. If ZAWA could focus primarily on coordinating and regulating the management of PAs by partner organisations, the effectiveness and cost effectiveness of parks could be greatly enhanced. NGOs and the private sector could be encouraged to take over the management of entire PAs or of concessions within PAs. Such a set up also would provide NGOs that are opposed to trophy hunting with the opportunity to reduce the prevalence of the practice by making payments in lieu of hunting revenues in the GMAs.

b) Attracting funding for the development of a national CBNRM programme. In addition to funding ZAWA and the PA network, there is a need for funding to allow for a national community based natural resource management (CBNRM) programme to facilitate the capture of a greater proportion of benefits from the PA network by communities. Such funding could build on the progress made by the Administrative Management Design for Game Management Areas (ADMADE) during the 1990s. The successes of the Namibian community conservancy programme and the Zimbabwean CAMPFIRE programme have been dependent on long term and substantial injections of technical capacity and funding (USD173 million and USD35 million respectively) ([49], C. Weaver pers. comm.). Likewise, the community conservancies in the northern Kenyan rangelands are supported by a coordinating NGO with funding of ~USD1.2 million annually [50]. A similarly well funded, supported and coordinated national CBNRM programme is needed in Zambia.

c) Encouraging allocation of a greater portion of overseas development aid towards PAs. There is a strong case for donors to direct a portion of international development aid towards PA management, capitalizing ZAWA and/or co management agreements between ZAWA and NGOs, and/or developing a national CBNRM programme. Recent estimates suggest that for every 1% increase in tourism related investment in the SADC region, a 0.3% increase in GDP per capita accrues [13]. An allocation of just 2–3% of the ~USD1 billion of overseas development aid that Zambia receives annually [51] would cover the costs of managing the national parks effectively and of protecting the main tourism asset [32]. However, there is a need for checks and balances to ensure efficient use of donor funds by ZAWA.

A potentially cost effective way of using donor funds to achieve both conservation and development objectives (ideally in the context of a coordinated national CBNRM programme) is through schemes that channel payments to communities living in or near PAs for the provision of ecosystem services. For example, communities could be paid an annual fee for desisting from converting habitat or for protecting wildlife from poaching. In the Maasai steppe in Tanzania for example, such an approach has achieved notable conservation gains for a cost of just USD48/km^2 [52], which compares favourably with the costs of traditional PA management. A key potential value of PES approaches is that they can help correct 'market failures' whereby wildlife that is valuable to the nation as a whole is not valuable to the people living with it, who thus over exploit the resource or invest little in protecting it [50]. PES approaches could be combined with efforts to provide communities with stable markets and fair prices for livestock and crops, as is being conducted in the Kenyan community conservancies, and as part of the community markets for conservation approach in parts of Zambia [50,53]. However, the latter approaches are only likely to be successful if combined with efforts to actively protect wildlife populations via anti poaching.

d) Other options. Capturing the willingness of international philanthropists to pay for conservation represents another potential means of funding PAs [54]. Several precedents for such investment exist, such as that provided in Gorongosa National Park in Mozambique and the Grumeti Game Reserve in Tanzania. Additionally, attracting carbon related investment via projects such as REDD+ could potentially generate funds for the protection of woodlands and associated biodiversity, notwithstanding the constraints currently associated with that programme [55]. Further, government could potentially generate additional revenue by taxing stakeholders who benefit substantively from ecological services provided by PAs, such as commercial farmers and power generating or mining companies.

5. Attracting significant private investment. To develop tourism and hunting businesses in national parks and GMAs, and to protect and manage wildlife in GMAs (assuming that ZAWA focuses their efforts on national parks) would require substantial private and/or donor investment. Rehabilitating a single depleted GMA is predicted to cost millions of dollars and such investments would likely take many years to recoup [43]. Attracting such investment is most likely under the following circumstances: an enabling policy environment; simple safe and standardized processes for investing; long leases (of at least 40 years for depleted areas [43]); attractive terms (e.g. as would be conferred if ZAWA desisted from taxing wildlife based land uses in GMAs); minimal red tape or interference from ZAWA, a functioning national programme for the development of community wildlife conservancies (see below) and knowledge that communities are supportive of wildlife investments on their land. In GMAs, investors and community partners should be able to choose any forms of wildlife based land uses and the combinations that will yield the best returns for their particular spatial setting. Consequently, hunting bans or bans on the hunting of high value species are to be avoided so long as hunting can be managed in a manner that ensures sustainability [12]. Finally, resident hunting should not be allowed to undermine private investments in GMAs and should only be permitted if desired by the community and investor partners and if priced appropriately.

6. Addressing key conservation threats decisively. For the PA networks to function better, there is a need to decisively address key threats such as human encroachment, bushmeat and other forms of poaching. Human encroachment could be addressed through linking the allocation of leases to communities with agreed land use plans (see below). Alternatively, portions of GMAs close to national parks could be re gazetted as 'buffer zones' where human settlement is not permitted (though the leases for such areas could still be leased to communities to enable them to benefit from legal wildlife based land uses, see below). In such instances and at the edge of community conservancies (see below), fencing external boundaries (if supported by communities) may play a significant role in reducing edge effects, reducing human wildlife conflict, demarcating boundaries and helping to prevent further encroachment [58,59]. Where human settlement has reached right up to the boundaries of national parks, the fencing of such sections may be justified if appropriate materials are used and if adequate funding for maintenance exists.

Addressing poaching requires elevated opportunities for communities to benefit legally from wildlife, stiffer legal frameworks relating to poaching (with penalties that reflect the value of wildlife and the threat posed by poachers to the life of PA staff) and improved anti poaching are required [2]. To achieve professional, well funded anti poaching requires either a much greater investment from ZAWA, and/or significant investments from the private and/or NGO sector.

7. Prioritising conservation efforts. Zambia's PA network is vast and funding limited. Furthermore, some of the GMAs are probably damaged beyond repair due to heavy human settlement and habitat modification. Given these factors plus the high human population growth rates, conserving the entire PA network in the long term is unlikely. There is a case for a scientific priority setting exercise to identify the PAs that should be the priority for investment of available funding.

Potential Models for Achieving Elevated Community Participation in the PA Network

The degree of involvement of communities in national parks versus GMAs should arguably differ as people reside the latter but

generally not the former. For national parks, one option would be to allocate ownership of PAs, shareholdings of PAs, or tourism concessions within parks to neighbouring communities for them to lease out to tourism operators. Precedents for such arrangements have been established in South Africa, for example, through the creation of contractual parks [56]. Such changes would require clear definition on who comprises 'the community' as at present, membership is poorly defined, compromising effective plan implementations and revenue sharing.

In the GMAs, we recommend changes that empower communities and enable them to participate in and benefit from wildlife based land uses through the formation of Community Wildlife Conservancies (CWCs). Precedents for such conservancies have been developed in both Namibia and the northern rangelands of Kenya, both of which have achieved significant conservation and livelihood gains [50,57]. While there are many potential variants of such models that could applied to the GMAs, there are a few general principles that we believe should be adhered to: a) communities should be allocated the maximum permissible degree of ownership over land and wildlife; b) that ownership should be structured such that it is exclusive for specific communities to avoid perpetuation of the tragedy of the commons; c) communities should accrue benefits from wildlife directly, and not via remittances from ZAWA; d) communities must actively participate in wildlife management decisions and not be passive recipients of hand outs; e) community structures that are used to administer finances relating to wildlife must be democratic, transparent and regularly audited to ensure equitable distribution of benefits and avoid elite capture, and f) there must be mechanisms to ensure funding for high quality anti poaching security given the level of threat in GMAs. Two examples of potential models for the establishment and functioning of CWCs in GMAs are as follows:

1. Complete devolution model. Here CWCs in the GMAs would be established as community conservancies based on joint ventures between communities and the private sector. ZAWA would not extract income from the CWC and would play a purely regulatory, facilitating and over seeing role. ZAWA currently earn nothing from half of the GMAs as it is and so in such areas this kind of arrangement would not cause loss of revenue for ZAWA. The community would create a democratic, accountable and transparent body or trust to administer the area as a conservancy. A long lease would then be allocated by government to that community conservancy trust, the validity of which should be contingent on a land use plan that ensures that a particular area is set aside for wildlife only. Communities would then sub lease the land to or engage in business partnerships with private or NGO investors, ideally for long periods to attract significant investment. That leasing process could follow either a public auction or an open tender process. The communities and successful bidding investors would then form a second body or trust with the mandate of managing wildlife in the GMA, ensuring professional anti poaching and effective communication and cooperation between the community and investors. Alternatively, the investors could gain representation on the community conservancy trust after signing a partnership agreement, and then that body would coordinate wildlife management. Investors would then pay: a) an annual land rental to communities (which means they would derive some income without waiting years for wildlife populations to recover); b) an annual resource use fee (e.g. bed night levies or licence fees for animals hunted) (which means that communities would receive income proportional to their conservation 'performance'); and, c) an annual levy to capitalize the body with the responsibility for managing wildlife. Investors could generate income either by acting as their own hunting or tourism operators, by auctioning hunting packages to the highest bidding operator, or sub leasing tourism concessions.

2. Partial devolution model. In this model, GMAs would be administered as community conservancies based on tripartite public private community partnerships involving communities, ZAWA and private investors. As in the previous model, the communities would form a body that obtains a lease for the land, and would sub lease the land to investors (or engage in a long term business partnership). A largely independent not for profit body would be established with representation from ZAWA, investors/participating NGOs and communities with the mandate of managing the wildlife in the area. The fees that have traditionally been paid to ZAWA by operators would be paid into that not for profit body to ensure that they are reinvested in the area.

Re designating GMAs as CWCs would confer multiple benefits: CWCs would secure land rights for communities and protect against the loss of land and natural resources that would arise from the current open access system; CWCs could provide an effective buffer role for national parks; communities would generate significant and sustainable incomes, meat supplies and employment; if wildlife populations were successfully rehabilitated, CWCs could generate economic outputs at least 20x greater than currently being earned in GMAs [43]; CWCs would attract external investment by a wide spectrum of donors; CWCs would create scope for communities to sell carbon and biodiversity credits by securing land rights [15]; and ZAWA would be relieved of the burden and costs of protecting wildlife in GMAs.

Legislative Changes Needed to Allow CWCs to Happen

Ownership of wildlife in Zambia is vested in the President on behalf of the country [19]. On private land, user rights over wildlife can be conferred to landowners via certificates of ownership, but there is no such provision for communities. Similarly, there is scope for investors, but not communities, to alienate land [9]. New legislation is required to enable communities to obtain 99 year leases for their land in GMAs following formation of a CWC, and to enable them to obtain full user rights over wildlife.

At present, fencing is a pre requisite for obtaining ownership over wildlife on wildlife ranches in Zambia [19]. In some contexts, as discussed, fencing can confer clear benefits [58,59]. However, fencing can also reduce ecological connectivity and provide massive supplies of snare material if inappropriate wires are used [58,60]. Fencing should not be a pre requisite for communities to obtain user rights over wildlife and should not be permitted between adjacent CWCs or between CWCs and national parks. If needed, fencing should also be composed of kinked wire mesh to prevent snare construction, and should be accompanied by an environmental impact assessment and a clear long term maintenance plan and budget.

Conclusions

Wildlife populations are faring poorly in many African protected areas [61] and many of the challenges and solutions highlighted in this paper occur in other African countries. The under funding of protected area networks is a widespread problem and parks agencies are often required to generate their own income, which creates the kinds of conflicts of interest outlined in this paper. There is a need for vastly elevated funding for PA management from both African and international governments and institutions. There is the need for improved mechanisms to enable communities to participate in and benefit more from wildlife in many African countries. In addition, creating frameworks for safe and secure private and NGO investment in PA

management is an intervention with widespread applicability. Strong measures to address unplanned human encroachment in PA networks are also needed in many areas, as are efforts to tackle high levels of ivory and bushmeat poaching. The net result of these interventions is likely to be significant improvements in the effectiveness of parks networks, substantial job creation and economic gains due to growth in tourism industries. In the absence of such changes, wildlife populations in protected areas in Zambia and many other countries are likely to continue to wane due to on going poaching and human encroachment.

Methods

Insights into the Performance of Protected Areas

We provided insights into the performance of PAs using: a) a literature review; b) data obtained from ZAWA and other sources; c) and, semi structured interviews with key stakeholders, including the highest ranking ZAWA officials (n 7); representatives from relevant NGOs (n 14); wildlife industry experts/photo tourism operators (n 11); and trophy hunting operators (n 13). The literature review was conducted using key words such as 'Zambia', 'GMAs', 'wildlife policy', 'CBNRM', 'ADMADE', 'trophy hunt ing', 'wildlife ranching', 'co management', 'bushmeat', 'and encroachment', etc. We included both published papers and unpublished consultancy reports. We searched for references using Google and Google Scholar. Selection of survey respondents was conducted by contacting and meeting as many individuals from each group that we could during our fieldwork period (Septem ber November, 2012). Refusal rate was zero.

1. Ecological performance of protected areas. We assessed ecological performance of protected areas by looking at the degree of human encroachment and the size and diversity of wildlife populations. Data on human encroachment were obtained from [6]. The 2010 Zambian census was used to obtain district level estimates of human population growth rates [16].

Data on wildlife abundance in protected areas were derived from aerial census reports [17,24,25,62 67]. The most recent reports were used, though some abundance estimates were made using census reports as old as 2003, and for some PAs no census data were available at all. Census data were available for 39 Zambian PAs (14 National Parks comprising 61,812 km^2 and 25 GMAs comprising 152,122 km^2) (or ~93% of the national park and GMA estate). Estimates of mammalian biomass were made by removing species of bushbuck *Tragelaphus scriptus* size or smaller, hippopotamuses *Hippopotamus amphibius* and predators as most reports did not provide estimates for those species. The typical mass of an individual in a population for each species following [68] was multiplied by population sizes to estimate biomass.

We used rainfall, soil nutrient status and large herbivore biomass for 28 wildlife areas in eastern and southern Africa [69] to create five regression curves for predicting herbivore biomass for: 1) medium soil nutrient areas for moist adapted species; 2) medium soil nutrient areas for arid adapted species; 3) low soil nutrient areas for moist adapted species; 4) low soil nutrient areas for arid adapted species with annual rainfall <700 mm; 5) low soil nutrient areas for arid adapted species with annual rainfall > 700 mm. In each case, herbivore biomass was plotted against rainfall using the software programme GraphPad Prism. These five regression curves were then used to predict *potential* herbivore standing crop biomasses (kg/km^2) for protected areas in which annual rainfall and soil nutrient data were available. Estimates for annual rainfall were determined from literature and internet sources, while soil nutrient status was determined using a combination of two sources: 1) soil maps [70] and 2) vegetation types identified from the literature and vegetation maps [71].

In protected areas where there was more than one soil or vegetation type, we estimated the proportion of each type within the area, and used these to calculate an average soil nutrient status. In many cases, the soil nutrient status estimated from soil and vegetation types corresponded well, but in cases when they differed, the lower estimate was selected for the sake of conservatism.

2. Economic performance of protected areas. Data on earnings from photo tourism in national parks, and from trophy and resident hunting in GMAs were obtained from ZAWA to assess economic performance of protected areas. Earnings of safari operators in GMAs were estimated using trophy off takes for 2012 obtained from ZAWA, following [28] and using the mean 2013 pricing for Zambian trophy hunts (from a survey of n 10 websites). Current per km^2 earnings from trophy hunting in Zambia were compared with regional estimates derived from [28]. Further insights into the performance of the hunting and tourism industries were obtained from the literature.

3. Social performance. Insights into the social performance of protected areas were obtained from the literature and through surveys. Comprehensive community surveys in GMAs have been completed by other authors recently (e.g. [8,9,30] and their findings provided insights into community related issues.

Ethics Statement

The University of Pretoria Ethics Committee approved this research, and approved the procedure for obtaining consent for the surveys conducted during the research. We were issued with written consent for this study from the Wildlife Producers' Association of Zambia. In addition Zambia Wildlife Authority provided verbal approval and participated in the research. From respondents we obtained verbal consent prior to conducting the surveys. Written consent from individual respondents was not considered practical or necessary and the requirement for written consent was waived by the University of Pretoria. We documented any cases where respondents did not wish to participate in order to calculate refusal rates.

Supporting Information

Figure S1 The (a) biomass and (b) diversity of wild ungulates (excluding species of bushbuck size and smaller and hippos, for which data were unavailable for state protected areas) in GMAs, national parks and extensive (unfenced) private game ranches [19]**.**
(TIFF)

Figure S2 The (a) biomass and (b) diversity of wild ungulates (excluding species of bushbuck size and smaller and hippos, for which data were unavailable for state protected areas) in protected areas and extensive game ranches with and without NGO or private investment in law enforcement.
(TIFF)

Acknowledgments

Thanks to ZAWA for permission to conduct the study, for participating in surveys and for provision of information, thanks to the Wildlife Producers Association of Zambia, Don Stacey and to the ranchers and other respondents.

Author Contributions

Conceived and designed the experiments: PL WAT VN JB MT CT. Performed the experiments: PL WAT VN JB MT CT. Analyzed the data: PL WAT VN JB MT MB RM FW CT. Contributed reagents/materials/analysis tools: PL WAT VN JB MT MB RM FW CT. Wrote the paper: PL WAT VN JB MT MB RM FW CT.

References

1. Cumming D (2004) Performance of parks in a century of change. In: Child B, editor. Parks in Transition: Biodiversity, Rural Development, and the Bottom Line. UK: Earthscan.
2. Lindsey PA, Balme G, Becker M, Begg C, Bento C, et al. (2013) The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. Biol Conserv 160: 80 96.
3. Caro TM, Pelkey N, Borner M, Campbell K, Woodworth B, et al. (1998) Consequences of different forms of conservation for large mammals in Tanzania: Preliminary analyses. Afr J Ecol 36: 303 320.
4. Nelson F, Lindsey P, Balme G (2013) Trophy hunting and lion conservation: a question of governance? Oryx 47: 501 509.
5. Government of Zambia (2010) Reclassification and effective management of the national protected areas system. Lusaka, Zambia: Ministry of Tourism, Environment and Natural Resources.
6. Watson FGR, Becker MS, Nyirenda MA (In press) Human encroachment into protected area networks in Zambia: Implications for large carnivore conservation. Environmental Change.
7. Simasiku P, Simwanza H, Tembo G, Bandyopadhyay S, Pavy J (2008) The impact of wildlife management policies on communities and conservation in game management areas in Zambia. Zambia: Natural Resources Consultative Forum.
8. Fernandez A, Richardson RB, Tschirley DL, Tembo G (2010) Wildlife conservation in Zambia: Impacts on rural household welfare. Michigan State University: Food Security Collaborative Working Papers.
9. Chemonics International Inc (2011) Situational and livelihoods analysis study in nine Game Management Areas, surrounding the Kafue National Park, Zambia. Washington DC, USA: Millenium Challenge Corporation.
10. Becker M, McRobb R, Watson F, Droge E, Kanyembo B, et al. (2013) Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. Biol Conserv 158: 26 36.
11. Manning I (2011) Wildlife conservation in Zambia and the Landsafe customary commons. Natural Resources Journal 52: 195 214.
12. Lindsey P, Balme G, Funston P, Henschel P, Madzikanda H, et al. (2013) The trophy hunting of African lions: Scale, current management practices and factors undermining sustainability. Plos One 8(9): e73808.
13. Makochekanwa A (2013) An analysis of tourism contribution to economic growth in SADC countries. Botswana Journal of Economics 11(5): 42 56.
14. Pfeifer M, Burgess ND, Swetnam RD, Platts PJ, Willcock S, et al. (2012) Protected areas: Mixed success in conserving east Africa's evergreen forests. Plos One 7: e39337.
15. Vinya R, Syampungani S, Kasumu EC, Monde C, Kasubika R (2011) Preliminary study on the drivers of deforestation and potential for REDD+ in Zambia. Lusaka, Zambia: FAO/Zambian Ministry of Lands and Natural Resources.
16. Zambia Central Statistical Office (2011) 2010 census of population and housing: Preliminary population figures. Lusaka, Zambia: Government of Zambia.
17. Simukonda C (2011) Wet season survey of the African elephant and other large herbivores in selected areas of the Luangwa Valley. Chilanga, Zambia: Zambia Wildlife Authority.
18. Poulsen JR, Clark CJ, Mavah G, Elkan PW (2009) Bushmeat supply and consumption in a tropical logging concession in northern Congo. Conserv Biol 23: 1597 1608.
19. Lindsey P, Barnes J, Nyirenda V, Pumfrett B, Taylor A, et al. (2013) The Zambian wildlife ranching industry: Scale, associated benefits, and limitations affecting its development. Plos One 8(12): e81761.
20. Bond I (2009) CBNRM as a mechanism for addressing global environmental challenges. In: Roe D, Nelson F, Sandbrook C, editors. Community management of natural resources in Africa: impacts, experiences and future directions. London, UK.: International Institute for Environment and Development. 95 104.
21. Owen-Smith N, Ogutu J (2003) Interactions between biotic components. In: Du Toit J, Rogers K, Biggs H, editors. The Kruger experience: ecology and management of savanna heterogeneity. Washington DC: Island Press. 310 331.
22. Whyte I, van Aarde R, Pimm S (2003) Kruger's elephant population: Its size and consequences for ecosystem heterogeneity. In: Du Toit J, Rogers K, Biggs H, editors. The Kruger experience: ecology and management of savanna heterogeneity. Washington DC: Island Press. 332 348.
23. Lindsey PA, Roulet PA, Romañach SS (2007) Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. Biol Conserv 134: 455 469.
24. Frederick H (2013) Aerial survey report: Luangwa valley, 2012. Chilanga, Zambia: Zambia Wildlife Authority.
25. ZAWA (2013) Liuwa Plain National Park aerial wildlife survey results 2013. Lusaka, Zambia: ZAWA.
26. ZAWA (2013) Kafue National Park general management plan. Chilanga, Zambia: Zambia Wildlife Authority.
27. Hamilton K, Tembo G, Sinyenga G, Bandyopadhyay S, Pope A, et al. (2007) The real economic impact of nature tourism in Zambia. Lusaka, Zambia: Natural Resources Consultative Forum.
28. Lindsey P, Balme G, Booth V, Midlane N (2012) The significance of African lions for the financial viability of trophy hunting and the maintenance of wild land. Plos One : e29332.
29. Snyman SL (2012) The role of tourism employment in poverty reduction and community perceptions of conservation and tourism in southern Africa. Journal of Sustainable Tourism 20: 395 416.
30. Bandyopadhyay S, Tembo G (2010) Household consumption and natural resource management around national parks in Zambia. Journal of Natural Resources Policy Research 2: 39 55.
31. Chomba C, Senzota R, Chabwela H, Mwitwa J, Nyirenda V (2012) Patterns of human wildlife conflicts in Zambia, causes, consequences and management responses. Journal of Ecology and the Natural Environment 4: 303 313.
32. World Bank (2007) Economic and poverty impact of nature-based tourism. Lusaka, Zambia: World Bank.
33. Manning I (2011) Wildlife conservation in Zambia and the landsafe customary commons. Pretoria: University of Pretoria, PhD thesis.
34. Lindsey P, Taylor A, Nyirenda V, Barnes J (2014) Through severe impacts on wildlife populations and net negative economic and food security impacts, bushmeat poaching is a market failure. Harare, Zimbabwe: FAO/Panthera/IUCN SULi/ZSL report.
35. Sichilongo M, Mulozi P, Mbewe B, Machala C, Pavy J (2013) Zambian wildlife sector policy: Impact analysis and recommendations for the future policy. Lusaka, Zambia: Africa Technical Environment and Natural Resources Unit, World Bank.
36. Cumming DH (2008) Large scale conservation planning and priorities for the Kavango-Zambezi Transfrontier Conservation Area. Unpublished report commissioned by Conservation International.
37. Douglas-Hamilton I (2009) The current elephant poaching trend. Pachyderm 45: 154 157.
38. Yamazaki K (1996) Social variation of lions in a male-depopulated area in Zambia. The Journal of Wildlife Management 60: 490 497.
39. Becker M, Watson F, Droge E, Leigh K, Carlson R, et al. (2012) Estimating past and future male loss in three Zambian lion populations. Journal of Wildlife Management DOI:10.1002/jwmg.446.
40. Wels H (2003) Private wildlife conservation in Zimbabwe: Joint ventures and reciprocity. Leiden, Netherlands: Brill.
41. Lindsey P, Midlane N, Sayer E, van der Westhuizen H (2013) Kafue National Park resource protection strategy review. New York: Panthera/Frankfurt Zoological Society.
42. Lindsey P, Balme G, Funston P, Henschel P, Hunter L, et al. (2013) The trophy hunting of African lions: Scale, current management practices and factors undermining sustainability. Plos One 8(9): e73808.
43. Lindsey P, Nyirenda V, Barnes J, Becker M, Taylor A, et al. (2013) The reasons why Zambian Game management areas are not functioning as ecologically or economically productive buffer zones and what needs to change for them to fulfill that role. Lusaka, Zambia: Wildlife Producers Association of Zambia.
44. Leader-Williams N, Baldus RD, Smith RJ (2009) The influence of corruption on the conduct of recreational hunting. In: Dickson B, Hutton J, Adams W, editors. Recreational Hunting, Conservation and Rural Livelihoods. Oxford, UK: Wiley-Blackwell. 296 316.
45. WTTC (2013) Economic impact of travel and tourism: Mid-year update, October 2013. London, UK: World Travel and Tourism Council.
46. WTTC (2012) Travel and tourism, economic impact 2012 Zambia. London, UK: World Travel and Tourism Council.
47. Secretariat of the Convention on Biological Diversity (2008) Protected areas in today's world: Their values and benefits for the welfare of the planet. Montreal, Canada: CBD.
48. Nyirenda VR, Nkhata BA (2013) Collaborative governance and benefit sharing in Liuwa Plain National Park, western Zambia.
49. Taylor RD (2009) Community based natural resource management in Zimbabwe: The experience of CAMPFIRE. Biodiversity and Conservation 18(10): 2563 2583.
50. Pye-Smith C (2013) The story of the northern rangelands trust. Isiolo, Kenya: Northern Rangelands Trust.
51. OECD (2013) Development aid at a glance. Paris, France: Organisation for Economic Co-operation and Development.
52. Ingram J, Wilkie D., Clements T, McNab R, Nelson F, et al. (In press) Evidence of payments for ecosystem services as a mechanism for supporting biodiversity conservation and rural livelihoods. Ecosystem Services.
53. Lewis D, Bell SD, Fay J, Bothi KL, Gatere L, et al. (2011) Community markets for conservation (COMACO) links biodiversity conservation with sustainable improvements in livelihoods and food production. Proceedings of the National Academy of Sciences 108: 13957 13962.

54. Spierenburg M, Wels H (2010) Conservative philanthropists, royalty and business elites in nature conservation in southern Africa. Antipode 42: 647 670.
55. Phelps J, Webb EL, Koh LP (2011) Risky business: An uncertain future for biodiversity conservation finance through REDD+. Conservation Letters 4: 88 94.
56. Reid H (2001) Contractual national parks and the Makuleke community. Hum Ecol 29: 135 155.
57. Jones B, Weaver C (2008) CBNRM in Namibia: Growth, trends, lessons and constraints. In: Suich H, Child B, Spenceley A, editors. Evolution and innovation in wildlife conservation in southern Africa. London, UK: Earthscan. 223 242.
58. Lindsey PA, Masterson CL, Beck AL, Romañach S (2012) Ecological, social and financial issues related to fencing as a conservation tool in Africa. In: Somers MJ, Hayward M, editors. Fencing for Conservation.: Springer New York. 215 234.
59. Packer C, Canney S, Loveridge A, Garnett S, Zander K, et al. (2013) Effective conservation of large carnivores. Ecological Letters 16: 635 641.
60. Lindsey PA, Romañach SS, Tambling CJ, Chartier K, Groom R (2011) Ecological and financial impacts of illegal bushmeat trade in Zimbabwe. Oryx 45: 96 111.
61. Craigie ID, Baillie JEM, Balmford A, Carbone C, Collen B, et al. (2010) Large mammal population declines in Africa's protected areas. Biol Conserv 143: 2221 2228.
62. Simwanza H (2004) Aerial survey of large herbivores in West Lunga National Park, Chizera, Musele Matebo, Lukwakwa and Chibkwika Ntambo Game Management Areas. Chilanga, Lusaka: Zambia Wildlife Authority.
63. Simwanza H (2004) Aerial survey to establish the status of large herbivores in the Upper Luano hunting block. Chilanga, Lusaka: Zambia Wildlife Authority.
64. Simwanza H (2005) Aerial survey of large herbivores in the Zambezi heartland, Zambia: October 2005. Kariba, Zimbabwe: African Wildlife Foundation.
65. Simukonda C (2008) A country-wide survey of large mammals in Zambia. Chilanga, Zambia: Zambia Wildlife Authority.
66. Frederick H (2011) Aerial survey of Kafue ecosystem 2008. Lusaka, Zambia: Zambia Wildlife Authority.
67. Viljoen P (2013) Liuwa plain national park and adjacent Game Management Area, Zambia: Aerial wildlife survey April 2013. Johannesburg: African parks network report.
68. Coe M, Cumming D, Phillipson J (1976) Biomass and production of large African herbivores in relation to rainfall and primary production. Oecologia 22(4): 341 354.
69. East R (1984) Rainfall, soil nutrients status and biomass of large African mammals. African Journal of Ecology 22: 245 270.
70. Jones A, Breuning-Madsen H, Brossard M, Dampha A, Deckers J, et al. (2013) Soil atlas of Africa. Luxembourg: European Commission.
71. Wild H, Fernandes A (1967). Vegetation map of the Flora Zambesiaca area. Salisbury, Rhodesia: Collins.
72. du P Bothma J, du Toit JG (2010) Game ranch management. Pretoria, South Africa: Van Schaik.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

International Affairs
5275 Leesburg Pike, MS: IA
Falls Church, VA 22041-3803

FEB 2 2016

The Director General
Zambia Wildlife Authority
Private Bag 1
CHILANGA
Zambia

Dear Director General,

As you are aware, The U.S. Fish and Wildlife Service (Service) published a final rule on December 23, 2015, listing the lion under the Endangered Species Act (ESA). After evaluating the available information on lion, the Service determined that *Panthera leo leo*[1], located in India and western and central Africa, should be listed as endangered, and *P. l. melanochaita*[1], located in eastern and southern Africa, should be listed as threatened. I encourage you to visit the Service's web page for more information (www.fws.gov/endangered).

Due to the listing under the ESA, a stricter domestic measure, any imports of a sport-hunted lion trophy into the United States, regardless of the subspecies or whether wild or captive bred, would require an import permit. In order to issue a permit, the Service, through its Division of Management Authority, must determine that the import of a sport-hunted lion trophy will enhance the propagation or survival of the species in the wild. The Service will examine the overall conservation and management of the species in the country where the specimen originated and whether that management addresses the three main threats that have been identified as to the decline of the species: Habitat loss, loss of prey base, and human-lion conflict. In that review, we will evaluate whether the import contributes to the overall conservation of the species in the wild by considering whether the biological, social, and economic aspects of a program from which the specimen was obtained provide a net benefit to the species and its ecosystem, and how U.S. hunters are contributing to this effort.

In evaluating these factors, we have found that the IUCN Species Survival Commission (SSC) Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0 (IUCN SSC 2012), provides useful principles, which, considered in conjunction with our permit issuance criteria, will aid us when making the required enhancement finding for importation of sport-hunted trophies. This document sets out guidance from experts in the field on the use of trophy hunting as a tool for "creating incentives for the conservation of species and

1 Based on new taxonomy identified in: Bauer, H., Packer, C., Funston, P.F., Henschel, P., & Nowell, K. (2015). *Panthera leo*. The IUCN Red List of Threatened Species. Version 2015.2. (http://www.iucnredlist.org/details/full/15951/0).

their habitats and for the equitable sharing of the benefits of use of natural resources'' (IUCN SSC 2012, p. 2) and recognizes that recreational hunting, particularly trophy hunting, can contribute to biodiversity conservation and more specifically, the conservation of the hunted species. The SSC document lays out five guiding: (a) Biological sustainability: The hunting program cannot contribute to the long-term decline of the hunted species; (b) Net Conservation Benefit: The biologically sustainable hunting program should be based on laws, regulations, and scientifically based quotas, established with local input, that are transparent and periodically reviewed; (c) Socio-Economic-Cultural Benefit: A well-managed hunting program can serve as a conservation tool when it respects the local cultural values and practices; (d) Adaptive Management: Planning, Monitoring, and Reporting: Hunting can enhance the species when it is based on appropriate resource assessments and monitoring (e.g., population counts, trend data), upon which specific science-based quotas and hunting programs can be established; and (e) Accountable and Effective Governance: A biologically sustainable trophy-hunting program should be subject to a governance structure that clearly allocates management responsibilities.

The Service believes that hunting can generate significant economic benefits if properly conducted. To assist us in our evaluation, I have included a list of questions regarding the management and conservation of lions in your country, the population status, your hunting regulations, and hunting program. If your office has the time and resources, we would greatly appreciate your effort in addressing the attached questions.

We hope that through authorization of import of sport-hunted lion from your country, the United States can assist in the conservation of the lion. While the United States has specific stricter domestic measures that require additional findings beyond those required for the issuance of an export permit by your country, there is every reason to believe that through scientifically based management programs and close monitoring and control of hunting within your country, that U.S. hunters can both enjoy their hunting experiences within your country and provide a significant benefit to African lion conservation within your country. If you have any questions, please feel free to contact me by mail, email, or telephone (Tim_VanNorman@fws.gov; (703) 358-2350).

Sincerely,

Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service

I. Overview

The lion is listed in Appendix II of CITES. As such, the Scientific Authority of the exporting country must make a determination that the export of a sport-hunted trophy will not be detrimental to the survival of the species (Article III, 2(a)). While the finding that the U.S. Fish and Wildlife Service must go beyond the "Non-detriment" standard, it would be very beneficial to our review if you could provide a copy of a recent "Non-detriment" finding made by your Scientific Authority.

II. Management Plan (a comprehensive plan addressing specific management goals or actions)

1. Does Zambia currently have a national management plan for lions and, if so, could you please provide a copy? If there is no national plan, have regional plans been developed and adopted, and if so, could you please provide copies?

2. Is your agency the only government agency that is responsible for managing lions within your country? If not, which other agency or organization within your national, regional, or local governments is responsible?

3. Have you developed a mechanism (i.e., adaptive management approach) for implementing the plan(s) and determining its effectiveness? Could you describe how implementation of the plan is progressing and if there are management or logistical problems that still need to be addressed?

4. Are there any other management plans or conservation plans that contribute to or interact with the lion management plan(s) (i.e., regional plans, hunting concession plans)?

II. Population Status

1. What is the status of lion populations within your country (e.g., population numbers; population trends; sex and age class distribution)?

2. Do you have a standardized process to conduct population censuses? If so, how often? What areas are censused? Do they include all hunting areas? What is the censusing methodology?

3. What is the current distribution of lions within your country (i.e., widespread, environmentally confined to specific areas, confined to national or regional protected areas)?

4. Even with protection activities and legal intervention, poaching could still occur. Do you have any estimates on the number of specimens lost to illegal killing annually?

5. What impact are human-lion conflicts having on local or national populations? Is there a standardized national policy to address such conflicts and problem lion control? If so, does this policy include culling of surplus animals and removal of nuisance animals? Is there domestic harvesting of lions for local consumption or use?

III. Conservation and Management

1. Please describe potential threats to the species, such as poaching and human-animal conflicts, and how these threats are being addressed.

2. Is your agency currently conducting any research efforts addressing conservation issues involving lion? What about other agencies or departments within your national or regional governments and what are their roles? Are you aware of any NGO projects currently underway that involve lion conservation or management? If so, could you describe such projects or provide contact information to the organization carrying out the work?

IV. Hunting Policies/Regulations

1. Please describe how the lion hunting program functions within your country. Specifically, do you have an established national/regional hunting quota? How is this quota determined? Many countries have established age restrictions on harvesting lions. Has your country established such age restrictions and, if so, what are they and how are they implemented?

2. What format do you use to manage sport hunting (i.e., establishment of national hunting districts under government control, awarding hunting concessions to privately owned operations)?

3. If hunting areas/concessions allocated to safari outfitters, how are they allocated? What requirements have been established for the concession holders (i.e., mandatory census activities, assistance to local villages, etc.)? Are concessions awarded on an annual basis or for longer periods? If concession areas are centrally controlled by your government (e.g., several outfitters hunt in the same areas and no one outfitter is responsible for overall management), what mechanism is used to monitor and control outfitters activities?

4. How much do hunting licenses cost foreign hunters? How does your government utilize this revenue? Does a percentage go directly back to lion conservation efforts or into more general wildlife management efforts? If so, what percentage is allocated to each? Is any of this revenue provided to local communities? If so, what percentage?

5. How does the sport-hunting program provide any other tangible benefits, besides revenue, to local communities (i.e., increase employment, jobs in antipoaching units)?

Vargas, Darcy <darcy_vargas@fws.gov>

Lion Questions

Vargas, Darcy <darcy_vargas@fws.gov> Tue, Feb 2, 2016 at 1:56 PM
To: info@zawa.org.zm

Dear Colleague,

The attached letter was mailed this afternoon. For your convenience, I am emailing a copy of it. Please feel free to respond by mail or email.

I look forward to your reply.

Thank you,

Darcy Vargas
Biologist
US Fish and Wildlife Service
MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803
www.fws.gov
www.cites.org

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

If you'd like to personalize your own sentence w/ hyperlink, here's the full link: http://visitor.r20.constantcontact.com/manage/optin?v=0016mDWXmIC-eCNJ4wf_4IA3WaTa8IjzcuPb8jWWJtQIDE8kRHO2RaQ17v2A6OUJgeCSOjzrh7ruV2Nz76Ues6ALGcio28DZ6UAnX5e55gpAO4%3D

2016.2.2 - Signed 2016 letter to Zambia.pdf
148K

Endangered Wildlife Trust
Conservation in Action

Endangered Wildlife Trust Response to the Department of Environmental Affairs Announcement of a Captive Lion Bone Export Quota of 800 Carcasses

Posted on June 29, 2017 by endangeredwildlifetrust



Yesterday (28 June 2017), the Minster of Environmental Affairs, Dr Edna Molewa, announced her decision on the proposed setting of a quota for the export of lion bones from captive bred lions. A quota of 800 skeletons (with or without skull) of captive bred lions has been set and international trade is restricted to trade in complete skeletons only, with no individual pieces to be exported. Lion bones are used as a substitute for tiger bones in Chinese Traditional Medicine because China has heavily restricted the use of tiger products.

The Endangered Wildlife Trust (EWT) notes that the trade in South African captive lion bones has been taking place for many years, with trade peaking from 2007, and that the setting of a quota was a directive from the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2016. However, we have serious concerns about the practice of farming lions for their bones, and the formal setting of a quota, for the following reasons:

- There are potential negative impacts on the conservation of lions in the wild across their range through increased poaching of wild lions for their parts.
- The commercial captive breeding of lions does not contribute to the sustainable, responsible use of South Africa's wildlife resources.
- There are welfare issues around captive animals and challenges around policing and prosecution of welfare offences.
- There appear to be links between lion bone and other wildlife crime networks (e.g. in many of the recent rhino horn busts, lion bone has also been found and links have been made between rhino horn traders and captive lion owners).
- There is a lack of evidence to support any clear community benefit from the captive lion industry. Social development is an important pillar of sustainability and the human aspects of the lion bone industry – in terms of direct benefit, upliftment and human welfare and safety – have not been addressed.

- Lion bone trade has the potential to damage "Brand South Africa". The global public pressure that was experienced following the release of the documentary "Blood Lions™" will likely be increased as a result of this quota. This has the potential to damage the good reputation that South Africa has as a tourism destination and a sustainable use and conservation leader.
- The captive breeding of wild animals for their parts is contrary to modern global trends and opinion e.g. through international pressure, tigers have stopped being captive bred for their parts.
- There is an increasing trend toward captive or intensive utilisation of wildlife. Wildlife is increasingly being treated as a commodity, rather than supporting sustainable use and conservation of biodiversity in the wild. While this is currently mostly limited to lions and rhinos, we are concerned that this may catalyse further non-conservation uses of wildlife resources.
- DEA appears to support strongly the captive breeding and farming of wildlife when their mandate is biodiversity conservation.
- A full public participatory process was not undertaken in setting this quota: there was no public input into the support of the captive lion trade at CITES, only eight working days were allowed for comment on the quota proposal, instead of 30. In addition, we have had no feedback on our formal submission regarding the setting of the quota.
- The EWT provided extensive comments and recommendations to DEA on both the practice of captive bone trade and on the proposed research project. We have had no feedback from the department on any of our concerns to date, and the statement made by the Minister does not address these either. Thus our concerns around the trade, setting and management of the quota and the proposed research project stand.

The EWT supports the conservation of wild lions, in their natural habitat, where they contribute to biodiversity conservation as keystone and flagship species, and where their health and welfare are not compromised. We maintain that economic activities related to lions should directly benefit the species in the wild, uphold the principles of sustainable conservation, uphold welfare best practice and promote Brand South Africa. There is no evidence that the practice of lion bone farming, or the related export quota, does any of the above.

Contacts:

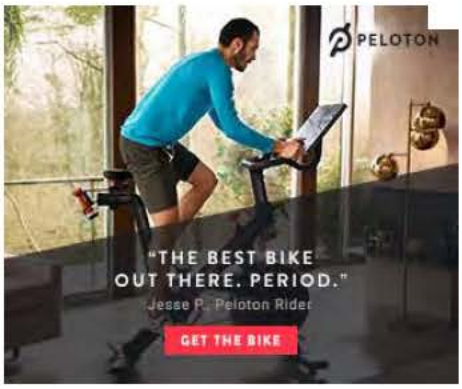
Dr Kelly Marnewick
Senior Trade Officer
Wildlife in Trade Programme
kellym@ewt.org.za
082 477 4470
011 372 3600

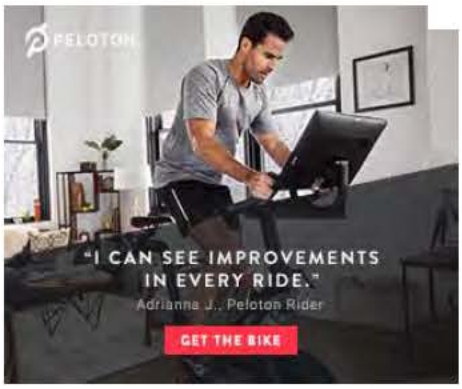
Belinda Glenn
Communication & Brand Manager
belindag@ewt.org.za

072 616 1787
011 372 3600

David Marneweck
Manager
Carnivore Conservation Programme
davidm@ewt.org.za
082 448 1721
011 372 3600

Advertisements





★ Like
One blogger likes this.

Public Response to the Department of Environmental Affairs' Proposed Captive Lion Bone Export Quota

Key conservation organisations secure global support to end canned hunting
In "Carnivore Conservation Programme"

CITES in Johannesburg – experiencing a South African first

This entry was posted in Uncategorized. Bookmark the permalink.

One Response to *Endangered Wildlife Trust Response to the Department of Environmental Affairs Announcement of a Captive Lion Bone Export Quota of 800 Carcasses*

Lea de Young *says:*
June 29, 2017 at 1:02 pm

I find the export of lion bones totally unacceptable. We really need to reach the younger generation in the countries who believe that animal parts represent medical miracles.

Reply

Create a free website or blog at WordPress.com.

Vargas, Darcy <darcy_vargas@fws.gov>

Fwd: Question from Ambassador

Gadd, Michelle <michelle_gadd@fws.gov> Mon, Jul 17, 2017 at 11:51 AM
To: Tim Vannorman <tim_vannorman@fws.gov>, Darcy Vargas <darcy_vargas@fws.gov>, "Hoover, Craig" <craig_hoover@fws.gov>

From US Embassy Lusaka: note that many concessions are not adhering to the age minimum (nor, according to other sources, to the recommended offtake density per km2).

-------- Forwarded message --------
From: **Hamlyn, Gunner G** <Hamlyngg@state.gov>
Date: Mon, Jul 17, 2017 at 11:17 AM
Subject: Question from Ambassador
To: "Gadd, Michelle" <michelle_gadd@fws.gov>

Hi Michelle,

First, thanks for sending my question on to the lion determination folks. I haven't heard back from them yet – and sorry, I can't reference that email specifically as Outlook is giving me issues right now and can't search anything less than a month old.

I sat in on a meeting with the Ambassador today and there were a couple questions he had regarding lion hunting. First was he was curious when you would be back in town. I couldn't recall if you had a date range planned already or not.

Second question was if a lion determination could be made to exclude only parts of a country's hunting areas. As you know, some, but not all, hunters who have concessions in Zambia reportedly do not follow the recommended lower limits on age. Granted, there are no actual charges or convictions from the government to this effect. With or without charges, would it be possible to specify which trophies from which hunting blocks or concessions can and cannot be imported?

Thanks,

Gunner Hamlyn

–

Gunner Hamlyn

Wildlife Conservation Coordinator

U.S. Embassy Lusaka

HamlynGG@State.gov

Ph: +260-211-357-445

Official

UNCLASSIFIED

--
Michelle Gadd, Ph.D.
Program Officer, African Elephant and African Rhino Programs
Division of International Conservation
U.S. Fish and Wildlife Service
5275 Leesburg Pike, MS: IA
Falls Church, VA 22041-3803
michelle_gadd@fws.gov

5th May, 2016

Timothy J. Van Norman,
Chief, Branch of Permits,
Division of Management Authority
U.S. Fish and Wildlife Service
United State Department of the Interior
5275 Leesburg Pike, MS: IA
Falls Church, VA 22041-3803
Tim_Vannorman@fws.gov

RE: Enhancement and Non-Detriment Finding for African Lion Sport Hunting in Zambia Completed by the Department of National Parks and Wildlife (DNPW).

We write in response to your letter dated 2 February 2016. The attached Enhancement and Non-Detriment Finding for African Lion Sport Hunting in Zambia comprehensively reviews the status of lion in Zambia, describes our well-managed sport-hunting program, and provides a response to the questions raised by your letter.

Zambia's policy on conservation is based on sustainable utilization as a way to enhance the economic and ecological importance of biodiversity and to advance development objectives. In this regard, lion has an important role not only as an apex carnivore in the Zambian terrestrial ecosystem, but also as a provider of economic benefits to the people of Zambia, especially those living in rural communities. Zambia acknowledges the threats that the species is facing, and therefore the need of implementing strategies, programmes and plans for lion conservation. At the same time, Zambia reaffirms its commitment to sustainable use of wildlife including lion.

In this vein, the Zambian government promulgated a suspension of, inter alia, lion trophy hunting from 2013 to 2015 to allow for the re-organisation of the hunting sector and an assessment of the status of the lion population. As of this month, the government is lifting that suspension. The government is taking this action for several reasons. First, the 2009 Lion Conservation Strategy was recently supplemented through the adoption of new guidelines on hunting of lion which implement an age-based harvest system. Second, in 2015 major legal reforms occurred in the wildlife sector with the adoption of the Zambia Wildlife Act No. 14.

The reforms give new impetus to the structure of wildlife conservation in the country. And third, after consultation with scientists and stakeholders, the government concluded that a limited offtake is sustainable and not detrimental to the survival of Zambia's lion. The government further concluded that sport hunting of lion in Zambia generates significant benefits for lion conservation and rural livelihoods.

Zambia's updated approach to lion management and hunting is based on three pillars: a) a conservative, precautionary quota, well below one of the recommended thresholds for sustainability, b) an age–based harvest limit and strong monitoring of lion offtakes, and c) significant and direct community benefits. The implementation of these pillars ensures a low, sustainable level of offtake. The considerable revenues generated by this low level of offtake are of crucial importance for conservation of the species, especially as they are used to benefit local communities and incentivize tolerance and continued conservation. Zambia's rural communities requested that the 2013-2015 suspension be lifted due to the detrimental impact on their livelihoods and increased human-livestock-lion conflict without hunting revenues. Based on this, we are confident that lion in Zambia are better protected when they are sustainably utilised than when a hunting moratorium removes all value and causes them to be regarded as nothing but a nuisance species.

The enclosed findings explain lion management and conservation in Zambia and our conclusion that the well-managed, limited sport hunting program is not detrimental to the survival of the species and in fact enhances the survival of the species. We trust you will agree. In this regard we hope to receive, at your earliest convenience, the positive USFWS determination on import of sport-hunted lions. If you have further questions about lion management and conservation in Zambia, we are confident that you will contact us and allow us to supplement this document.

Yours faithfully,

Paul Zyambo
DIRECTOR – DEPARTMENT OF NATIONAL PARKS AND WILDLIFE
FOR/PERMANENT SECRETARY – MINISTRY OF TOURISM AND ARTS

Cc: Permanent Secretary – Ministry of Tourism and Arts
Director - U.S. Fish and Wildlife Service, dan_ashe@fws.gov
Chief - Division of Management Authority, Craig_Hoover@fws.gov -
Chief - Division of Scientific Authority, Rosemarie_Gnam@fws.gov
Director - International Affairs, bryan_arroyo@fws.gov

Enclosures:
Enhancement and Non-Detriment Finding for African Lion Sport Hunting in Zambia
Annexes

MINISTRY OF TOURISM AND ARTS

ENHANCEMENT AND NON DETRIMENT FINDINGS FOR AFRICAN LION SPORT HUNTING IN ZAMBIA



MAY, 2016

Department of National Parks & Wildlife
P/Bag 1,
Chilanga
Tel: (260) 211 278335, 211 278365
Fax: (260) 211 278365, 211 278244
Email: info@zawa.org.zm

TABLE OF CONTENTS

1.0 Introduction 1

2.0 Biological status 1

2.1 Distribution 1

2.2 Population status 2

2.2.1 Luangwa Ecosystem 3

2.2.2 Kafue Ecosystem 4

2.2.3 Lower Zambezi Ecosystem 5

2.3 Genetic Variability 5

3.0 Conservation and Management 5

3.1 Legislation 5

3.2 Comparison in the provisions of the Zambia Wildlife Act No. 12 of 1998 and the Zambia Wildlife Act No. 14 of 2015 with particular reference to Hunting, Licenses, and the Wildlife Fund. 6

3.2.1 Classes of licences 6

3.2.2 The Wildlife Fund 7

3.3 Supporting Statutory Instruments (SIs) 7

3.4 Zambia's Conservation Strategy and Action Plan for the African lion 8

3.4.1 Other Species Conservation Plans and Strategies that interact with lion Conservation strategy 9

3.5 Enforcement 10

3.5.1 Anti-Poaching Operations 12

3.6 Stakeholder Involvement in Lion Conservation 13

3.6.1 Hunting Outfitters 13

3.6.2 Communities 13

3.6.3 Non-Governmental Organizations 13

4.0 Lion Surveys and Methods 14

5.0 Utilization 16

5.1 Safari hunting in Zambia 16

5.2 Lion hunting Areas 16

5.2.1 GMAs 16

5.2.2 Open Game Ranches 16

5.3 Hunting Quotas 18

5.3.1 Quota allocation process 18

5.3.2 Lion Quotas and utilisation 2005 – 2012 20

5.3.3 Lion Hunting Quotas and guidelines for hunting lions 22

5.4 Allocation of hunting concessions 26

5.4.1 Obligations of the concessionaire in the hunting concession agreement 27

5.4.2 Compliance to obligations of the concession agreement 29

5.5 Mechanism for monitoring trophy hunting in Zambia 30

5.5.1 Quota monitoring *30*
5.5.2 Lion Hunting Monitoring *30*
5.6 International Trade 32

6.0 Involvement of the hunting sector in Lion Conservation 33
6.1 Benefits of lion hunting in Zambia 33
6.1.1 Ecological Benefits *33*
6.1.2. Economic Benefits *33*
6.1.3. Social Benefits *34*
6.2 Transparency 34

7.0 Threats and Mitigation 34
7.1 Habitat Encroachment and Fragmentation 34
7.1.1 General Management Plans *35*
7.1.2 Eviction of illegal squatters *36*
7.1.3 Open Game Ranches and Trans-frontiers Conservation Areas *36*
7.2 Human Lion Conflict 37
7.3 Bush meat poaching and prey depletion 39
7.3.1 Prey Availability and abundance *39*

8.0 Community Based Natural Resources Management (CBNRM) 43
8.1 CBNRM in Zambia 43
8.2 Community Benefits 44

9.0 Revenues and Expenditures from Trophy Hunting 45
9.1 Animal and hunting fees 45
9.2 Revenues from safari hunting 46
9.2.1 Revenues from lion hunting 47
9.3 Expenditures of revenues 48
9.4 Funds disbursed to Communities 49

10.0 Conclusions and Non-detriment findings 50

11.0 References 51

APPENDIX 1 - Assessment of the Zambia DNPW Enhancement and Non-Detriment Findings against the IUCN SSC "Guiding principles on trophy hunting as a tool for creating conservation incentives. Ver. 1.0. IUCN SSC (2012)" 55

APPENDIX 2 - Reference Table to the USFWS Letter and Questionnaire on Lion in Zambia 63

Annex 1 Zambia Wildlife Act No. 14 of 2015 66

Annex 2 Zambia's Conservation Strategy and Action Plan for the African Lion 67

Annex 3 Contact details for selected Hunting Associations and NGO's in Zambia 68

Annex 4 Report on the 2015 aerial census of elephants and other large mammals in Zambia Volume ii: population estimates and statistics for other large mammals and birds..... 69

Annex 5 Current fees as set by Statutory Instrument No. 60 of 2007..... 70

LIST OF FIGURES

Figure 1. Distribution of lion in Zambia 2
Figure 2. Organisation of the Wildlife Conservation and Management Section 11
Figure 3. Example of lion sighting form to be used by Professional Hunters 30
Figure 4. Lion Trophy record form 31
Figure 5. Population trends for selected species in the Kafue National Park 2006 – 2015 40
Figure 6. Ungulate population trends in South Luangwa National Park 41
Figure 7. Population trends for buffalo, impala, waterbuck and warthog in the Lower Zambezi National Park 42
Figure 8. Species abundance in the Luangwa ecosystem National Parks vs GMAs 43
Figure 9. Hunting Revenues 2010 - 2015 (ZMW) 46
Figure 10. Lion animal fees as a proportion of total animal fees (in USD) 48

LIST OF TABLES

Table 1. Previous lion population estimates for Zambia 3
Table 2. Zambia Law Enforcement Effort 2015 12
Table 3. Results from Law Enforcement Operations carried out by the Wildlife Law Enforcement Unit 2012 - 2015 13
Table 4. 2015 Activities & Recoveries from Law Enforcement Operations supported by CSL in the Luangwa Ecosystem 14
Table 5. List of Open Game Ranches in Zambia 18
Table 6. Institutions involved in Zambia's quota allocation process 19
Table 7. Zambia lion Allocated Quotas for the period 2005 to 2012 21
Table 8. Lion harvest rates in Zambia 2005 – 2012 (Lions /1000 km^2) 22
Table 9. Lion Hunting Quota for 2016 23
Table 10. Current Annual financial obligations of hunting concessionaires to Communities in selected Game Management Areas (in Zambian Kwacha) 28
Table 11. Contributions of Safari Companies to Wildlife Conservation, an example from the Luangwa System (2008 - 2015) 29
Table 12. Lion trophy exports (term Trophies) from Zambia 2008 - 2012 32
Table 13. Status of General Management Plans in Zambia's lion hunting Areas 36
Table 14. Livestock killed or maimed by lions in Zambia for the period 2008 to 2015 – by Ecosystem 38
Table 15. Control of Problem Lions in Zambia 38
Table 16 Total ZAWA Revenues (ZMW) 2010 - 2015 46
Table 17. Safari hunting revenues (ZMW) 2010 - 2015 47
Table 18. ZAWA Expenditures 2010 - 2015 (ZMW) 48
Table 19. Funds disbursed to Communities (2010 - 205) in ZMW 49

1.0 Introduction

Zambia's policy on conservation is based on sustainable utilization as a way to enhance the economic and ecological importance of biodiversity. In this regard, lion has an important role not only as an apex terrestrial carnivore in the Zambian ecosystem but, also as a potential provider of economic benefits to the people of Zambia especially those living in rural communities. Zambia realizes the threats that the species is facing, and therefore the need of having strategies, programmes and plans on lion conservation. In this vein, the Zambian government through the then Zambia Wildlife Authority (now Department of National Parks and Wildlife - DNPW) formulated a lion conservation strategy (2010) and more recently has produced guidelines on hunting of lion in Zambia, which are included in this document. Importantly, the Zambian government in the recent past has promulgated a suspension of, inter alia, lion trophy hunting from 2013 to 2015, but the suspension was lifted in 2016 after data collection on Zambia's lion population showed that a limited offtake is sustainable and impacted rural communities requested that the suspension be lifted due the detrimental impact on their livelihoods and increased human-livestock-lion conflict without hunting revenues.

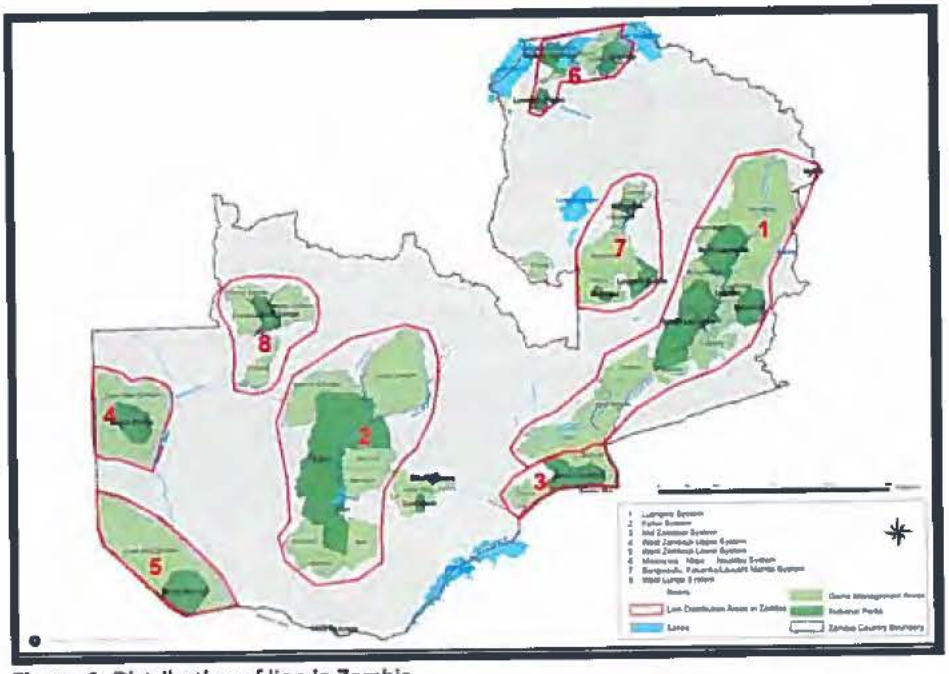
In 2015, major legal reforms occurred in the wildlife sector with the review of the Zambia Wildlife Act No. 12 of 1998. The reforms give new impetus to the structure of wildlife conservation in the country. To strengthen the lion management programme, DNPW needs additional resources to reinvest into lion research, protection and conservation. Sustainable utilization, in the form of highly selective and well-monitored sport hunting, can provide the needed revenues to achieve these goals. The proceeds from lion sport hunting are re-invested into conservation and sustainable development in local communities. In this way, sustainable sport-hunting of lions provides direct benefits to both conservation of Zambia's wild lion populations and the people living with the lions in their areas thereby promoting conservation ethics at the national and local level.

2.0 Biological status

2.1 Distribution

There are three main clusters of lion populations in Zambia; Kafue, Luangwa and Lower Zambezi ecosystems, the latter two of which share connectivity through the intervening game management areas. The historical distribution of lion prior to the 1960s is recorded as occurring throughout Zambia (Ansell, 1978), although this very general statement is likely to be reflective of historic habitat porosity, low human density and popular perceptions as opposed to being documented through systematic surveys. Current distribution of the species is restricted to National parks and the surrounding game management areas with a few lion sightings and dispersers reported each year in open areas. In addition to stronghold populations in the three main clusters, smaller numbers of lions exist in Liuwa Plains, Sioma Ngwezi, Nsumbu and the Lavushi Manda National Parks. The Kazungula and Siavonga Open Areas have vagrant populations shared with other countries. Historically, lions occurred in the West Lunga complex, although no recent sightings have been reported from that area. In contrast, lions have been documented in the Bangweulu Swamp area in recent years (Fig 1). The Lower Zambezi Population is the only significant population that is likely to be transboundary, although lions are known to move between countries in the Kavango Zambezi Transfrontier Park (KAZA).

The total lion range in Zambia is about 145,000 km^2. This represents about a 63 % of Zambia's protected area network (230,000 km^2).



1,2,3*

Figure 1. Distribution of lion in Zambia

2.2 Population status

Low density, broad and clumped distribution, largely nocturnal activity pattern, and the difficulty of observing lions in areas outside of those heavily visited by photo-tourists, makes the precise inventory of lion populations a difficult task (Schaller, 1972). These difficulties may be overcome in areas where lions are habituated to humans, but represent significant hurdles in areas where lions are heavily affected by human persecution such that they may lead to gross underestimates (Bauer & Van Der Merwe, 2004).

Previous lion estimates for the country have typically relied on expert opinion e.g., Chardonnet, 2002; Bauer and Van Der Merwe, 2004; Riggio, 2011; Riggio et al., 2013. Bauer and Van Der Merwe, 2004 gave a total national estimate of 1,500 lions, without breaking it down into component ecosystem populations. Table 1, presents the estimated lion populations according to Chardonnet, (2002) and Riggio (2011). There are subtle differences in the estimates between the two in that areas looked at differed in terms of area size. For example, whereas Chardonnet, 2002 estimated lion population for Nsumbu National Park, Riggio, 2011 included Lusenga Plains National Park in their estimate.

Table 1. Previous lion population estimates for Zambia

Protected Area	2002	2011
Nsumbu Complex	39	<50
Bangweulu		<50
Luangwa Ecosystem	1,633	
Petauke Corridor	165	425 - 835
Lower Zambezi NP and Kariba shore	183	
Kafue Ecosystem	1026	250 - 500
West Lunga	153	153
LPNP, SNNP & West Zambezi GMA	376	
LPNP		3
SNNP		<50

Source: Chardonnet, 2002 and Riggio, 2011.

Due to varying estimates, the Zambia Wildlife Authority (now DNPW) in collaboration with partners instituted intensive monitoring studies in the Luangwa and Kafue ecosystems specifically aimed at estimating the status of the lion populations in these key ecosystems. The sections below give a summary of the results in each of the core lion areas.

2.2.1 Luangwa Ecosystem

The Luangwa ecosystem can be divided into two parts; the Upper Luangwa consisting of South Luangwa, North Luangwa, Lukusuzi, Nyika, and Luambe National Parks with the surrounding Musalangu, Lupande, Munyamadzi, Mukungule and Sandwe Game Management Areas. The other area is what is considered as the Corridor Area consisting of West Petauke, Chisomo and Luano GMAs with the surrounding Open Areas. The Luangwa is considered as the most important lion cluster in the country (ZAWA, 2009). The density of lion in this ecosystem is likely affected by the topography, with the valley section having more prey density than the plateau and escarpment sections.

Yamazaki 1996, studied lions in a 355 km^2 of the Luangwa Valley the Nsefu sector in SLNP and part of the Lumimba and Lupande Game Management Areas. He studied 63 lions in 6 prides. He reported population densities ranging from 12.4 – 13.8 lions /100km^2. He found that the status of the male lion population in the study area was affected by high harvest rate.

A more recent field based study (Rosenblatt et al 2014) found for a portion of (2775km^2 study area) South Luangwa NP, a minimum density of 3.4 lion/100km^2 and a maximum density of 8.83 lion /100km^2. The IUCN Red List Assessment (Bauer et al 2015) for lion report in Table 3 of the Supporting Information a decline of 28% in the Luangwa population Such Table 3 caption is the following: *Inferred Lion population trend based on interpolated census data from 1993-2014 in 47 monitored Lion subpopulations (note that these are study subpopulations not necessarily representing total site subpopulation).* In fact, the data shown above is only for a small portion of the South Luangwa NP and not for the whole ecosystem.

In reality the Rosenblatt et al., 2014 study referenced above report an initial population estimate in 2008 of 102 (95%CL 90 - 123) lions and a final population estimate in 2012 of 94 lions (95%CL 92 - 106) a 9.21% decline i.e., about a 2% decline per year (2008-2012) and not a 28% decline as suggested and inferred by the IUCN data. A published rebuttal to the IUCN data and to a subsequent publication by Bauer et al. (2015b) that relied on the IUCN data, points out several errors in data analyses and draws a very different conclusion to claims of continent-wide species decline. (Riggio et al. 2015)

The Zambian Carnivore Programme has continued with field studies in the same study area of Rosenblatt 2014, to analyse, inter alia, lion demography in the area. In 2013, ZCP reported preliminary lion numbers were high. This was based on intensive monitoring of 13 prides and 13 coalitions collectively comprising 141 individuals, with 3 adjacent prides of 20 animals each and a number of new male coalitions (ZCP, 2014). This implies that the study population together with pride in adjacent areas was at least 200 lions. In 2014, ZCP indicated it was monitoring 15 prides and 13 coalitions, with a total of 166 individual lions identified and re-sighted. Partial data for the 2015 research season indicate that the study area now supports 15 coalitions in addition to the 15 prides, with improved cub survival and female and adult survival (Becker & Mweetwa, 2015).

The 2013 and 2014 numbers are based on observed numbers in the field and have not taken into consideration effort and detection to vigorously estimate the population size for the study area. But indicators are that the moratorium on hunting has stabilized prides in the study area and improved cub survival and number of male coalitions. No intensive research has been conducted in the corridor area, but, plans for surveys based on animal call-ins are planned for later in 2016.

Based on the current data, the lion population in this area is considered to be stable and potentially increasing.

2.2.2 Kafue Ecosystem

The Kafue National Park and surrounding Game Management Areas cover an area of approximately 66,000km^2. The earliest intensive studies on lion in the Kafue ecosystem were carried out between 2003 and 2005 by Ron and Anne Carlson (Becker et al., 2012). Since then a number of studies have been initiated to determine abundance and vital rates (Midlane et al., 2014, 2015 and ZCP, 2014).

The study by Anne and Ron Carlson covered an area of 4,720km^2 in northern Kafue National Park bordering the Lunga Luswishi and Kasonso Busanga GMAs (Becker et al., 2012). Population data was collected from 107 individually identified animals in 13 prides and 4 coalitions. The density of lion ranged between 1.5 adults/100km^2 and 1.8 lions/100km^2. The study population age structure was 21% cubs, 11% sub-adults, and 68% adults. The adult sex ratio was 3 females to 1 male. Mean pride size ranged from 2 to 7 adult females. Adult males comprised 17% of the observed population.

Midlane et al., 2015 estimated 228 lions (95 % CI 179 – 277) and 264 (95 % CI 204 – 325) for an 11,000 km^2 study area in northern Kafue. Estimated population density was 2.08 lions/100 km^2 in 2010 (95 % CI 1.63–2.53) and 2.41/100 km^2 (95 % CI 1.86–2.96) in 2011. Midlane et al's 2015 density of lion was higher than the estimated density by Becker et al, 2012. However, differences in methods and categorization of age classes preclude comparison.

In 2013, ZAWA (now DNPW) in collaboration with ZCP initiated intensive monitoring study of lions in northern Kafue covering the same intensive study area of Midlane et al's 2015 study, to monitor not only monitor abundance and trends, but to also estimate vital rates for this population. At the close of the 2014 season, there were 56 uniquely identified lions in 9 collared prides and 6 male coalitions, with several other unknown adults nomadic through the area (ZCP, 2014). Building on Carlson's and Midlane's studies the ZCP study represents a long term effort to provide demographic vital rates for this population of lions.

It is believed based on the Midlane data and other reports that the lion population in this ecosystem is stable.

2.2.3 Lower Zambezi Ecosystem

The third significant lion cluster in Zambia is represented by the Lower Zambezi system, composed of the Lower Zambezi NP, and the Chiawa and Rufunsa GMAs. This system is linked to the Luangwa ecosystem through Luano, West Petauke, and Chisomo GMAs and the Open Game ranches in the open areas east of the Luangwa River.

Chardonnet 2002, estimated the Lower Zambezi National Park and Kariba Shore area (9140 km^2) lion population at 183 lions (range 128-238). Riggio et al., 2012 estimate for the area included areas in Zimbabwe, thus cannot be included. Intensive studies undertaken for the periods 2001 – 2003 and 2006 – 2009 estimated for a 695 km^2 section of the Lower Zambezi National Park a density ranging from 1.7 lion/100km^2 to 5.2 lion 100/km^2 and 2.2 lions/100km^2 to 5.2 lions /100km^2. The study population ranged from 11 to 34 adults lions (Leigh, 2005). The population consisted of 4–37% cubs, 0–28% sub-adults, 7–46% adult males, and 31–50% adult females. Becker's study from 2012 was the last intensive lion study of the Lower Zambezi National Park. However routine monitoring through scout patrols as for all other Parks in Zambia continues in the area. This routine monitoring indicates the population in this area is recovering.

2.3 Genetic Variability

The Zambia Lion Project (ZLP) conducted an analysis of DNA sequence diversity of Zambian lion from samples collected during the period 2004 – 2012 (Curry et al., 2015). The study revealed genes that link Southern African with East African lion populations among the Zambian lion population. This suggests that Zambia may serve as a bridge connecting these lion populations. Overall gene diversity throughout the Zambian lion population was 0.7319 +/- 0.0174 with eight haplotypes found; three haplotypes previously described and the remaining five novel. These five genes, have only been reported in Zambia so far. Genetic diversity of Zambian lions is much higher than comparable areas in eastern and southern Africa were genetic diversity has been studied (Curry et al., 2015). The conclusion from this study is that Zambian lions represent a genetically diverse and healthy population. The new taxonomy proposed by IUCN citing the work of Bertola et al., (2016), used by the USFWS but not yet by CITES probably merit further discussions.

3.0 Conservation and Management

3.1 Legislation

In 2015, the Zambia Wildlife Act No. 12 of 1998 was repealed and replaced with the Zambia Act No. 14 of 2015 (Annex 1). The wildlife Act of 2015 provided for the transformation of the Zambia Wildlife Authority into a government department - the Department of National Parks and Wildlife (DNPW). The act is the principal legislation guiding the management of wildlife in Zambia, and the department is the only

government department responsible for the management of wildlife (lions inclusive) in Zambia. The Act also provides for the promotion of opportunities for the equitable and sustainable use of public wildlife estates; provides for the establishment, control and co-management of Community Partnership Parks for the conservation and restoration of ecological structures for non-consumptive forms of recreation and environmental education; provides for the sustainable use of wildlife and the effective management of the wildlife habitat in Game Management Areas; enhances the benefits of Game Management Areas to local communities and wildlife; involves local communities in the management of Game Management Areas; and provides for the development and implementation of management plans. Crucially to ensure the sustainability of the wildlife sector, the Act provides for the setting up of a Wildlife Fund, were funds from licensing and donors will be deposited.

The act provides for stiffer penalties related to poaching and enforcing all wildlife related violations in Zambia. Hunting of all wild animals without a permit is illegal. Further, it is a criminal offence to hunt, kill, capture or be in possession of a lion specimen without a license. Lion is considered a protected species under the Zambia Wildlife Act and therefore attracts stiffer penalties without option of a fine. Other legislation includes the regulations (Private Wildlife Estates) and Statutory Instruments already in force implementing the 1998 Act (These are CITES, Hunting, Elephant Hunting).

Other statutory instruments are in preparation for the implementation of the 2015 Wildlife Act including a specific statutory instrument on lion hunting.

This revision simplifies the system while continuing to generate much-needed revenue for DNPW.

3.2 Comparison in the provisions of the Zambia Wildlife Act No. 12 of 1998 and the Zambia Wildlife Act No. 14 of 2015 with particular reference to Hunting, Licenses, and the Wildlife Fund.

3.2.1 Classes of licences

Under the Zambia Wildlife Act no.12 of 1998, section 33 of the Act provided for the following classes of licences; (a) non-resident hunting licence; (b) resident hunting licence; (c) bird licence; (d) professional hunter's licence; (e) apprentice professional hunter's licence; (f) professional guide's licence; (g) apprentice professional guide's licence; (h) special licence; (i) photographic tour operator's licence; (j) hunting outfitter's licence; (k) restricted professional hunter's licence; and (l) commercial photographic licence.

The new Act on the other provides for the following types of licences *(a)* hunting licence; *(b)* bird licence; and *(c)* professional hunter's licence. The new Act has substantially reduced the number of licences that can be issued and has gone a step further and classified some of the old licences to permits. Section 39 makes provision for the issuance of the following permits *(a)* fishing permit; *(b)* capture permit; *(c)* professional guide's permit; *(d)* photographic tour operator's permit; and *(e)* commercial photographic permit. The new Act has done away with Resident and Non Resident licences. However, these activities will be undertaken under a hunting license issued to national and *bonafide* residents of hunting areas. The special licence has been replaced with a capture permit.

3.2.1.1 Procedure for obtaining a licence

Under the Zambia Wildlife Act No.12 of 1998, section 5(i) of the Act provided for the Authority to issue licenses and permits under, however, under the Zambia Wildlife Act No. 14 of 2015, section 7 establishes

the Wildlife Management Licensing Committee which shall be responsible for; considering applications for licenses, permits and certificates and grant, renewing or refusing to grant or renew licenses, permits and certificates; and terminating, suspending or revoking licenses, permits and certificates. The application for the licenses recognised under the Act is in a prescribed form requires payment of a prescribed fee under a specific Regulation. The creation of a Licensing Committee ensures transparency and accountability in the award of licenses by ensuring the discretion to award licenses exists in more than one individual.

3.2.2 The Wildlife Fund

Paragraph 22 of the first schedule under part II regulation 22 of the Zambia Wildlife Act No. 12 of 1998, provided for the funding of the Zambia Wildlife Authority which consisted of moneys (a) appropriated by Parliament, (b) paid to the Authority by way of fees, levies, grants or donations, and (c) vested or accrued to the Authority. The Authority was responsible for the funding the performance of its functions, salaries, allowance and other expenses it incurred. The Zambia Wildlife Act No 14 of 2015 in, section 109 establishes the Wildlife Development Fund for purposes of development of research, conservation and management. Whereas in the repealed Act the Authority was responsible for the disbursement of funds, under the provisions of the current Act, the Minister responsible for wildlife manages and administers the Fund through the Fund Committee. The DNPW is in the process of preparing a Statutory Instrument on the Wildlife Development Fund. The Department is liaising with the Ministry of Finance on the mechanism for sharing revenue with local communities. Currently there are regulations namely Statutory Instrument No. 89 of 2004, which provides that the Department pays into a fund established by a Community Resource Board 50% of the total revenue earned from Animals fees and 20% of concession fees from that particular GMA.

3.3 Supporting Statutory Instruments (SIs)

A number of statutory instruments have been drafted to compliment the operation of the new Act. Some of the pertinent ones include;

a) **The Zambia Wildlife (Granting of Hunting Concessions) Regulations, 2016**

   This SI provides for the Department a clear procedure for the advertisement, evaluation, negotiation and award of Hunting Concession Agreements to successful bidders, which ensures transparency in the award of these agreements.

b) **The Zambia Wildlife (Lion Sport Hunting) Regulations, 2016**

   This SI places certain conditions for hunting of Lions in Game Management Areas, including but not limited to: age-based regulations, banning the hunting of female lions, and requiring all lion hunts to be at least 16 days.

c) **The Zambia Wildlife (Keeping of Big Cats in Captivity) Regulations 2016**

   This SI will regulate the keeping of big cats in Captivity, and the export and import of live big cats.

d) **The Zambia Wildlife (Conducting of Ecological Assessments or Research on Wildlife) Regulations, 2016**

This SI regulates ecological research on wildlife, outlines the procedure for obtaining permission to conduct such research, and sets the fees to be charged for research activities

e) **The Zambia Wildlife (Elephant Sport Hunting) Regulations, 2016**

The revised SI on Elephant Sport Hunting will provide for additional procedures to hunt elephant for sport hunting, the designated areas for sport hunting, ownership and export of ivory from elephant sport hunting. These regulations ensure elephant hunting is carefully managed and sustainable.

f) **The Zambia Wildlife (Licenses and Fees) Regulations, 2016**

This particular SI is under consideration, the Department is still using the 2007 edition for purposes of pricing and issuance of licenses. The new permit under the new Act have not yet been captured under this SI.

3.4 Zambia's Conservation Strategy and Action Plan for the African lion

Zambia developed a ten-year Conservation Strategy and Action Plan for the African lion in 2010. (Annex 2) Zambia's vision as stated in the Strategy is to have a secure, viable and well managed wild population of lion that will support conservation of biodiversity that is in harmony with human development. The Strategy's mission is to galvanize stakeholder cooperation in the conservation and management of the African lion in its natural habitats in the country thereby contributing to biodiversity conservation, socio-economic development and spiritual well-being of local communities, the general public and the country as a whole, with the ultimate goal of securing, restoring and maintaining viability and genetic diversity of lion populations.

Since the approval of the strategy and in accordance with its section 6.0 several actions have been carried out by the Zambian government and its cooperating partners to implement the relevant objectives and targets of the strategy. In particular research has been initiated, management actions taken to address research and monitoring, local community benefits, human lion conflict, land use planning and zoning and trade. Specific actions taken are described in the relevant sections below.

A voluntary program to assess and age lions taken as trophies was established by ZAWA (now DNPW) in partnership with the Zambia Lion Project (ZLP). Since 2005, this program has obtained DNA samples of lions (trophies and living) across Zambia and, from 2006-2012, obtained tooth samples to estimate age of lions taken as trophies. The establishment of trophy lion sampling protocols, and the cooperation of Zambia's hunting fraternity in participating in these studies, represent a strong base from which future sampling of trophy lion (and leopard) will be conducted. In addition, results from the past sampling demonstrate the performance of the hunting sector during the past lease period (prior to age-based selection regulations), and provide a baseline for comparing future performance. Further, new studies are continually improving the accuracy of estimating the age of wild lions, which will provide additional tools to assist authorities in trophy age enforcement.

The conservation strategy noted that monitoring of hunting and illegal offtake was problematic and information was dispersed in various units of the Zambia Wildlife Authority. To address this, ZAWA (now DNPW) in 2013 set up a Conservation Unit whose main responsibility is monitoring hunting, human wildlife conflict, private wildlife estates and the effectiveness of law enforcement. Through this unit data are flowing regularly on hunting and other activities. The Conservation Unit serves as a centralized repository for these data providing for long-term monitoring of progress and trends.

The strategy requested for proper monitoring of lion diseases and health. This has been accomplished through the veterinary unit of the DNPW which is regularly sampling lion specimens for diseases and assisting law enforcement officers in the treatment of injured lions due to illegal activities, such as snaring. In addition, the DNPW authorized ZCP, South Luangwa Conservation Society (SLCS), and Game Rangers International (GRI), three NGOs working in the Luangwa and Kafue ecosystems to employ veterinarians that are field based and help in monitoring wildlife health and removal of wire snares.

Of the twelve ecologists that were employed by DNPW since 2010, three are devoting 70 per cent of their work time to lion related issues.

In implementing the strategy, several additional lions related studies have been initiated with a number of stakeholders such as the Zambia Carnivore programme (ZCP), Kafue Lion Project, Zambia Lion Project (ZLP) and WWF – Zambia (See section 4.0)

The Strategy has recently been effectively updated through the development of new guidelines governing lion hunting in Zambia. The guidelines (see section 5.3.3.2) are now in the process of being transformed into a Statutory Instrument on lion hunting which will also include provisions for monitoring lion hunting through an age-based system. As described above, the protocol for sampling and age estimation of trophy lions is already well-established, and significant improvements have been made for estimating lion age (among others see White and Belant 2016, White et al. 2016). At a participatory workshop held on 11th April, 2016 in Lusaka, these guidelines were discussed with key stakeholders in lion conservation in Zambia in order to obtain the maximum participation which is key to the success of its implementation.

Zambia's Lion Conservation Strategy and Action Plan was devised to guide lion management and conservation in Zambia for ten years and its goals address the same issues of concern (scientific management, human-lion conflict, and protection of suitable habitat) as the U.S. Fish and Wildlife Service identified in its threatened Endangered Species Act listing of the lion. DNPW is implementing the plan adapting it to management challenges and on knowledge generated through on-going monitoring and research.

3.4.1 Other Species Conservation Plans and Strategies that interact with lion Conservation strategy

Zambia recognises that the effective conservation of wildlife is through the conservation of ecosystems and not protected areas or species. Large carnivores engage in wide ranging behaviour and depend on intact ecosystems with a wide array of prey species. Well conserved large carnivore populations are an indication of intact ecosystems. And the conservation of other species that require large, intact ecosystems can simultaneously benefit large carnivores like lion by ensuring habitat and prey base are protected.

In this regard, conservation strategies for wild dog (ZAWA, 2005), elephant (ZAWA 2005), rhino (2005), and crocodile (ZAWA, 2005) were developed, and the rhino and elephant conservation strategies are currently undergoing review with the support of WWF-Zambia and the Nature Conservancy respectively. Because of the reliance of these species on intact ecosystems, the effective conservation of these species would contribute to the successful conservation of lion as well.

In addition, the DNPW is mandated by law to develop General Management Plans (GMPs) for all protected areas to guide the development and management of these areas. GMPS are discussed in section 7.1.1 below.

The hunting concession agreements (sections 5.4) that are signed by the Hunting Concession Holder, the DNPW and the Community commit all the parties to proper management of habitat, fire and wildlife. These are key sections to the agreement among these three parties.

3.5 Enforcement

DNPW is empowered by the Zambia Wildlife Act and supporting legislation to deal with issues of poaching or illegal harvesting of wildlife. Within DPNW law enforcement is under the section of Wildlife Conservation and Management (see Figure 2).

This Section is responsible for the general enforcement of wildlife laws. It is responsible for the conservation and management of wildlife and development of infrastructure in protected areas. The section's functions are outlined below:

- Detect and investigate wildlife crimes;
- Manage and mitigate human wildlife conflicts;
- Regulate operations of private wildlife estates (nature conservancies/game ranches);
- Facilitate infrastructure development in protected areas;
- Sensitise the general public on wildlife conservation;
- Manage eco systems and landscapes and conserve specific species;
- Formulate and implement park regulations;
- Promote regional and international cooperation in the area of wildlife management, conservation and law enforcement; and
- Facilitate the training of Wildlife Police Officers

The section is headed by an Assistant Director who is assisted by Principal Warden- Operations, Principal Warden- Conservation, Principal Engineer, and Principal Natural Resources Management officer. The section is organised in four units as follows:

Wildlife Law Enforcement Unit

The Unit is responsible for enforcing wildlife laws, detection and investigation of wildlife crimes. Currently the Unit has a staff compliment of 1, 250 Wildlife Police Officers covering an estimated 236, 376 km^2 of wildlife estates. This translates into an average of 189 km^2 for each Wildlife Police Officer, which is under the recommended international standards. The government of Zambia has committed itself to employ an extra 1,450 Wildlife Police officers in the next three years, starting with 600 officers planned for employment in 2016. A considerable amount of its funding comes from safari hunting permit and concession fees (see section 9).

Wildlife Conservation Unit

The Wildlife Conservation Unit is responsible for regulation of operations of private wildlife estates, management of ecosystems, landscapes and conservation of specific species as well as formulating and implementing park regulations. The Unit also manages and mitigates human wildlife conflicts and is responsible for facilitating the training of Wildlife Police Officers.

Infrastructure Development Unit

The Unit is responsible for construction and maintenance of infrastructure in protected areas, as well as maintenance of equipment plant and machinery.

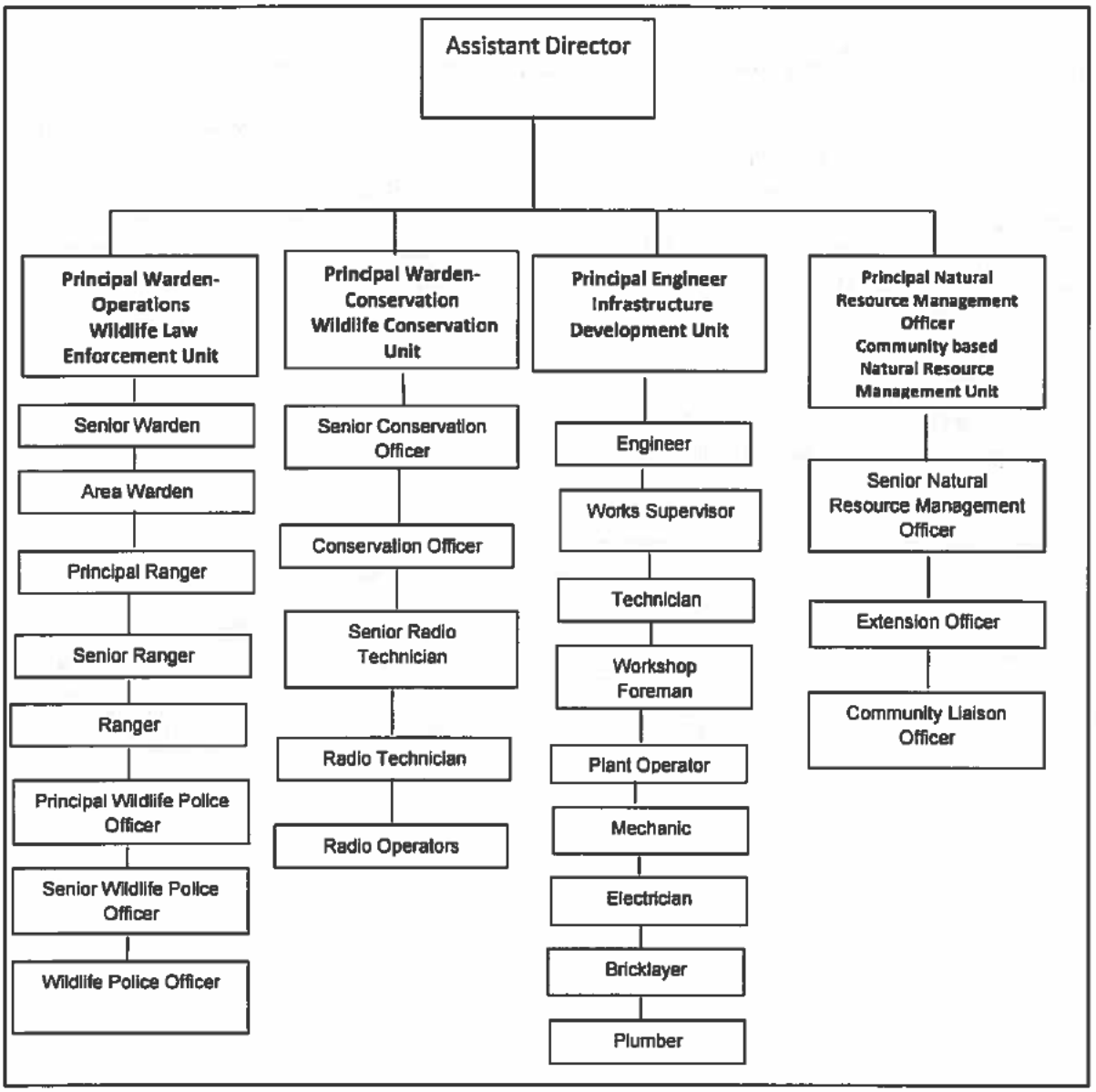


Figure 2. Organisation of the Wildlife Conservation and Management Section

Community Based Natural Resources Management Unit

The Community Based Natural Resources Management Unit is responsible for co-managing Game Management Areas with local communities and facilitating their economic and social well-being. The functions of the Unit include the following:

- Provide technical support to Community Resource Boards on the management of human and natural resources in Game Management Areas and open areas;
- Train village scouts and Community Resources Board members (see section 8);
- Facilitate the election of Village Action Groups and Community Resources Board members; and

- Monitor projects and the utilisation of funds disbursed to Community Resources Boards (CRBs).

Furthermore, an Investigations Unit is responsible for carrying out investigations and intelligence services related to wildlife crimes. The Unit is falls directly under the office of the Director National Parks.

Finally, the President of the Republic of Zambia directed the Defence and security wings in the country to join in the fight against poaching (http://zambiadailynation.com/2015/08/25/use-of-army-to-protect-wildlife-commended/; 25 August 2015; http://www.parliament.gov.zm/node/4936; parliamentary debates 10 February, 2016). In this regards, the Government has since formed a National Anti-poaching Task Force to be chaired by the Zambia Army in which all the security wings will join in the fight against illegal wildlife trade and trafficking as it is in some other African countries such as Botswana. DNPW is part of this Task Force.

3.5.1 Anti-Poaching Operations

The following tables show the effort (table 2) and results (table 3) from anti-poaching operations carried out by the Zambia Wildlife Authority in 2015.

Table 2. Zambia Law Enforcement Effort 2015

Activities	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
No. of Patrols	3,002	2,489	2,378	2,648	10,517
Patrol Days	15,334	12,913	14,350	11,752	54,349
Staff Involved	6,467	5,691	5,879	5,475	23,512
Patrol Man-days	54,468	60,485	61,486	60,589	237,028

Source: Conservation and Management DNPW

Table 3. Results from Law Enforcement Operations carried out by the Wildlife Law Enforcement Unit 2012 - 2015

s/n	Category	2012	2013	2014	2015	Total
1	Poachers Arrested	1,437	1,625	1671	1,920	6,653
2	Axes	129	196	70	218	613
3	Bicycle	269	320	144	358	1,091
4	Boats	37	9	18	11	75
5	Bush Meat Recovered (Kgs)	8,327.60	13,542.70	22831.4	29,427	74,129
6	Elephant Poached	110	135	136	168	549
7	Home Made Guns (MLG)	188	258	252	295	993
8	Home Made Shot Guns	162	75	142	283	662
9	Hunting Spears	25	80	119	118	342
10	Military Rifles	18	21	21	33	93
11	Motor Bike	5	4	12	13	34
12	Motor Vehicles	20	17	16	29	82
14	Shot Guns	156	163	134	331	784
15	Snares	5,370	8,406	9885	7,666	31,327
16	Sport Rifles	74	22	32	105	233

Source: Conservation and Management DNPW

3.6 Stakeholder Involvement in Lion Conservation

3.6.1 Hunting Outfitters

Hunting companies and professional hunters provide significant support to conservation activities throughout the hunting areas of Zambia. Section 5 provides detailed information on their involvement in anti-poaching, habitat conservation, and community development. In particular hunting operators are at the forefront in the fight against poaching in Game Management Areas through their financial and logistical support to Community Resources Boards (CRBs).

3.6.2 Communities

Community Resources Boards are responsible for wildlife management in Game Management Areas including the employment of Community Scouts who are responsible for anti-poaching operations in these areas. In section 8 we provide a detailed description of Community Based Natural Resources Management in Zambia. Communities are considered as key partners in wildlife management in Zambia

3.6.3 Non-Governmental Organizations

There are several NGOs in Zambia supporting the government in conservation activities through support to anti-poaching units. In the key lion clusters of Luangwa, Kafue and Lower Zambezi ecosystems, the Frankfurt Zoological Society (FZS) that has been active in the North Luangwa National Park for over 20 years, Conservation South Luangwa (CLS) (Formerly South Luangwa Conservation Society) in South Luangwa National Park and surrounding GMAs, Game Rangers International that has been active in the Kafue ecosystem since 2010 and Conservation Lower Zambezi (CLZ) is active in the Lower Zambezi National Park and surrounding GMAs. The aerial support that some of these NGOs provide is quite useful for locating illegal activities and monitoring animal distribution. In 2014 CLZ provided 185 hours of flying time in the Lower Zambezi National Park whilst in 2015, CSL provided over 258 hours of flying support to ZAWA in the South Luangwa National Park and surrounding GMAs (Table 2). Other NGOs providing active

support to DNPW in these areas include the Nature Conservancy (TNC) and WWF – Zambia that are active in providing support to Community Natural Resource organisations in GMAs.

Annex 3 provides the contact details for hunting associations and selected NGOs active in Zambia.

Table 4. 2015 Activities & Recoveries from Law Enforcement Operations supported by CSL in the Luangwa Ecosystem

Activities	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Ambush Patrols	5	8	13	8	34
Day Patrols	30	21	56	58	165
Fisheries Operations	7	6	1	3	17
Forest Operations	4	4	0	3	11
Intelligence & Investigations	16	38	12	18	84
Long Patrols	35	27	25	33	120
Roadblocks	16	25	20	20	81
Short Patrols	2	3	5	4	14
Snares Recovered	43	22	72	112	249
Suspects Apprehended	13	28	24	40	105
Firearms Confiscated	3	16	15	17	51
Hours flown on Surveillance	70.1	64.4	74.5	49.6	258.6
Effective Patrol Man days	2779	1623	1686	2275	8363

Source: CSL 2015 Annual Report

4.0 Lion Surveys and Methods

Because of the difficulties in estimating lion population numbers (see section 2), long term studies are recommended. Additionally, due to questions as to the validity of point-in-time estimates of lion population size, the concept of "population trend" is becoming more widely accepted for assessing lion populations. Thus, whereas focal studies may benefit from monitoring individuals, it is recommended that long-term "trends" should be the priority for lion population monitoring moving forward. In this regard, the Department of National Parks and Wildlife in conjunction with the ZLP and ZCP has instituted long-term studies to monitor trends in key areas for lion conservation in Zambia. Methods currently available for surveying lions and have been used in Zambia include:

1. Scat (Genetics), molecular analysis[DNA] (Creel & Rosenblatt, 2013; Curry, White & Derr, 2015)
2. Spoor; spotting and recording spoor by location and differences in sizes in spoor in transects (Midlane et al., 2014 and 2015).
3. Call-ups; playing recorded lion calls or wildlife distress calls at fixed survey points (Midlane et al., 2015).
4. Mark-resight studies of individuals [Pride observations, Photo profiles, Collaring and monitoring movements] (Yamazaki, 1996; Rosenblatt et al., 2014).
5. Scout sightings, community and operator interviews [Hunting and Photographic operators] (Leigh, 2005; Becker et al., 2012)

Unlike elephants and other large herbivores where aerial surveys are used with standardized methodologies such as the MIKE standards for aerial surveys (Craig, 2012), there are no standardized methods for lions and in most cases the methods listed above are used in combination. Lions have largely

been estimated by 'guess estimates' using the above ways of observation and relating to the size of the area, and more recently by using models such as Possible Lion Occupancy (Midlane et al., 2014).

As stated in the previous sections, several research projects on lion are ongoing in Zambia. In partnership with the DNPW, the Zambia Lion Project (ZLP) initiated lion research in 2004. Research has focused on presence/absence surveys of lions throughout Zambia, and DNA has been collected from trophy and controlled lions and via biopsy darting of live animals throughout Zambia's parks and GMAs. Products of ZLP's DNA studies to date include several scientific publications describing 1) genetics of lions within Zambia's Lion Conservation Units (LCUs) (Dubach et al. 2013), 2) a perspective of Zambia's lions' genetics at the continental scale (Bertola et al., 2015), and an in-depth study that documents the genetic diversity of Zambia's lions throughout the country (Curry, White & Derr, 2015). As detailed above, ZLP in 2006 established a lion trophy monitoring program and has since worked with hunting operators and outfitters to gather data on trophy lion trophy hunting and trophy quality, specifically trophy lion age towards developing sustainable offtake. Two new scientific studies on age estimation of lions, resulting from the above described program, are now available. The first provides a method estimating age to within six month of age on average (White et al. 2016). The second describes individual variation in lion teeth and places the issue of aging lion trophies into the practical context of trophy monitoring programs (White and Belant, 2016).

The Zambia Carnivore Programme's (ZCP) current lion research efforts are focused in three areas the South Luangwa National Park, the Kafue National Park and the Liuwa Plain National Park. ZCP's seeks to document population trends and demographic vital rates of lions in these key lion areas. Products of ZCP's work include multiple publications on effects of trophy hunting in Zambia (Becker et al., 2012; Rosenblatt et al., 2014); lion abundance (Becker et al., 2012, Riggio et al., 2012, Rosenblatt et al., 2014) disease prevalence (Berestein et al., 2012 and 2013, Williams et al., 2014); effects of wire snaring (Becker et al., 2012, Watson et al., 2013) bush meat and prey depletion (Lindsey et al., 2012) habitat fragmentation, encroachment and degradation (Watson et al., 2013; Creel et al., 2013; Lindsey et al., 2014;) and policy (Creel et al., 2014).

Other lion studies have been done by independent researchers and graduate students (Carlson, 2004; Leigh, 2005; Midlane et al., 2014; 2015).

Zambia is committed to continuing and expanding further scientific surveys of Lions in order to assess the population status. Depending on the availability of funding, DNPW is planning surveys to be conducted in two areas: i) the corridor between South Luangwa National Park and Lower Zambezi National Park, comprising several GMAs and Open Game Ranches and ii) GMAs surrounding the eastern part of North Luangwa National Park. This will supplement the ongoing work of the Zambian Carnivore Programme in selected areas of South Luangwa and Kafue National Parks.

Additional genetic analyses are also being conducted by Zambia Lion Project, including assessments that will help inform DNPW in future efforts to translocate lions among different regions in Zambia in order to re-establish lion populations in historic lion range e.g., West Lunga complex.

In short, DNPW has an active research program that informs and supplements its active lion management and forms the foundation of the sport-hunting system. Overall the research capacity at DNPW needs to be further strengthened through specific research-oriented funding.

5.0 Utilization

5.1 Safari hunting in Zambia

Safari hunting in Zambia is consistent with the country's general tourism and wildlife policy. The mission of the Zambian wildlife policy is to conserve Zambia's wildlife for biodiversity and socio-economic enhancement. Sustainable utilization is the best management model to achieve the objectives of this mission outside National Parks, especially in areas where it is desirable that wilderness be maintained, and without attracting the high-human density and infrastructure typical of photographic tourism. Safari hunting is the most efficient land use in areas without species density and infrastructure because it offers high value with low impact on habitats. Large wilderness areas ensure high appreciation by clients because of the natural beauty and large variety of trophy animal species, some of them endemic to Zambia e.g., Cookson's wildebeest, black lechwe, and Kafue lechwe.

5.2 Lion hunting Areas

Lion hunting in Zambia is carried out in hunting blocks located in Game Management Areas surrounding National Parks in the Luangwa, Kafue and Lower Zambezi ecosystem and in Open Game Ranches/Conservancies (Table 3). For the period 2005 to 2012 lion hunting was carried out in 21 Game Management Areas and 5 Open Game Ranches.

5.2.1 GMAs

Game Management Areas (GMA) are a category of protected areas in Zambia designed to form buffer zones between National Parks and Open Areas. The main land use forms in GMAs has been Safari and Resident hunting. However, a few GMAs have included photographic tourism. Settlement is allowed in designated areas defined by the GMA's General Management Plan. CBNRM in Zambia is implemented in GMAs through Community Resource Boards (CRBs) provided for by the Wildlife Act of 2015 (see section 8). There are 36 Game Management Areas covering 177,404 km^2.

5.2.2 Open Game Ranches

Open Game Ranches are unfenced private wildlife estates outside public protected areas that are reserved by a person or local community for wildlife conservation and management. Game ranching in Zambia has evolved in the last ten years as one of the best conservation success stories. Started in areas that were severely depleted in terms of wildlife species and with widespread illegal activities such as poaching, illegal logging and mining, thanks to partnerships between private investors and local communities most of these areas have been rehabilitated and recolonised by wildlife including lion.

The concept of Open Game Ranches is unique in that the private sector and the community agree to protect wildlife on privately owned or communal lands. Unlike closed Game Ranches, Open Game Ranches are not fenced and the animals are free to move back and forth beyond the ranch boundary into the surrounding Game Management Areas. This avoids fragmenting habitats and blocking wildlife movement corridors. The wildlife is still considered as belonging to the state. In exchange for protecting the wildlife the Department of National Parks and Wildlife issues the Open Game Ranches annual non-resident hunting quotas. The anti-poaching efforts in these lands contribute directly to assisting the Department in protecting national parks and GMAs. In many instances the owners of the ranches have invested in these areas by restocking the areas with more game species thus improving the diversity.

Most of these Open Game Ranches, even though private sector driven have co-management agreements with local communities.

One example of an innovative partnership developing in the Open Game Ranches is Kaindu Community Game Ranch, close to Kafue National Park.

In 2002, DANIDA (Danish Aid Agency) created the Kaindu Natural Resources Trust (KNRT) and an existing farm, FARM 10415, was developed as an unfenced Game Ranch that was to be managed by the Trust for the benefit of the Kaindu community. The main objective was to create income from safari hunting since Kaindu was one of the few Kafue communities not attached to a Game Management Area (GMA) and did not benefit from any form of tourism. In 2005 this project floundered due to insufficient capacity and lack of financial resources.

In 2008 Royal Kafue Ltd., a development company, forged a direct partnership with KNRT which has 20% of the shares of the development company. As landlords, the Kaindu community is considered the investor. Farm 10415 was leased from KNRT with the objective of establishing a number of commercial models making best economic use of the property while keeping the environment sacrosanct. This agreement has the approval of the traditional leadership of Chief Kaindu, The Royal Establishment Committee, Mumbwa District Council, the District Commissioner, the Office of the President, and the then ZAWA. The enterprise has been sustained through the innovative nexus of direct ownership of land and management of wildlife and other natural resources by the local community. In 2010 Farm 10415 was registered with ZAWA as Kaindu Community Game Ranch.

The KNRT, a legal environment body representing the Kaindu people, has title to approximately 15,500 hectares of pristine wilderness and this was a tremendous advantage to the promoters as DANIDA had initiated surveys and social studies had been implemented. The location was ideally suited due to its close proximity to both Lusaka and the Kafue National Park, which is hugely advantageous. The land and soils were deemed unfit for agriculture but adjoined game rich feeder areas from the adjacent Lunga Luswishi GMA to the north and both the Mushingashi Conservancy and Kafue National Park to the west.

Unlike the first effort, this partnership has succeeded by active participation of skilled and well-resourced partners in a business enterprise, and by the community holding an equity stake as well as retaining title to the land. The Royal Kafue project was one of the first of its kind to be successfully implemented in Zambia and demonstrates an awareness of natural resources as assets. It has the potential to diminish the market for illegal wildlife products and can reverse the depletion of natural resources. So far, wildlife is recovering in the area, and the ranch has hosted several tourist safari hunters, thus generating revenue for the enterprise.

All Open Game Ranches increase the land available for wildlife conservation (lion included) and buffering the loss of wildlife habitats in the country. Example of these includes the Open Game Ranches located on the eastern banks of the Luangwa River southward of the South Luangwa NP such as Nyakolwe, Nyamvu and Munyamadzi Game Ranches. Zambia currently has 17 registered open Game ranches extending, according to official DNPW data, for over 2,500 km^2 (Table 5).

Table 5. List of Open Game Ranches in Zambia

S/n	Name	Location	Area (Ha)	Area (Sq.km)
1	Illinda Game Ranch	Kasempa	55,000	550
2	Mushingashi Game Ranch	Mumbwa	36,557	366
3	Nyakolwe Game Ranch	Sinda	24,800	248
4	Sitatunga Game Ranch	Kasempa	22,000	220
5	Mpyamanzi Conservancy	Nyimba	20,000	200
6	Munyamadzi Open Game Ranch	Nyimba	17,500	175
7	Kaindu Natural Resources Trust	Mumbwa	15,500	155
8	Musonweji Game Ranch	Mufumbwe	15,000	150
9	Chinamanama	Mpika	15,000	150
10	Nyamvu Game Ranch	Nyimba	12,000	120
11	Chipepo Royal Game Ranch	Gwembe	10,650	107
12	Nkalamu Game Ranch	Nyimba	6,000	60
13	Kanzutu Game ranch	Sandwe	3,100	31
14	Kazumba Game Ranch	Nyimba	750	8
15	Bangweulu Island	Samfya	500	5
16	Mulilanama Open Game ranch	Nyimba	350	4
17	Kalwelwa	Mwinilunga	350	4
			255,557	2,556

5.3 Hunting Quotas

5.3.1 Quota allocation process

Zambia has a participatory quota setting process. The main scientific information used in the quota setting process for most species is derived from aerial surveys which are regularly done in the country and includes many ungulate species. Other information is taken from ground counts, patrol sightings, local and expert opinion and hunting monitoring. Quota setting is done for each hunting block in GMAs for all types of hunting after close of hunting season and prior to the next hunting season.

The quota for lion is set using information from scientific studies, field observations from professional hunters, operators and field officers and from hunting records. This allows CRBs and DNPW to review the previous hunting season's offtake (see also section 5.3.3.1).

DNPW follows a bottom-up approach where CRBs submit a proposal of a quota to DNPW head office for adoption and approval. The following table illustrates the quota setting process.

Table 6. Institutions involved in Zambia's quota allocation process

Institution	Information provided by institution for quota setting	Benefits for participating in quota setting
Community Resource Boards	Provides info on: - Observed trends of illegal offtake of wildlife - Human settlement patterns - Status, availability and distribution of wildlife in the area - Resource use in the area	- In depth understanding of how quotas are set - Improved knowledge of the relationships between safari hunting and other wildlife management activities in the same area - Improved sense of ownership of the quota
Department of National Parks and Wildlife	- Provides info on: - Wildlife populations - Trends of illegal offtake - Previous year's quota utilization - Law enforcement info in relation to illegal offtake - Monitors hunting activity - Facilitates quota setting workshops	- Enabling democratic and participatory environment for reaching consensus on quotas and allocations; - All key stakeholders to participate in setting quotas, thereby improving the sense of ownership; - Provides a platform for information exchange that can be used to arrive at quotas - Final approval of quotas for GMAs
Lease holders (Operators)/Professional Hunters	- Provides information on: - Wildlife population trends; - Safari sector performance - Competitiveness of the area - Resource use - Wildlife and other conflicts in the area - First-hand input in quota setting	- Opportunity to come up with a sustainable and economical quota for safari - Opportunity to participate in the process - Opportunity to have a long-term view of the sustainability of hunting in the area
Other organizations including some NGOs	- Provide financial support to CRBs and DNPW, - Provide technical support for wildlife population estimates	- Represents the interests of the communities including quota setting - Training on quota setting, facilitate workshops and provide technical assistance on wildlife management.

The quotas are compiled by the Research Unit in DNPW after feedback from the field staff, safari hunting outfitters and CRBs. Management approves the quotas before they are distributed to operators by the Licensing Unit. Quotas are verified by the Wildlife Conservation and Management Unit. To enhance transparency and accountability, the DNPW is now required to share the approved quotas with other government agencies, which include among others the Auditors General's office and Anti-Corruption Commission. This ensures that the quotas produced cannot be altered by any person and provides the sustainability and benefits of the system.

= 68/yr

5.3.2 Lion Quotas and utilisation 2005 – 2012

Zambia issued a total of 683 lions on quota for the period 2005 to 2015 in 21 Game Management Areas and 5 Open Game Ranches (Table 4). For this period the highest number of lions issued on quota was 117 issued in 2005 and the lowest was 55 issued in 2011 (Table 4). The quotas were generally based on the levels of utilisation of the previous year's lion quotas and in some instances the quota was fixed in the concession agreements. This level of utilisation may have been locally unsustainable considering that lions like most large carnivores have low adult mortality rates (Murray et al., 2010). However, the trend during the period 2005 – 2012 was towards a low offtake quota. This was attributable to two factors: 1) a decrease in allocated quota by ZAWA (now DNPW), and 2) greater selectivity by hunters engaged in the voluntary age-based trophy selection program.

To address this concern, by 2012 the country's lion quota had been reduced by 58 per cent. Although offtake overall was decreasing through greater selectivity, the program was voluntary and a high offtake of males was still of concern in two of the Game Management Areas (Lupande and Lumimba) (Yamazaki, 1996; Rosenblatt et al., 2014).

Moreover, during this same period Zambia took measures in protecting lion populations in the Lower Zambezi and Nsumbu Complex. Following the results of studies undertaken in the Lower Zambezi (Leigh, 2005 referred to in Becker et al., 2012), the DNPW (then ZAWA) discontinued lion hunting in Chiawa Game Management Area. In the same vein due to uncertainty about the lion populations in Tondwa and Luano GMAs lion hunting was discontinued in these areas in 2006 and 2009 respectively. Thus for the Lower Zambezi ecosystem, lion hunting has only continued in Rufunsa GMA. However, for this particular GMA lion hunting was only allowed because of the high levels of human lion conflict with 10 lions killed in an effort to mitigate conflict during the period 2005 to 2016 (Refer to Section 7.2 below)

Research by Packer et al., 2011 in the Serengeti recommends lion harvest rates of 1 lion/1000 km^2 in high lion density areas and 1 lion/2000 km^2 in low density areas. This was to be in lieu of adopting a five/six-year aging approach. However, recent research seems to suggest that this may not be the case across all ecosystem, due to differences in population demographic rates (Creel et al., 2016 in review). In any case, a review of Zambia's offtake rates for the period 2005 to 2012 indicates that harvest rate of 1 lion/1000 km^2 was only exceeded in 4 of the 21 Game Management Areas in which lion hunting was conducted for the period 2005 to 2012 (Table 5). Three of these were in the Luangwa ecosystem and one in the Kafue ecosystem. For the other 17 Game Management Areas the harvest rates were far below the rate of 1 lion /1000 km^2 despite some areas being in high lion density areas. For some areas lion hunting was stopped altogether.

Harvest rates in Open Game Ranches were greater than 1 lion/1000km^2. However, Open Game Ranches are typically managed with high levels of protection and large prey bases per km^2.

Table 7. Zambia lion Allocated Quotas for the period 2005 to 2012

s/n	Hunting Area	Area (sq.km)	2005	2006	2007	2008	2009	2010	2011	2012
1	Lupande GMA	4,840	12	10	12	8	10	8	6	7
2	Lumimba GMA	4,500	14	11	14	14	10	12	7	9
3	Munyamadzi GMA	3,300	10	10	9	6	5	5	5	6
4	Mukungule GMA	2,402	3	3	3	2	1	1	1	1
5	Chisomo GMA	3,390	2	2	2	1	0	1	0	0
6	Musalangu GMA	17,350	13	12	13	13	12	12	6	9
7	Sandwe GMA	1,530	3	3	3	3	1	0	0	1
8	West Petauke GMA	4,140	6	4	4	5	5	5	4	4
9	Luano GMA	8,930	3	1	2	1	1	0	0	0
10	Chiawa GMA	2,334	2	0	0	0	0	0	0	0
11	Rufunsa GMA	3,179	2	2	2	2	1	2	1	1
12	Mumbwa GMA	3,370	7	5	6	6	4	5	4	5
13	Nkala/Bililli GMA	3,274	4	3	4	3	2	2	2	2
14	Mulobezi GMA	3,430	8	5	5	3	5	4	4	5
15	Namwala GMA	3,600	2	2	2	3	2	2	1	2
16	Kasonso Busanga GMA	7,780	4	4	3	4	3	3	3	3
17	Lunga Luswishi GMA	13,340	7	7	7	6	6	6	4	5
18	Sichifulo GMA	5,175	3	3	2	2	2	0	1	1
19	West Zambezi GMA	38,070	3	4	4	4	1	0	0	0
20	Mufunta GMA	5,104	0	0	0	0	0	0	1	1
21	Tondwa GMA	540	2	1	0	0	0	0	0	0
22	Mushingashi Game Ranch	365	2	2	3	3	2	2	2	2
23	Nyakolwe Game Ranch	248	3	0	1	3	2	2	1	2
24	Munyamadzi Game Ranch	180	2	2	2	1	1	1	1	1
25	Nyamvu Game Ranch	120	0	0	0	0	0	1	1	1
26	Kaindu Natural Resource Trust	106	0	0	0	0	0	0	0	1
	Total	**137,517**	**117**	**96**	**103**	**93**	**76**	**74**	**55**	**69**

Table 8. Lion harvest rates in Zambia 2005 – 2012 (Lions /1000 km²)

Hunting Area	Area (sq.km)	2005	2006	2007	2008	2009	2010	2011	2012
Lumimba GMA	4,500	2.22	1.33	2.89	2.89	2.00	2.00	1.11	2.00
Munyamadzi GMA	3,300	2.73	-	1.82	1.82	1.21	1.52	1.21	1.21
Lupande GMA	4,840	1.86	0.62	2.27	1.24	1.65	1.03	1.24	1.03
Musalangu GMA	17,350	0.46	0.17	0.69	0.46	0.52	0.40	0.29	0.35
Mukungule GMA	2,402	-	-	0.42	0.42	0.42	0.42	-	-
Chisomo GMA	3,390	0.59	-	-	0.29	-	-	-	-
Sandwe GMA	1,530	1.96	-	-	1.31	-	-	-	0.65
West Petauke GMA	4,140	0.48	-	-	0.48	-	0.48	0.72	0.48
Nkala/Bililí GMA	3,274	0.61	-	0.61	0.31	0.31	-	0.31	0.31
Mumbwa GMA	3,370	1.19	0.30	1.19	1.48	1.19	1.19	1.19	1.48
Mulobezi GMA	3,430	0.87	-	0.87	0.87	0.29	0.87	0.58	0.58
Lunga Luswishi GMA	13,340	0.30	0.30	0.30	0.37	0.45	0.37	0.30	0.37
Sichifulo GMA	5,175	0.19	-	-	0.19	-	-	0.19	0.19
Kasonso Busanga GMA	7,780	0.26	-	0.39	0.39	0.26	0.26	0.26	0.13
Namwala GMA	3,600	-	-	0.28	0.56	0.56	0.28	-	-
Mufunta GMA	5,104	-	-	-	-	-	-	0.20	-
Rufunsa GMA	3,179	0.31	0.31	0.31	0.31	0.31	-	0.31	0.31
Luano GMA	8,930	-	-	-	-	-	-	-	-
Chiawa GMA	2,334	0.43	-	-	-	-	-	-	-
West Zambezi GMA	38,070	-	-	0.03	0.05	-	-	-	-
Tondwa GMA	540	-	-	-	-	-	-	-	-
Kaindu GR	106	-	-	-	-	-	-	-	9.43
Nyakolwe GR	248	13.04	-	4.35	8.70	8.70	4.35	4.35	8.70
Mushingashi GR	365	2.74	2.74	5.48	8.22	2.74	-	5.48	2.74
Munyamadzi GR	180	-	5.56	11.11	5.56	5.56	5.56	5.56	-
Nyamvu GR	120	-	-	-	-	-	8.33	-	-

5.3.3 Lion Hunting Quotas and guidelines for hunting lions

5.3.3.1 Lion Hunting Quotas - 2016

In line with the procedures outlined in section 5.3.1, and with additional measures described in this section 5.3.3 and subsections, the DNPW has established a quota for 2016 of 24 lions (Table 9). This is the lowest hunting quota that the country has had in the last 10 years. The quota is much more conservative than the thresholds of 1 lion/2000km² for low density areas and 1.0 lion/1000km² for high density areas.

Zambia's lion population could sustainably handle higher offtakes, but DNPW chose to reopen hunting slowly to allow for careful monitoring and implementation of an age-based guideline for legal lion trophies.

Table 9. Lion Hunting Quota for 2016

s/n	Hunting Area	Area (sq.km)	Quota	lions / 1000 sq.km
1	Musalangu GMA	17,350	4	0.23
2	Lupande GMA	4,840	2	0.41
3	Lumimba GMA	4,500	3	0.67
4	Munyamadzi GMA	3,300	2	0.61
5	Kasonso Busanga	7,780	1	0.13
6	Mulobezi GMA	3,430	2	0.58
7	Nkala/Bilili GMA	3274	1	0.31
8	Mumbwa GMA	3,370	1	0.3
9	West Petauke GMA	3,227	1	0.31
10	Sichifulo GMA	5,175	1	0.19
11	Lunga Luswishi GMA	13,340	2	0.15
12	Rufunsa GMA	3,179	1	0.31
13	Mufunta GMA	5,104	1	0.2
14	Open Game Ranches	2,556	2	0.78
	TOTAL	**80,425**	**24**	0.3

Source: Research, DNPW

5.3.3.2 Guidelines for Hunting Lion

In reopening lion hunting in 2016 following a three-year moratorium, DNPW consulted independent lion experts to get advice and held a workshop with stakeholders in April 2016. This resulted in the formulation of guidelines on lion hunting in Zambia. The guidelines are considered as part of an adaptive process to manage lion hunting in the country and are being finalized with relevant stakeholders in a participatory manner. They will be further reviewed at the end of the 2016 hunting season taking into account the experiences from the first year of implementation.

It is possible to achieve sustainable lion hunting by using 'best practice' approaches in hunting. The guidelines include:

1. Utilisation must be based on scientific principles: use area size and lion density, population status trends and prey availability;
2. Hunted lions must be from a minimum age of 5 years.
3. Use adaptive approaches in managing lion. This may include varying quotas according to lion population status in a particular hunting area.

It is important therefore, to establish a monitoring mechanism that provides information on:

A) Indicators that show the lion trends in a particular area

1. Hunting effort - time spent to find the desirable trophy;
2. Hunting Success – was the hunted lion of desired and acceptable trophy size
3. Trophy size - Size of skull, body length, shoulder height etc.
4. Age – the average age of lawful trophies

B) The status of habitat and prey in a particular area

1. Satellite images of the area
2. Encroachment levels
3. Quantitative and Qualitative indication of prey

C) Regular collection of data on the hunted lions with prompt checking on the accuracy of information provided

1. Skull, teeth, and hide to be examined, sampled and permanently tagged
2. Provide certificates for proof of sampling and rating of trophy.

5.3.3.3 Specific lion hunting provisions

The guidelines also recommend:

1. No hunting of female lions
1. No hunting of any lion born or held in captivity;
2. No use of pre-recorded sounds in lion hunting;
3. No lion hunting on fenced game ranches;
4. Lion will only be hunted in Prime and Secondary areas and Open Game Ranches known to be rich in lion and prey.

5. Establish a central place for trophy measurements of hunted lions for exports. During the workshop held in April, 2016 Professional hunters and DNPW staff underwent training in aging lions.

5.3.3.4 Age-based Harvesting

The guidelines have categorized lions into 4 categories to facilitate age based harvesting. These categories are:

Category 1

Male lions between 5 and 6 years old and above

Category 2

Male lions above 4 years old, but below the age of 5 years old. exports allowed!

Category 3

Male lions 4 years old and below - confiscated

Category 4

Male lions of 7 years old or above

3) A person holding a Professional Hunter's licence, shall not hunt any male lion in Categories 2 and 3 and if such a person hunts a male lion in this Categories, on top of the fines prescribed in schedule I, the Department shall order the following:

   a) Where the lion hunted is of Category 2, allow the export of the trophy

   b) Where the lion hunted is of Category 3, confiscate the hunted trophy

4) Where a professional hunter's client harvests a lion in Category 4 the Director may, based on a system developed by the Department, award the concession where the harvest took place of one more lion in the quota in any of the next hunting seasons.

5) A professional Hunter shall submit a lion sighting form and a lion trophy size record form.

6) The Concessionaire or Professional Hunter or their appointed representative shall physically submit the trophy to the department for measurement, and all relevant requested data e.g., photographs, at least two months after the hunt.

7) A lion hunt shall be a minimum 16 days

Moreover, the following will be applied:

8) A lion daily conservation fee of $150.00 per hunter and $100 per observer shall be established and the revenues from this fee shall be used for monitoring purposes.

9) The Director shall establish a lion aging evaluation participatory committee composed of experts with specific competence in aging procedures for lions. This committee will also include representatives from the Professional Hunters Association, the Safari Operator Association and

the Wildlife Producers Association together with officers from the Department nominated by the Director. The committee shall meet once a year to establish the age of the hunted lions in order to allow the issuance of CITES export permits.

10) A concessionaire who feels that their area does not have enough adult lions in category 1 is free to ask the department to suspend lion hunting in their concession for a stated period of time.

11) For the 2016 hunting season no hunting concession shall have more than 1 lion on quota.

The above guidelines will be incorporated in a proper Statutory Instrument that the DNPW is at present in the process of finalizing to allow lion hunting to restart in May-June 2016.

On the whole, monitoring these guidelines and indicators allow for adaptive adjustment of lion quotas.

The new management approach to Lion hunting in Zambia is based on three pillars, i) a conservative, precautionary quota, well below one of the recommended thresholds for sustainability, ii) an age–based harvest limit and strong monitoring of lion offtakes, and iii) significant and direct community benefits. This will ensure that lion hunting in Zambia is sustainable and does not negatively affect the population. In addition, in the hunting concession agreements signed in 2015 no hunting outfitter has been guaranteed a lion on quota, it is made clear that the quota for any species shall be based on scientific methods including the latest available survey and aging techniques.

5.4 Allocation of hunting concessions

According to section 7 of the Zambia Wildlife Act No. 14 of 2015 the DNPW in consultation with the local community is mandated to grant hunting concessions to a business enterprise for the purpose of hunting in a specified hunting block. For a business enterprise to be granted a hunting concession it needs to –

- be registered in Zambia;
- have a tourism enterprise license;
- have a valid Tax Clearance Certificate;
- provide proof that the company is not bankrupt; and
- any other conditions set out by the Evaluation Committee.

The allocation of hunting concession is done in accordance with the Zambia Public Procurement Act No 12 of 2008. The procedure for granting hunting concessions is by open tender in the following manner–

- (a) **Call for bids;**

  The Department invites bids from Local and Citizen Companies by advertisement in the media for companies to submit bids for granting of safari hunting concessions.

(b) **Submission of bids by the applicants;**

Bids must be submitted in accordance with the Instructions to Bidders contained in this solicitation documents. Bids must be submitted using the **"TWO ENVELOPE SYSTEM"**. The Technical Proposal and the Financial Proposal must be placed in separate envelopes clearly marked **"Technical Proposal"** and **"Financial Proposal"** and each bearing the name of the bidder and the name of the hunting block.

(c) **Opening and evaluation of bids;**

Bids shall be opened in the presence of the bidders or their representatives who choose to attend, on the date, time and place specified in the solicitation documents. The evaluation shall be carried out by an Evaluation Committee, which shall base their evaluation on numerically weighted criteria set forth in the Wildlife Act. During the evaluation, the Committee shall examine the bidder's submissions for responsiveness to the technical and substantive requirements of this Tender offer. The Financial bid shall not be opened until the qualitative technical evaluation of each bid has been completed and scored. Only the financial bids of those bidders that are technically responsive and scoring above 80 shall be opened and the award shall be made to the bidder whose financial bid is found to be the highest amongst the technically responsive bids for each hunting block subject to it only being equal or above the Reserve Price.

(d) **Negotiation and Award of contract;**

The Department in conjunction with the Local Community after negotiations with the successful bidders negotiate on the critical areas such as community obligations law and enforcement contributions, awards the Hunting concession agreement to the Bidder whose bid has been determined to be substantially and technically responsive and scoring the highest evaluated price and has been determined to be the highest evaluated bid. Thereafter due diligence is conducted before signing the Hunting Concession Agreement.

(e) **Length of Leases**

The lease periods for the hunting blocks is variable and is dependent on the classification of the hunting block. Lease periods range from 7 to 15 years. Hunting of lions is done in Prime and Secondary hunting blocks. Classification of blocks depends on the species richness and relative abundance of species. Prime hunting areas generally have short lease periods compared to understocked hunting areas. Generally understocked areas have no lion on quota because of the low wildlife numbers in these areas, but are given a longer lease period. This is to allow the concessionaire invest more resources for the rehabilitation of the area and allow wildlife numbers to recover before they could embark on hunting.

5.4.1 Obligations of the concessionaire in the hunting concession agreement

The awarded contracts to the concessionaires of a hunting area include 4 obligations, namely

Law Enforcement: - the concessionaire is obliged to support resource protection through the employment of Community Scouts, provision of logistical support such as vehicles, fuel, patrol rations, and equipment. This obligation is performed thoroughly by the concessionaires and their professional hunters with removal of snares, assistance in the arrest of poachers, illegal loggers, encroachers, and illegal miners.

Social and Community Development: - the concessionaire is obliged to support Community development through support to community social needs such as health and education. In this regard some concessionaires have agreed to support the employment of teachers and nurses, purchase of ambulances and building classrooms, clinics and houses for teachers and health personnel so that they are resident within the communities.

In addition to Community development obligations, concessionaires are obliged to provide 50 % of the meat from hunted animals to the local community. White and Belant (2015), estimated that sport hunting provides approximately 129.8 tonnes of meat annually to rural communities,

which coincides with times of food scarcity in most of these rural communities. (See Section 6.1.3).

Infrastructure Development: - the concessionaire is obliged to support the Community in infrastructure development as agreed during the negotiations. Common infrastructure projects include boreholes, class rooms, community clinics and roads, and road maintenance and wildlife scout outposts.

Resource Monitoring and Fire Management: - the concessionaire is obliged to support resource monitoring. This is basically monitoring the status of the wildlife in their concession. This includes support to fire management, vegetation and habitat monitoring, game counts, quota setting and general support to the Community Resources Boards.

The above obligations are one of the components of the partnership in conservation of natural resources between the Communities, Safari Operators/professional hunters and the DNPW. Therefore, no hunting concession agreement is valid without the signature of the Chief/s or CRB.

The following table illustrates the annual financial obligations of operators in the allocated blocks for the duration of their respective concession agreements.

Table 10. Current Annual financial obligations of hunting concessionaires to Communities in selected Game Management Areas (In Zambian Kwacha)

GMA	Status	Community Obligation	Law Enforcement	Infrastructure Development	Resource Monitoring
Chiawa	Secondary	130,000.00	50,000.00	100,000.00	50,000.00
Kasonso Busanga	Prime	300,000.00	50,000.00	50,000.00	10,000.00
Lumimba	Prime	310,000.00	187,750.00	140,625.00	36,500.00
Lunga Luswishi	Secondary	300,000.00	165,000.00	100,000.00	55,000.00
Lupande	Prime	580,000.00	127,000.00	100,000.00	30,000.00
Mulobezi	Secondary	120,000.00	110,000.00	125,000.00	25,000.00
Mumbwa	Prime	345,000.00	90,000.00	50,000.00	50,000.00
Mukungule	Secondary	100,000.00	50,000.00	20,000.00	20,000.00
Munyamadzi	Prime	425,000.00	165,000.00	117,000.00	110,000.00
Musalangu	Prime	335,035.00	150,000.00	100,000.00	34,500.00
Nkala	Prime	200,000.00	75,000.00	25,000.00	25,000.00
Sichifulo	Secondary	120,000.00	118,000.00	60,000.00	30,000.00
West Petauke	Prime	150,000.00	90,000.00	100,000.00	27,000.00
Total		**3,415,035.00**	**1,427,750.00**	**1,087,625.00**	**503,000.00**

Source: DNPW

On top of these financial obligations the concessionaire and professional hunters provide important voluntary contributions to increase the level of protection and social development in the hunting areas. These include additional contributions to law enforcement, community development, infrastructure and resource monitoring. Examples of three companies' voluntary contributions in their blocks to communities located in the Luangwa Ecosystem are listed in Table 11.

Table 11. Contributions of Safari Companies to Wildlife Conservation, an example from the Luangwa System (2008 - 2015)

Year	Other Contributions	Permanent Employees	Casual Employees	Snares Removed	Comments
2008	64,595,000.00	42	135	2,779	• Support to Traditional Ceremony, • Support to Community Youth Group, • Donation to Secondary School, • Donated 2 Hammer mills, • Donated Land rover, • Funded awareness meeting against snaring
2009	41,500,000.00	42	137	1,894	• Support to traditional Ceremony, • 1 Hammer mill • Cement and iron sheets for community shelter, • Transport and lodging for CRB members to attend meetings
2010	60,500,000.00	42	139	1,664	• Support to Traditional Ceremonies • Sponsoring Community Members to International meeting • Settling Statutory Fees Arrears for CRB • Outboard Engine • Contribution towards Village scout training
2011	33,000,000.00	42	144	1,686	• Motor bike spares • Transport • Second land hand cruiser • Fertilizer and seed
2012	35,706,000.00	42	148	1,521	
2013	20,004,000.00	24	75	715	• Hunting Operations could not sustain contributions, • Service parts for vehicle
2014	20,000,000.00	24	75	544	• Spares for truck • Hunting operations could not sustain contributions
2015	5,000.00	12	30	401	• Supported law enforcement operations, • No hunting but met concession agreement obligations

*Data from three companies in three hunting blocks

5.4.2 Compliance to obligations of the concession agreement

The Hunting Concession Agreement has provisions specifying the mechanism of monitoring the implementation of the agreement. Mechanisms include annual evaluations at the end of the hunting season, and before the beginning of the next hunting season that involve the Department, CRBs and representatives of the concessionaire. A concession holder who does not comply with the obligations can have their concession terminated before the end of the agreement's term.

5.5 Mechanism for monitoring trophy hunting in Zambia

5.5.1 Quota monitoring

As explained in section 5.3.1 quotas are allocated to the hunting companies in a participatory process. The final quotas are issued by the licensing unit. The produced quotas are distributed to the CRBs, Hunting companies and DNPW field stations. During the hunting season wildlife officers accompany hunters on all hunts. The officer records activities related to the hunt on specified forms i.e., Safari Hunting monitoring forms, trophy measurement forms, and a client questionnaire. The officer endorses used licenses ensuring that they cannot be used again. The law requires that all harvested trophies are to be registered.

5.5.2 Lion Hunting Monitoring

Apart from the procedures described in section 5.5.1 above, the DNPW is introducing a monitoring system specific for lions. This monitoring system as explained in section 3.1 will be based on a statutory instrument which is in preparation, which will introduce a mandatory sampling system that requires trophy lions meet or exceed a minimum age as one measure for harvesting trophy lions. The monitoring system will be based on specific forms (Figures 3 and 4) that will help ensure proper compliance with the provisions of the law, including confirmation of legal licenses and collection of data associated with the hunt including but not limited to location, date, participants, and photos, as requested by DNPW. The monitoring system will be complemented by regular surveys for lions throughout the GMAs.

LION SIGHTING FORM

Game Management/Open Area: ..... Hunting Block: .....Name of recorder: .....

Sighting #	Date (dd/mm/yy)	Time	Pride Size and Structure						Pride Identity	GPS Location (in decimal degrees)		Activity	Photos (Y/N)
			# Cubs	# AM	# AF	# SAM	# SAF	Total #		Latitude	Longitude		

Clear pictures of lions indicating whisker spot patterns are required for every sighting.

AM = Male; AF = Female; SAM = Sub Adult Male; SAF = Sub Adult Female

Notes

Age estimate in the field: Mane characteristics, nose pigmentation, skin coloration, leg markings, whiskers, colour and wear of teeth (in the lab).

Activities: These may include; resting, feeding, walking, chasing/hunting etc.

Pride identity: Identity code can be any name given to a particular pride or coalition of males.

Figure 3. Example of lion sighting form to be used by Professional Hunters

TROPHY SIZE RECORD FORM

Name of Professional Hunter:	Hunting Outfitter:

DETAILS OF CLIENT

Name of client:	Nationality:

Country of Residence	
Postal Address	

GMA permit No:	Non Resident Hunting Licence No:

DETAILS OF HUNT

Name of GMA		Hunting period from to	
Name of Hunting Block			

Date Killed or wounded	Species	Sex	Killed or Wounded	Give Your Estimate of Lion Age	GPS Location		Trophy for export	
					South	East	Yes	No

DETAILS OF TROPHY MEASUREMENTS

Species	Body length (tip of nose to end of tail)	Shoulder height (Shoulder to base of paw)	Skull length	Skull width	Left canine length	Right canine length

Figure 4. Lion Trophy record form

5.6 International Trade

The African lion is included in Appendix II of the Convention on International Trade in Endangered Species of wild fauna and flora (CITES). Legal utilization of lion in Zambia occurs under sport (safari) hunting. Table 11 below gives the number of lion trophies from Zambia as recorded by CITES for the period 2008 - 2012.

Other exports recorded in Zambia include parts and derivatives such as specimens for scientific purposes, skulls, skins and live animals but in low numbers (CITES trade database). Note that due to the lag time associated with trophy preparation and export, CITES trade data may not accurately reflect offtake on a year to year basis.

Table 12. Lion trophy exports (term Trophies) from Zambia 2008 - 2012

Year	2008	2009	2010	2011	2012
Number	50	40	89	37	73

Source: CITES Trade Database

Lions are imported in Zambia as live captive bred lions for lion walks. This demand is driven by the private sector to support the growing photo tourism market in Livingstone area in Southern Zambia. Although this international trade is not related in any way to hunting it creates a conservation challenge. The lions are imported from neighbouring South Africa and Zimbabwe. Since 2008, a total of 54 lions have been imported into Zambia on condition that they will not be introduced into the wild as these are captive bred lions.

A Statutory Instrument is under preparation, which seeks to regulate the importation and captive uses of lion, leopard and cheetah in Zambia. This includes banning the holding of, breeding, commercial use (walking and petting) in captivity of all large cats other than for temporary veterinary purposes. In addition, animals currently being held in captivity in Zambia will be required to be castrated or spayed to eliminate further breeding, and all commercial uses of captive-held cats will be phased out as there is little or no value to conservation attached to these activities (Hunter et al., 2013). Particular care will be taken to avoid the "dumping" of captive-held cats into wild areas for any reason, especially for hunting or 'release' as means for the owners to avoid the penalties or costs associated with authorized disposition of their animals. By taking these steps, Zambia will ensure that it does not become a hosting for activities associated with captive-bred lions that negatively impact wild lion populations and their conservation (Williams et al., 2015).

Worldwide, there is growing concern over use of lion parts, especially in illegal trade. Unknown volumes of wild lion and lion parts are illegally utilized in Zambia. Lion parts are allegedly sought, traded and used for charms, magic and medicinal purposes. The level of illegal use of lion parts in Zambia is currently unknown, but is not considered to be significant, however impacts of trade in lion bones and other body parts is recognized as being potentially detrimental to wild lion populations.

The DNPW will be is establishing an investigation into current levels of illegal trade and use of lion parts. Identifying levels and source routes will be a first step in controlling this potential, but not actual yet, threat to Zambia's wild lion populations.

6.0 Involvement of the hunting sector in Lion Conservation

6.1 Benefits of lion hunting in Zambia

Sustainable utilization has demonstrated ecological, economic and social benefits and is a critical component of DNPW's overall lion management strategy.

It is for these reasons that DNPW is committed to improving lion management strategies throughout Zambia thereby achieving maximum benefits for lions and people

6.1.1 Ecological Benefits

Lion hunting is an essential component of the tourism industry that maintains wildlife areas as suitable habitats for wildlife. In Zambia, GMAs and Open Game Ranches (there are also Open Areas and Fenced Game Ranches) where safari hunting is conducted represent nearly 180,000 km^2 as compared to about 64,000 km^2 in national parks that are strictly protected. Without the incentives provided by hunting, this habitat could be lost and converted to other, less optimal land uses that do not include wildlife.

Trophy hunting, by definition, targets post-breeding males. By ensuring that offtake is sustainable (including the targeting of non-breeding males of certain minimum age, without dependent young), hunting provides maximum benefits while ensuring minimal negative effects on the remainder of the lion population.

Conservation of a species requires conserving the genetic variability and viability of a population rather than focusing on individual animals. While individual deaths serve to inform on sources of mortality, disease and more, loss of specific individuals do not affect population trends. However, humans (photo-tourists) may become emotionally attached to individuals, often because they are unaware of the cycles of life and death in nature. By better educating tourists and locals on the realities of population versus individual losses and gains, a more comprehensive understanding of the ecological, economic and social benefits associated with sustainable hunting of lions can be obtained. This is one of the objectives of DNPW and it should be the objective of all stakeholders who seek to conserve Zambia's wild lion populations.

6.1.2. Economic Benefits

- Lion hunting is the mainstay of safari hunting in Zambia; it attracts tourist hunters and brings income to the communities and the nation; particularly to wildlife conservation.
- DNPW devolves 50 percent of the Game Fees and 20% of the Concession Fees to rural communities to improve their livelihoods.
- Safari Operators provide:
  - Creation of employment
  - Financial support to anti-poaching
  - Provision of Health care
  - Provision of Education
  - Infrastructure development
  - Provision of meat (see below)

The remaining part of revenues are used by DNPW for wildlife conservation including lion itself through, inter alia, support to Law enforcement including anti-poaching and prosecutions and resource monitoring.

For further details, refer to this section and sections 8 and 9.

6.1.3. Social Benefits

- Lion–human conflicts occur on the interface between communities and lion range. Often, this results in "problem animals" being removed through lethal means. Increased conflict may indicate either increase in lion numbers or in human population, and require a reduction in lion numbers and/or redress in human settlement patterns.
- Lion hunting increases revenue to communities and places a value directly on the presence of living with lions thereby providing local people with tangible benefits for conserving wildlife.

For further details, refer to this section and sections 7, 8 and 9.

In particular, the economic and social benefits of sport hunting to rural communities through the provisioning of game meat have been illustrated in a recently published study (White and Belant, 2015). Provisioning of game meat to rural communities by the sport hunting sector in Zambia for three game management areas (GMAs) was on average > 6,000 kgs per GMA of fresh game meat annually from hunting operators. In most of the GMAs, provisioning of meat exceeded what was required in the lease agreements. Provisioning of game meat peaked during the end of the dry season (September–October) coincident with when rural Zambians are most likely to encounter food shortages. Extrapolating the results across all GMAs estimated 129,771 kgs of fresh game meat provisioned annually by the sport hunting sector to rural communities in Zambia at an approximate value for the meat alone of >US$600,000 exclusive of distribution costs. During the hunting moratorium (2013–2014), this supply of meat was halted, adversely affecting rural communities previously reliant on this food source. The paper recommended that proposed alternatives to sport hunting should consider protein provisioning in addition to other benefits (e.g., employment, community pledges, and anti-poaching funds) that rural Zambian communities receive from the sport hunting sector.

The hunting sector's support is crucial to the government's actions in conserving wildlife and habitats. It cannot be stressed enough the crucial role that safari hunting plays in wildlife conservation in Zambia. During the 2013 to 2016 moratorium on lion hunting (leopard hunting was stopped only in 2013 and 2014) the government was forced to subsidize the operations of ZAWA, Community Resource Boards and wildlife management (see section 9.0 below).

6.2 Transparency

The Wildlife Act of 2015 established a Wildlife Management Licensing Committee whose task is to supervise and grant, renew and revoke licenses, permits and certificates related to hunting. The committee is composed of several members appointed by the Minister of Tourism and Arts selected from different institutions including representatives from Ministries responsible for environment, lands, fisheries, forests, finance, tourism, chiefs, and mines. Other officials will come from the Attorney General's office, Ant-Corruption Commission, and Tourism Council of Zambia. This committee will enhance transparency on the administrative processes related to licensing.

7.0 Threats and Mitigation

Threats to the persistence of lion populations in Zambia include habitat encroachment and fragmentation, bush meat poaching/snaring, human lion conflict and prey depletion.

7.1 Habitat Encroachment and Fragmentation

With 20 National Parks and 36 Game Management Areas Zambia has close to 35% of it land mass set aside for wildlife conservation. Including National and local forests and National heritage sites this land mass is

well over 40 % of the country's total land area (Lindsey et al., 2014). However, habitat encroachment and fragmentation are increasingly threatening to reduce the ecological functionality and connectivity of these protected areas. Watson et al., 2013 reported rates of encroachment from roads in some areas of 2km per year and 18 ha per day light hour in a 160,000 km^2 study area covering the Luangwa and Kafue ecosystems. Large carnivores, lions inclusive are sensitive to encroachment and fragmentation even in areas outside protected areas through edge effects (Woodroffe and Ginsberg, 1998). The eradication of tsetse flies in most protected areas render these areas suitable for domestic livestock. The recent aerial survey in the country estimated cattle at well over 45,000 in the Kafue ecosystem (ZAWA, 2016; Annex 4). Watson et al., 2013 and 2014 recommend carefully planned human settlements, and agricultural development zones in GMAs to counter the effects of encroachment and fragmentation. To deal with the challenges posed by habitat encroachment and fragmentation, the Zambian government through DNPW has employed a number of strategies outlined in the three subsections below.

7.1.1 General Management Plans

The majority of the GMAs in which lion hunting occurs have a General Management Plan (GMP) in place. Only Munyamadzi, Sandwe and West Petauke in the Luangwa ecosystem, and Rufunsa GMA in Lower Zambezi do not have General Management Plans at present. A General Management Plan (GMP) outlines the basic management and development guidelines for a GMA or Open Area after the systematic assessment of land and water potential, alternatives for land use, economic and social conditions in order to provide the best land use options for addressing land use conflicts / problems and achieving identified land use management objectives over a 10-year period. It is prepared through a highly consultative, interactive and participatory Strategic Planning Process (SPP) involving all key stakeholders. The GMP emphasises the commitment of all concerned, affected and interested stakeholders to balance between the preservation and utilization of the protected area's biodiversity in order to ensure the long-term survival of the natural resources including wildlife resources in a way that benefits the local communities. As such the final document is ratified by a Community Resources Boards, their patrons (who are usually the chiefs in these areas) and the DNPW. Table 13 below gives the status of GMPs for critical areas in the lion range ecosystems.

Table 13. Status of General Management Plans in Zambia's lion hunting Areas

s/n	GMA	Ecosystem	Status	Date Ratified
1	Musalangu GMA	Luangwa	Ratified	2014
2	Lupande GMA	Luangwa	Ratified	2014
3	Lumimba GMA	Luangwa	Draft	-
4	Munyamadzi GMA	Luangwa	In preparation	-
5	West Petauke GMA	Luangwa	In preparation	-
6	Sandwe GMA	Luangwa	In preparation	-
7	Kasonso Busanga	Kafue	Ratified	2014
8	Mulobezi GMA	Kafue	Ratified	2014
9	Nkala GMA	Kafue	Ratified	2014
10	Mumbwa GMA	Kafue	Ratified	2014
11	Sichifulo GMA	Kafue	Ratified	2014
12	Lunga Luswishi GMA	Kafue	Ratified	2014
13	Mufunta GMA	Kafue	Ratified	2014
14	Rufunsa GMA	Lower Zambezi	In preparation	-

Source: Planning Unit DNPW

7.1.2 Eviction of illegal squatters

Furthermore, in an effort to maintain habitat in National Parks and GMAs successful operations were made to remove squatters. Interestingly, the local Chiefs and their communities requested the DNPW that people illegally settled in the wilderness zones of the GMAs be resettled so that they could fully realize the benefits from protecting the wildlife areas. The government has fully come out in support of removing squatters illegally settled in areas designated as conservation zones in GMAs (http://www.parliament.gov.zm/node/5019 ; parliamentary debates 18th February, 2016; https://www.daily-mail.co.zm/?p=42954&paged=424; Zambia Daily Mail 8th September, 2015). Lukusuzi National Park, Namwala and Mumbwa GMAs are examples of protected areas in which squatters were recently evicted.

For example, over 2000 households from Mumbwa GMA were evicted from the conservation zone as designated in the General Management Plan. The local community argued that the encroachers were actually settlers from other areas of the country and their action of illegally settling in the zone prevented the local communities from realising the benefits associated with wildlife as the pressure on wildlife increased. The Zambia Lands Tribunal ruled on 4th September, 2013 that the encroachers were settled in the area illegally. The government therefore gave them two years to prepare for eviction and the action was successfully conducted in August, 2015. The whole exercise cost the Department around ZMK44, 520.00, and was carried out in conjunction with the office of Disaster Management and Mitigation Unit (DMMU), under the Office of the Vice President.

7.1.3 Open Game Ranches and Trans-frontiers Conservation Areas

As detailed in section 5.2.2 Open Game Ranches are privately owned lands bordering GMAs or National Parks that stock wildlife. These areas, regulated in the Wildlife Act 2015, further buffer the National Parks and GMAs from encroachment and ensure movement corridors are protected. These are new models of

wildlife conservation in the country that the Zambian government is supporting to ensure sustainable use of wildlife resources and protection of habitats.

In the most recent conservation developments, establishment of the Kavango-Zambezi Transboundary Park (KAZA) by Peace Parks seeks to protect a contiguous habitat of over 280,000km^2 that includes the whole of Kafue NP ecosystem and the Sioma Ngwezi National Park region as part of an international effort to maintain connectivity of viable habitats for all species, including lions. Other proposed Trans – frontier Parks include the Liuwa - Mussuma between Zambia and Angola and the Mana Pools - Lower Zambezi between Zambia and Zimbabwe.

In general, due to the increase in donor funding and increased number of economic opportunities availed through tourists' lodges, protected areas in general attract a lot of immigrants on their boundary areas (Wittemyer et al., 2008). Zambia has not been spared from the phenomenon, Mfuwe the gateway town to the South Luangwa National Park has seen increased population growth and increased infrastructure development unlike other areas in the ecosystem devoid of photographic tourist's lodge (Twakundine Simpamba Senior Ecologist SLNP pers. comm.). This has caused habitat loss. Because hunting concessions usually have one operator over a large area and are located in areas that are not easily accessible, Safari hunting helps in buffering protected areas from the effects of immigration, while at the same time providing economic support to rural communities and maintaining habitat. In general, the Safari hunting sector is extremely supportive of initiatives aimed at maintaining wild areas. Their presence acts as a deterrent to would be squatters. They also act as monitors and able to immediately inform the CRBs or the Department of illegal settlements in GMAs.

7.2 Human Lion Conflict

Human-Lion conflicts (HLC) are not uncommon in Zambia. Fortunately, retaliatory killings by livestock owners are not as common as in East Africa. Therefore, direct lion poaching is not believed to be significant. ZAWA (now DNPW) developed an adaptive system that includes a procedure whereby reported cases of lion damages are investigated by field officers and complete reports are reviewed by the most senior officer for immediate feedback. Interventions include; scaring lions through blasting, or killing the animals suspected to be responsible for the attack on livestock and humans. This approach is considered incompatible with sustainable conservation of wildlife, and may contribute to the decline in the lion populations. DNPW is committed to implement the best practises on HLC including for example the HLC toolkit developed by the Niassa Carnivore Project. This will be done through the development of a specific policy on Human Wildlife Conflict that the department, pending the availability of funding, would like to devise as soon as possible.

Moreover, table 14 below shows the livestock killed by lions due to conflict in Zambia for the period 2008 to 2016. In the same period at least 8 people have been reported as having died as a result of being attacked by lions and a further 13 having been injured as a result of a lion attack.

Table 14. Livestock killed or maimed by lions in Zambia for the period 2008 to 2015 – by Ecosystem

Protected Area	Lower Zambezi Ecosystem	Kafue Ecosystem	Luangwa Ecosystem	West Zambezi GMA	West Lunga	Total
Cattle killed	0	65	42	54	23	184
Shoats killed	0	4	36	0	0	40
Pigs killed	0	14	30	1	0	45
Donkeys killed	0	2	0	17	0	19
Dogs killed	0	0	8	0	0	8
Other livestock killed	13	0	14	0	0	27
Livestock maimed	0	4	0	0	0	4

Sixty-eight lions have been killed as a result of human lion conflict since 2002. Development of a specific policy to address Human Wildlife Conflict, as described above, is anticipated to greatly reduce the number of lions killed as problems through increased use of non-lethal strategies to deal with conflicts. As table 15 shows the number of lions killed on control spiked in the period 2013 to 2015.

Table 15. Control of Problem Lions in Zambia

Year	lions controlled
2002	2
2003	4
2004	1
2005	0
2007	5
2008	8
2009	2
2010	5
2011	3
2012	8
2013	5
2014	10
2015	14
2016	1

The average number controlled in the period 2010 to 2012 was 5.3 lions per year, this almost doubled to 9.7 lion per year in the period 2013 to 2015. This could be a result of the moratorium where lions cannot be hunted by tourist hunters thus leading to increased conflicts. Movement of lions out of the National Parks and GMAs into regions where they become "problems" is likely to be exacerbated by high lion densities that occur in the absence of sport hunting. Rather than just controlling them for the sake of reducing conflict, it would be beneficial if these lions were hunted through safari hunting because of the

increase in tolerance by rural communities toward lions generated by the revenues from sport hunting which are also used to protect lion habitat and to implement other mitigation measures.

The Lower Zambezi and Luangwa ecosystems accounted for 70 % of the lions killed on control. The levels of lethal control in the Lower Zambezi is particularly high with Rufunsa GMA accounting for 42 % of the animals killed in this ecosystem. The high levels of conflict in the Rufunsa GMA could be as a result of high human settlements along the river, thus there is competition for resources between wildlife and people. Considering the lower density of lions recorded from studies in the Lower Zambezi, lion hunting in this GMA is strategically meant to increase tolerance of lions and then contributing to solve problem animal conflict and bring communities on side by providing revenue that contributes to their livelihood strategies.

7.3 Bush meat poaching and prey depletion

Poverty and the necessity for rural people to obtain some income are the main drivers of bush meat poaching in Zambia. Although bush meat poaching occurs widely in Zambia it has not yet resulted in an overall decrease of the potential lion prey. As illustrated in section 7.3.1 below, results of the recent aerial surveys have shown an overall stable to increasing population of key prey species in the Kafue and Luangwa ecosystems.

7.3.1 Prey Availability and abundance

Abundance of prey species is highly correlated with lion density (Hayward, 2007; Périquet et al, 2014). Protected areas with healthy prey population support healthy populations of large lions. Therefore, prey abundance is a good indicator of the status of lion populations. The recent aerial survey of large mammals in Zambia (Annex 4) indicate that for key wildlife species in the Kafue ecosystem, their numbers have been increasing over the period 2006 to 2015. The trends for the Luangwa system have been stable to increasing. The only exception being the Lower Zambezi ecosystem where there has been a significant decrease in one of the main lion prey, the buffalo. The causes of this decline are being investigated. Figures 5, 6 & 7 below show the population trends of the key wildlife species in the South Luangwa, Kafue, and Lower Zambezi National Parks, the core areas for wildlife in the three main lion clusters in Zambia. The Kafue ecosystem can potentially hold more prey species than it currently has, and the observed increasing trend is encouraging as it is likely to result in the increase of lion in this huge ecosystem.

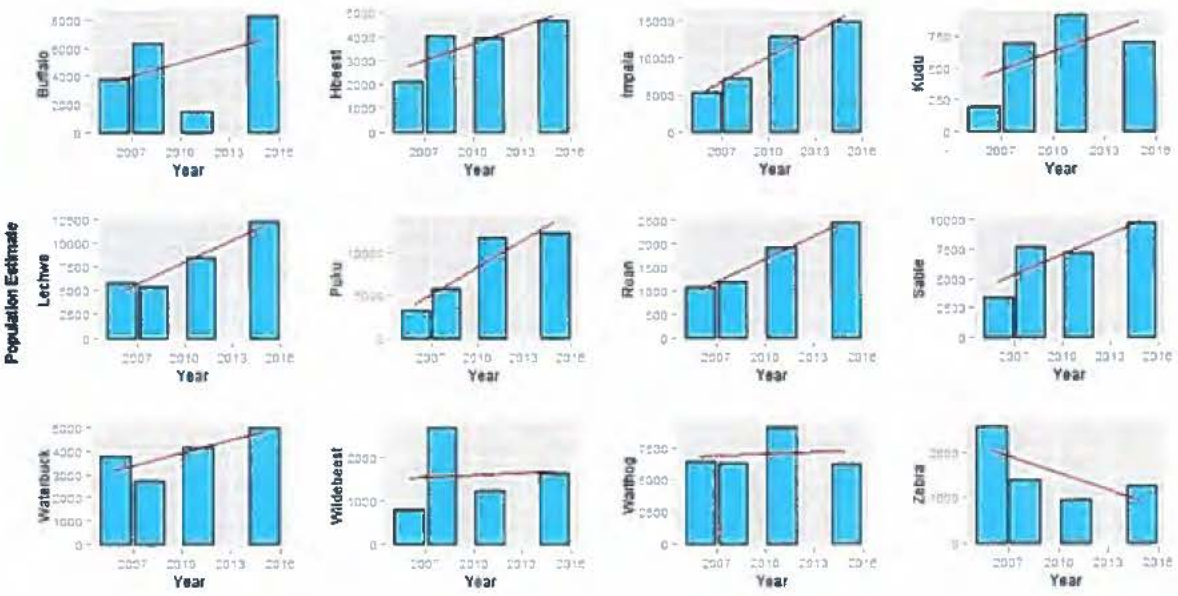


Figure 5. Population trends for selected species in the Kafue National Park 2006 – 2015

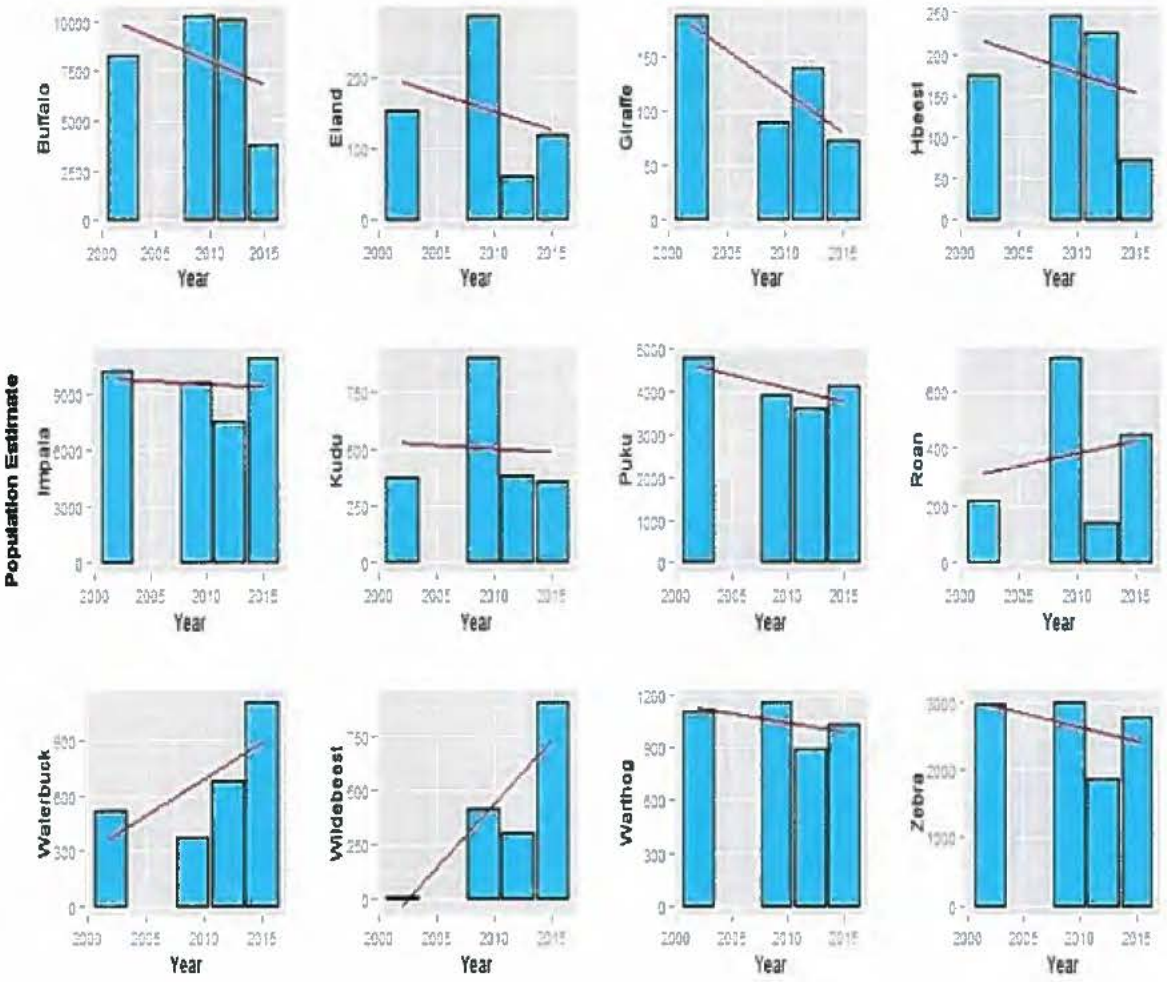


Figure 6. Ungulate population trends in South Luangwa National Park

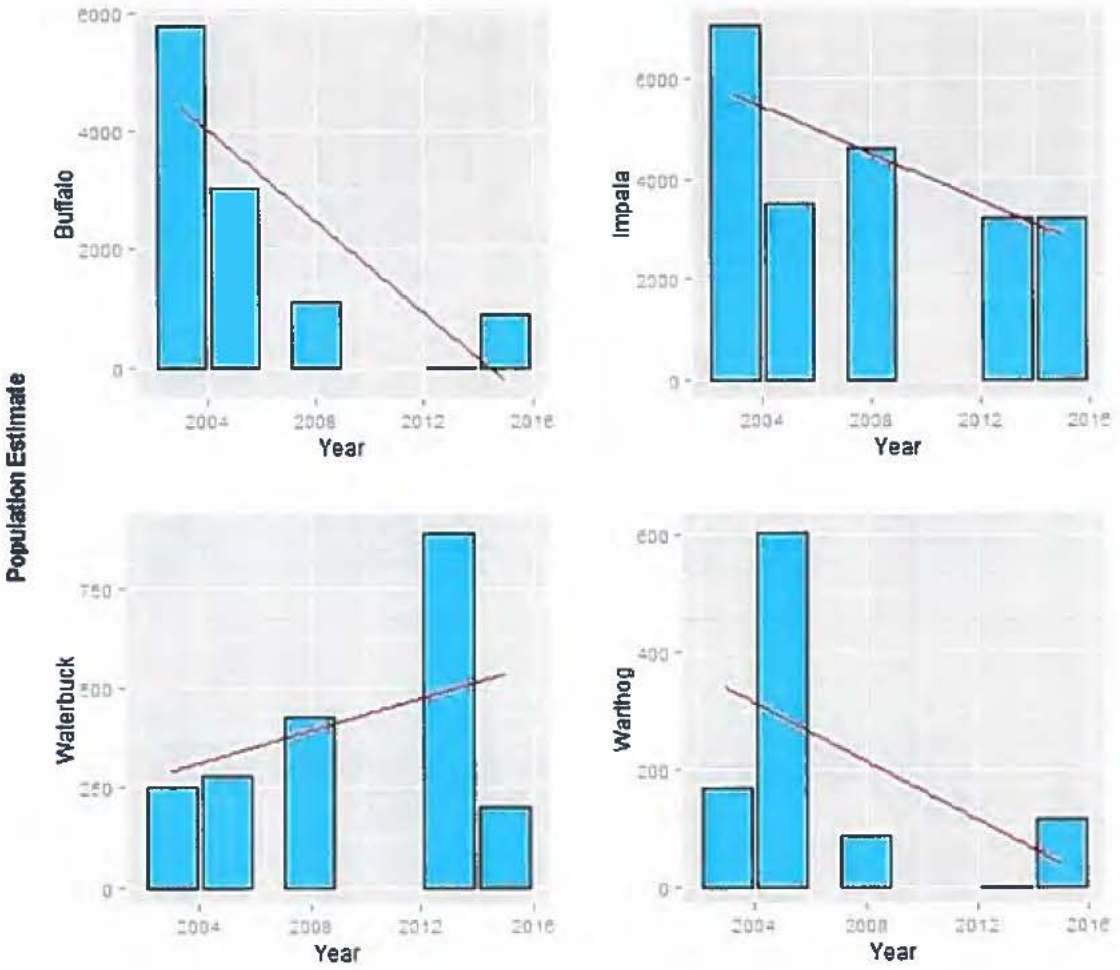


Figure 7. Population trends for buffalo, impala, waterbuck and warthog in the Lower Zambezi National Park

Figure 8 below is a comparison of ungulate abundance in the Luangwa ecosystem between GMAs and the 4 National Parks (South Luangwa, North Luangwa, Lukusuzi and Luambe National Parks). Buffalo and wildebeest were more abundant in the GMAs than in the National Parks. These findings underscore the importance of GMAs as habitat for populations of some species, in particular, buffalo and wildebeest and the need to maintain the habitats intact.

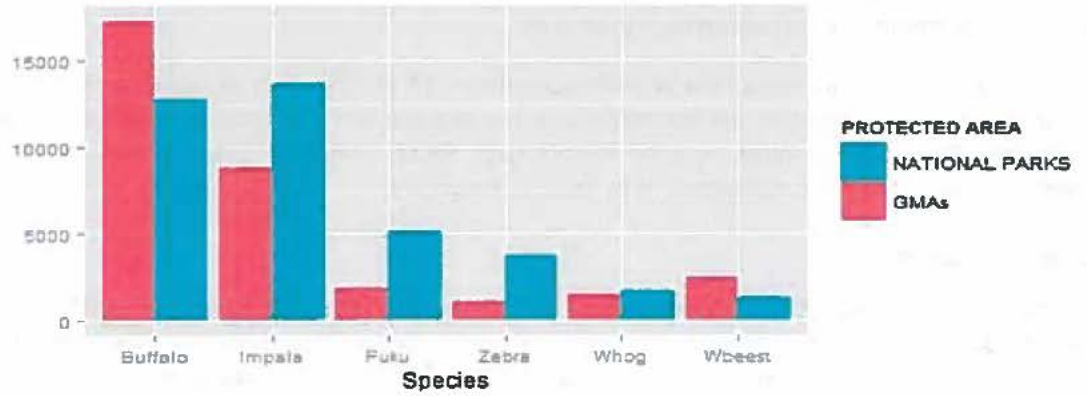


Figure 8. Species abundance in the Luangwa ecosystem National Parks vs GMAs

8.0 Community Based Natural Resources Management (CBNRM)

8.1 CBNRM in Zambia

The origin of CBNRM in Zambia owes much to a program that came to be known as the Administrative Management Design Program for Game Management Areas (ADMADE), which commenced in 1987. Funded by the United States Aid for International Development (USAID), ADMADE established the principle that communities had the right to participate in wildlife management and that it was the most effective way to achieve conservation. The program could be considered as one of the first CBNRM programs in Southern Africa. The theory behind the program, was to encourage rural participation in wildlife conservation. Rather than all taxes on safari hunting going to the state treasury, government to returned a portion of some revenue streams to a local GMA committee for its use in development and for investments in wildlife management.

In 1999, the Department of National Parks and Wildlife Service (NPWS) was transformed into the Zambia Wildlife Authority (ZAWA) - a statutory body established by the Zambia Wildlife Act number 12 of 1998. The Act gave birth to Community Resources Boards (CRBs), based on the ADMADE model and they were legally mandated to co- manage wildlife resources in Zambia.

Following the 1998 Zambia Wildlife Policy, local communities residing in chiefdoms and geographic areas which are contiguous to any wildlife estate or any open area are encouraged and assisted to apply and register as Community Resources Boards (CRBs) with the DNPW. Management of all CRBs established for the purpose of enhancing management and sustainable use of wildlife resources outside National Parks is done through a democratically elected representation of the local community themselves, but day to day operations of any CRB should be through a secretariat. The elections are done according to Village Action Groups and it is from those elected in these Action Groups that form members of the CRB. The chief of the area is regarded as the patron of such CRBs. DNPW cooperates with all registered CRB's and provides the technical input that assists them to develop management strategies. It is the responsibility of DNPW to work with CRBs and other stakeholders in the preparation of general management plans using a participatory planning process and format developed by the Department and adopted to meet local condition requirements.

All meetings of the CRBs are conducted in a democratic way, decision reached through consensus, and minutes of all their transactions and deliberations recorded. DNPW, District Council and non- governmental organisations (if present in the area) are called to the meeting to provide

the appropriate technical input that will assist CRBs make informed decisions about the rational and sustainable utilization of natural resources in their area.

Since the entry into force of the Zambia Wildlife Act number 14 of 2015 (See section 3.1), the Wildlife Policy is at present under review by the Ministry of Tourism and Arts and it will strengthen several aspects of the Zambia CBRNM programme such as wildlife user rights, Human Wildlife Conflicts and it will improve stewardship in wildlife management by local communities.

8.2 Community Benefits

The Zambia wildlife Act No. 12 of 1998 introduced rights to benefit from natural resources. The Zambia Wildlife Act No. 14 of 2015 allows greater participation of local communities, thus establishing their rights to use and manage natural resources in GMAs and Open Areas. This includes provisions for participation in developing management plans. In particular, as provided for by the 2015 Wildlife Act, a local community in a chiefdom in a Game Management Area, or in an open area or a particular chiefdom with common interests in the wildlife and natural resources in that area, may apply to DNPW for registration as a Community Resources Board (CRB). According to the Zambia Wildlife Act No. 14 of 2015 the CRB have the following functions:

i. negotiate, in conjunction with the Department, co-management agreements with hunting outfitters and photographic tour operators;
ii. manage the wildlife under its jurisdiction within quotas specified by the Department;
iii. appoint community scouts to exercise and perform the duties of a wildlife police officer under the supervision of a wildlife police officer in the area falling under the board's jurisdiction;
iv. in consultation with the Director, develop and implement management plans which reconcile the various uses of land in areas falling under the board's jurisdiction; and
v. Perform such other functions as the Minister or Director may direct or delegate to it.

From the revenues generated, members of local communities have been employed by CRBs as Community Scouts, funded also through obligations under the Concession Agreement (see section 5.4.1.), to assist DNPW with law enforcement and monitoring of wildlife resources. These scouts also help in assess crop damage and problem animal controls in their communities, where they also conduct environmental awareness among the local populace.

There are currently seventy-five (75) registered CRBs which employ approximately 750 Community Scouts operating in various GMAs in Zambia with a total monthly wage bill of ZMW 359,779.50 (USD 38,853.13). An additional 79 support staff (these include Book Keepers and Administrative officers) are employed by CRBs across Zambia. In some GMAs revenues from hunting are used to pay teachers and medical staff as in the case for Nabwalya CRB while others offer student scholarships which range from secondary school to tertiary education.

The revenues the local communities obtain allows them access to social amenities and various rural development projects. The projects span construction of bole- holes, schools, clinics, and feeder roads, as well as crop damage counter-measures including solar and chili pepper fences. More residents benefit indirectly from participating in wildlife management and accessing the resource, depending on the ability of the wildlife sector to generate funds. It has to be noted that local communities have limited benefits from non-consumptive tourism.

Animal fees are shared:

i. 5% of the funds go to the CRB patron (traditional leader or Chief);
ii. 45% of the funds go to the CRB in the form of community funds; and
iii. 50% of the funds go to ZAWA in the form of conservation funds.

Concession fees are shared:

i. 5% of the funds go to the CRB patron (traditional leader or Chief);
ii. 15% of the funds go to the CRB in the form of community funds; and
iii. 80% of the funds go to ZAWA in the form of conservation funds.

According to the "Guideline on the use of Community funds accrued from wildlife management" the communities are expected to be utilised as follows:

i. 45% of the funds go to wildlife management, including resource protection and patrols:
ii. 35% of the funds go to community projects such as construction of clinics, roads, schools, and wells; and
iii. 20% of the funds go to administration of the CRBs.

9.0 Revenues and Expenditures from Trophy Hunting

The fee revenues discussed in this section relate to revenues of DNPW, part of which are shared with communities. But a foreign client contributes far more to Zambia's economy than permit and concession fees. A foreign client pays to the operator a daily fee, and hunting a lion are often sold as a package together with other species such as buffalo, hippo, and impala. Therefore, the foreign client pays for more than just lion and for a significant period of time.

In addition to the daily fees, clients will often pay observers fees and taxes not imposed by DNPW, such as firearms taxes to the Treasury.

Safari hunting also generates "multiplier" impact due to the client's travel, tipping, eating in restaurants, purchase of souvenirs, and taxidermy requirements. The multiplier spending also generates tax revenue for the country's general Treasury. In short, the revenues generated by tourist safari hunting are many times greater than the fees directed to DNPW which are summarized here.

9.1 Animal and hunting fees

Hunting license fees in Zambia are statutory, the current hunting animal fee for a lion is US $4,200.00 to the outfitter. In addition to animal fees the hunting outfitter pays concession fees and outfitters fees annually. The department charges GMA Area fees per hunt and annual Professional Hunter fees. Other minor fees include certificate of valuation of trophies, certificate of ownership of trophies, permit to export, handling fees, and the CITES security stamp.

A foreign client pays a fee above this depending on what the outfitter charges. The department does not deal with the foreign client directly. It should be noted that hunting a lion is sold as a package together with other species such as buffalo, hippo, and impala among others. Therefore, the foreign client pays for more than just lion. Annex 5 provides the current animal fees as set by statutory instrument No. 60 of 2007.

9.2 Revenues from safari hunting

Table 16 Total ZAWA Revenues (ZMW) 2010 - 2015[1]

Description	2010	2011	2012	2013	2014	2015
Consumptive Revenue	23,676,244.65	24,352,872.71	27,120,628.30	5,166,710.21	4,568,488.41	16,956,733.29
Non Consumptive Revenue	26,183,244.27	28,311,567.47	34,596,145.48	36,501,500.48	52,029,138.51	50,297,933.05
Grants	14,254,780.64	33,717,778.22	27,247,240.21	70,688,875.94	59,506,322.16	122,866,591.92
Other Income	254,572.20	65,625.31	252,594.34	64,314.03	110,403.04	442,312.78
Total Income	64,368,841.75	86,447,843.71	89,216,608.33	112,421,400.66	116,214,352.12	190,563,571.04

Table 16 provides a breakdown of ZAWA fee revenues for the period 2010 to 2015.

In 2013 and 2014, there was no hunting in 19 out of the 33 hunting blocks in the Country due to a moratorium imposed in 2013, which included lion and leopard although for the latter hunting was resumed in 2015. This led to reduced revenues from game permit fees and concession fees, thus the significant drop in revenue during the period 2013 - 2014 as illustrated in figure 9 below.

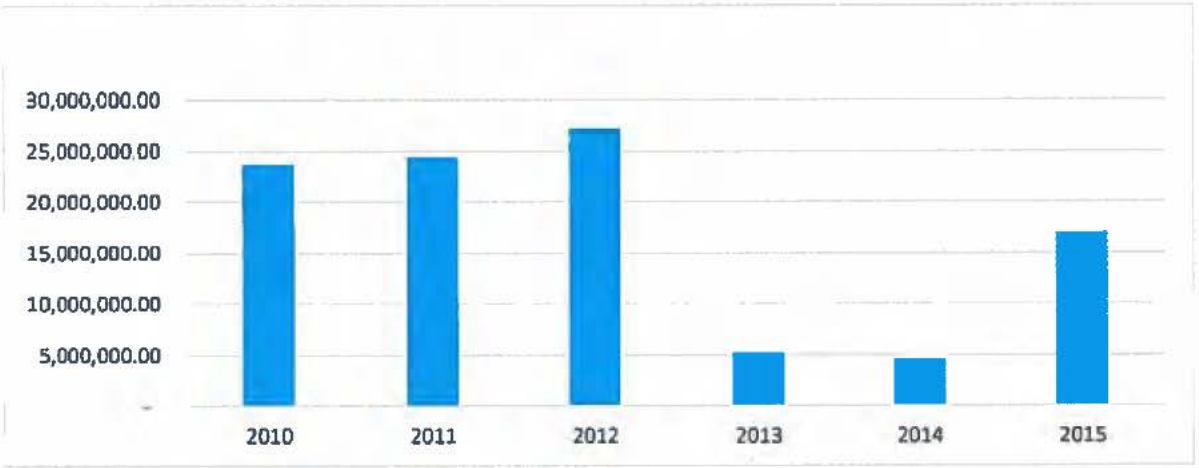


Figure 9. Hunting Revenues 2010 - 2015 (ZMW)

[1] For conversion rates from ZMW to USD please refer to:
https://www.fiscal.treasury.gov/fsreports/rpt/treasRptRateExch/historicalRates.htm

On average hunting revenues accounted for 32% of all the revenues that ZAWA received in the three years (2010 - 2012) before the moratorium on cats hunting.

During the moratorium (2013 & 2014) this reduced to an average of 4%. The deficit in terms of revenue was offset by an increased allocation from grants, which saw the grants almost triple from 22% in 2010 to 64% of ZAWA's income by the end of 2015.

The contribution of non-consumptive tourism averaged 36% during the six-year period from 2010 – 2015. On average Safari hunting revenues accounted for 88% of all the income from consumptive hunting during the pre-ban years reducing to 67 per cent during 2013 and 2014. It increased to 74% in 2015 with the resumption of hunting in some hunting blocks.

Table 17. Safari hunting revenues (ZMW) 2010 - 2015

Source	2010	2011	2012	2013	2014	2015
Animal Fees – Safari	13,390,444.50	14,653,302.15	17,007,494.58	1,168,063.84	3,063,611.44	7,459,738.45
Concession fees	5,609,062.99	5,201,607.05	5,886,650.62	1,097,808.40	292,644.80	4,009,874.25
Hunting rights	-	358,394.75	170,484.84	17,846.40	-	84,859.10
Bird License – Safari	216,168.28	192,480.95	179,500.04	24,178.42	16,022.65	60,236.60
Professional Hunters License	319,251.70	352,524.56	330,213.52	54,814.12	60,823.78	150,365.60
Outfitters Safari License	464,074.23	560,022.50	606,776.17	232,320.00	271,137.50	733,722.50
GMA Permit Fees	-	-	561,722.27	59,441.27	81,088.17	212,267.78
Total Income	19,999,001.70	21,318,331.96	24,742,842.04	2,654,472.45	3,785,328.34	12,711,064.28

Source: DNPW Accounts Unit

9.2.1 Revenues from lion hunting

Lion together with leopard and elephant (note however that elephants' trophies import restrictions apply in some countries) are the main drivers of revenues generated from trophy hunting. For the pre-ban period (2010 – 2012) lion revenues averaged 6.5 per cent of all revenues from animal fees and 1.24 per cent of ZAWA's total income during the pre-ban. It should be noted however, that licenses are usually sold as a package with other animals on the license, and as such the contribution of lion is actually higher than indicated in the graph. In 2013-2015, zero revenue was raised from lion hunts. The lack of revenue, and specifically lion hunting fees, reduced then-ZAWA's capacity for management and protection of lion (and other species).

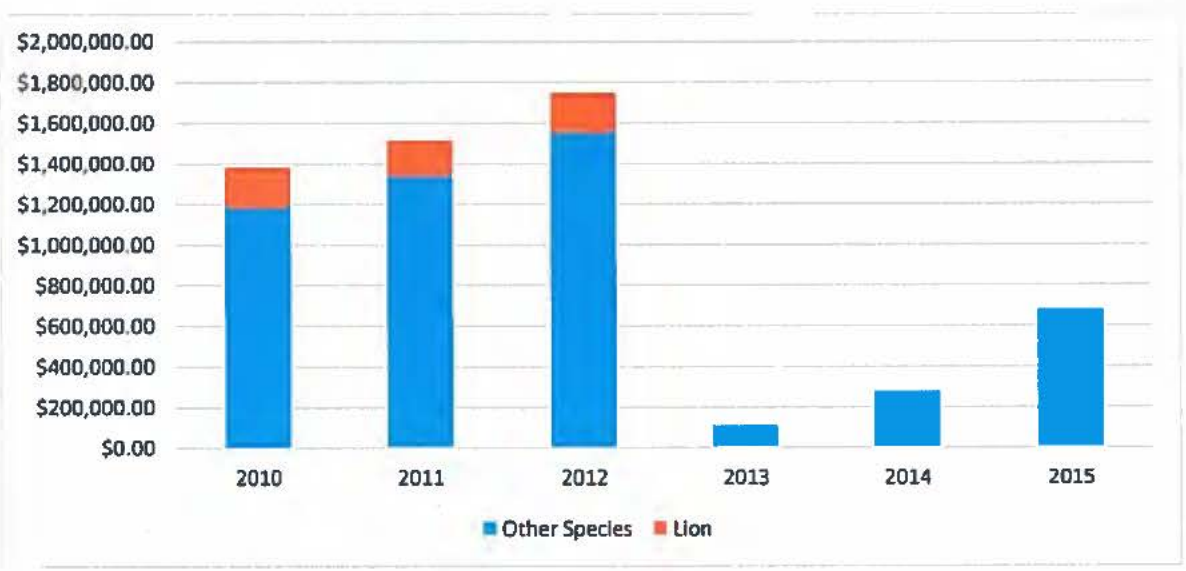


Figure 10. Lion animal fees as a proportion of total animal fees (in USD)

As discussed in section 5.3, the DNPW is re-establishing lion hunting that will restart in May 2016. Among the issues under discussion there is the feasibility of introducing a lion conservation fee on top of the animal fee, while requiring that lion hunting cover a minimum of 16 days. This is to maximize revenues and to use the additional conservation fee for specific monitoring programs on lion hunting. In addition, a Statutory Instrument, the Zambia Wildlife (Licenses and Fees) Regulations, 2016, revising Hunting Fees is under consideration and the lion fee will be slightly increased, under the proposed regulations. The upward adjustment in addition to the conservation fee will imply the price of lion goes up, adjusting to price in other countries, due to the reduction in quota.

9.3 Expenditures of revenues

Hunting revenues are utilized for general wildlife management activities and conservation activities. In this regard, hunting revenues pay for Scout/Wildlife Officers salaries, resource protection, prosecutions, animal surveys and staff training among other things. On average over the period 2010 to 2015 salaries accounted for 72% of all expenses. Of this amount close to 90% was salary related expenses for uniformed staff directly related to Conservation and management. Table 18 below is a summary of ZAWA's expenses for the period 2010 to 2015.

Table 18. ZAWA Expenditures 2010 - 2015 (ZMW)

S/N	Description	2010	2011	2012	2013	2014	2015
1	Operational Expenses	7,729,077.76	10,012,021.52	9,789,236.09	8,336,135.84	11,284,084.16	10,664,712.10
2	Salary Related Expenses	52,887,642.67	56,396,245.59	79,251,728.88	59,809,879.01	66,526,576.47	119,473,738.31
3	Administrative Expenses	6,324,166.93	6,603,338.51	10,511,912.98	9,130,591.80	7,935,295.74	16,660,015.70
4	Staff Training, Workshops and Transfers	1,206,917.95	1,660,735.79	2,229,534.12	755,587.28	1,343,203.38	3,867,097.07
5	Animal Surveys and Control	93,358.96	472,550.91	12,166.50	1,135,281.90	9,505.42	49,494.70
6	Repair and Maintenances	2,518,924.22	2,728,577.50	2,740,956.28	2,277,535.73	3,389,423.12	4,189,049.25
7	Consultancy and Legal Fees	2,430,375.14	3,594,930.37	1,099,026.64	830,955.46	1,825,947.53	900,438.27
8	Other Expenses	571,983.42	1,393,469.12	592,732.10	728,672.33	894,165.44	941,403.78
	Total Expenditure	72,962,447.04	82,861,869.31	106,227,293.58	83,004,639.33	93,208,201.26	156,545,949.18

The hunting revenues shown in table 17 cover an average of 25 per cent of ZAWA's expenditure during the pre-ban period, which was enough revenue to cover ZAWA operational expenses. The revenues from lion animal fees during the pre-ban period were enough to cover expense for Animal surveys and control during this period.

The added value of lion hunting cannot in any case be measured only in financial terms. The value to habitat protection, law enforcement and social benefits are some of the immaterial components of the lion hunting's contribution to conservation.

In the past, DNPW has not used fees generated from the hunting of a specific species for the conservation and management of that specific species, but rather pooled funds for enforcement and management costs. Again, one of the issues under discussion is the requirement of a lion conservation fee that will be specifically used for lion monitoring.

9.4 Funds disbursed to Communities

As explained in section 8, the Wildlife Act of Zambia provides for a revenue sharing system between the government and the communities. The following (table 19) are the revenues disbursed to communities in the period 2010 to 2015.

Table 19. Funds disbursed to Communities (2010 - 205) in ZMW

Year	Amounts Paid
2010	5,192,443.52
2011	10,660,206.34*
2012	4,658,671.35
2013	5,246,776.84
2014	5,203,553.87
2015	3,368,390.76
Total	34,330,042.68

As explained in section 8.2 above, guidelines governing the use of funds disbursed to the communities stipulate that the funds should be utilized in the following manner:

- 45% of the funds go to wildlife management, including resource protection and patrols;
- 35% of the funds go to community projects such as construction of clinics, roads, schools, and wells; and
- 20% of the funds go to administration of the CRBs.

Note that the increased disbursement in 2011 shown in Table 19 was a result of additional support from government. Further, although revenues went up significantly in 2015, community disbursement went down because there were less revenues from hunting due to the moratorium. Moreover, many employees of the safari hunting outfitters were also out of work during that time.

10.0 Conclusions and Non-detriment findings

Sustainable development and the need to fight poverty is the first and foremost priority of the Zambian government to also achieve wildlife conservation. The depletion of wildlife is slowly reducing in Zambia due to important investments made by the government, private sector, and donors.

In general, protection is important if done in parallel with poverty reduction strategies which shall include consumptive and non-consumptive wildlife utilization. In this regard, trophy hunting is one of the components that the Zambian government is using in its wildlife conservation strategies because of the high level off benefits, tangible and intangible, that it can produce. Safari Operators are in need of a good and healthy wildlife population in order for the sector to be viable. To achieve that they are supporting the government in actions not only to increase protection of habitats and wildlife, but also in community development.

The new management approach to lion hunting in Zambia is based on three pillars, i) a conservative, precautionary quota, well below one of the recommended thresholds for sustainability, ii) an age–based harvest limit and strong monitoring of lion offtakes, and iii) significant and direct community benefits. This will ensure that lion hunting in Zambia is sustainable and does not negatively affect the population.

Zambia has spent considerable resources to improve lion hunting and is experiencing a successful partnership with all stakeholders to ensure sustainability of the offtakes and financial and socials returns to conservation.

The CITES Scientific Authority of Zambia has considered the population of lion in Zambia; the quota-setting system and current precautionary quota of only 24 lions; the newly implemented age-based harvest policy; the limited offtake; the adaptive management of lion; and the substantial revenues generated for DNPW operations, anti-poaching, and community development. The Scientific Authority has considered the current threats to lion, including loss of habitat and human-lion conflicts, and potential of safari hunting to mitigate those threats.

Upon considering these factors and in accordance with Article IV of CITES and CITES Resolution Conf.16.7, the Scientific Authority concludes that the low level of off-take generated by safari hunting is not detrimental to the survival of the lion in Zambia and the amount of revenues generated by this low level of off-take are of crucial importance for the conservation of the species also because of the benefits it provides to rural communities. Safari hunting provides a net benefit to the species, it does not pose a threat to the species, and it is not a detriment to the survival of the species. In fact, the Scientific Authority of Zambia finds the regulated safari hunting of lion in Zambia enhances the survival of the species. The newly-developed lion management systems, Statutory Instruments and hunting reforms employ an adaptive management approach thereby ensuring long-term sustainability, health and enjoyment of Zambia's wild lion populations.

The CITES Scientific Authority of Zambia underlines that it expects CITES Parties to implement CITES Resolution Conf. 2.11 with particular reference to paragraph b) that states: *"in order to achieve the envisaged complementary control of trade in Appendix-I species by the importing and exporting countries in the most effective and comprehensive manner, the Scientific Authority of the importing country accept the finding of the Scientific Authority of the exporting country that the exportation of the hunting trophy is not detrimental to the survival of the species, unless there are scientific or management data to indicate otherwise"*.

11.0 References

Ansell, W. F. H. (1978). *The mammals of Zambia* (No. 1). National Parks & Wildlife Service.

Bauer, H. and van der Merwe, S. 2002. *The African Lion Database*. The African Lion Working Group, IUCN/SSC.

Bauer, H., & Van Der Merwe, S. (2004). Inventory of free-ranging lions Panthera leo in Africa. Oryx, 38(01), 26-31.

Bauer, H., Packer, C., Funston, P.F., Henschel, P. & Nowell, K. 2015. Panthera leo. The IUCN Red List of Threatened Species 2015: e.T15951A79929984. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T15951A79929984.en. Downloaded on 29 March 2016.Contains supplementary material.

Bauer, H., Chapron, G., Nowell, K., Henschel, P... & Packer, C. 2015b. Lion Panthera leo populations are declining rapidly across Africa, except in intensively managed areas. Proc. Natl. Acad. Sci. USA 112(48):14894-14899.

Becker, M., McRobb, R., Watson, F., Droge, E., Kanyembo, B., Murdoch, J., & Kakumbi, C. (2013). Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. Biological Conservation, 158, 26-36.

Becker, M. S., Watson, F. G., Droge, E., Leigh, K., Carlson, R. S., & Carlson, A. A. (2013). Estimating past and future male loss in three Zambian lion populations. The Journal of Wildlife Management, 77(1), 128-142.

Becker & Mweetwa (2015), Management of Big Cats in Zambia: An Overview of Research and Recommendations: Presentation to ZAWA, September 2015.

Berentsen, A.R., Dunbar, M.R., Becker, M.S., M'soka, J., Droge, E., Sakuya, N.M., Matandiko, W., McRobb, R. and Hanlon, C.A., 2013. Rabies, canine distemper, and canine parvovirus exposure in large carnivore communities from two Zambian ecosystems. Vector-Borne and Zoonotic Diseases, 13(9), pp.643-649.

Bertola LD, Tensen L, van Hooft P, White PA, Driscoll CA, et al. (2016). Autosomal and mtDNA Markers Affirm the Distinctiveness of Lions in West and Central Africa. PLoS ONE 10(10): e0137975 doi: 10.1371/journal.pone.0137975.

Bertola LD, Tensen L, van Hooft P, White PA, Driscoll CA, et al. (2016) Correction: Autosomal and mtDNA Markers Affirm the Distinctiveness of Lions in West and Central Africa. PLoS ONE 11(3): e0149059. doi: 10.1371/journal.pone.0149059

Carlson, A.A. (2004) African Wild Dog Conservation Project, Kafue National Park, Zambia. 2004 Annual Report. Conservation and Research for Endangered Species. Zoological Society of San Diego

Chardonnet, Ph.(Ed) 2002. Conservation of the African Lion: Contribution to a Status Survey. International Foundation for the Conservation of Wildlife, France & Conservation Force, USA.

Craig, G.C. 2012 Monitoring the Illegal Killing of Elephants: Aerial Survey Standards for the MIKE Programme. Version 2.0. CITES MIKE programme, Nairobi

Creel, S., & Rosenblatt, E. (2013). Using pedigree reconstruction to estimate population size: genotypes are more than individually unique marks. *Ecology and evolution*, *3*(5), 1294-1304.

Creel, S., Becker, M. S., Durant, S. M., M'soka, J., Matandiko, W., Dickman, A. J.,& Rosenblatt, E. (2013). Conserving large populations of lions–the argument for fences has holes. Ecology letters, 16(11), 1413.

Creel, S., M'soka, J., Droge, E, Rosenblatt, Eli, Becker, M., Matandiko, W, Simpamba, T (2016). Assessing the sustainability of African lion trophy hunting, with recommendations for policy. Ecological Applications. In Review

CSL (2016), Annual Report to the Department of National Parks and Wildlife. Mfuwe, Zambia

Curry, C. J., White, P. A., & Derr, J. N. (2015). Mitochondrial Haplotype Diversity in Zambian Lions: Bridging a Gap in the Biogeography of an Iconic Species. PloS one, 10(12), e0143827.

DPNW (2016), Report on the 2015 aerial census of elephants and other large mammals in Zambia: Part II Population estimates for other large mammals and birds, Department of National Parks and Wildlife (In Review). Chilanga, Zambia

Dubach, J.M., Briggs, M.B., White, P.A., Ament, B.A., & Patterson, B.D. (2013). Genetic perspectives on "Lion Conservation Units" in Eastern and Southern Africa. Conservation Genetics, 14:741-755.

Hayward, M. W., O'Brien, J., & Kerley, G. I. (2007). Carrying capacity of large African predators: predictions and tests. Biological Conservation, 139(1), 219-229.

Hunter, L.T., White, P., Henschel, P., Frank, L., Burton, C., Loveridge, A., Balme, G., Breitenmoser, C. and Breitenmoser, U. (2013). Walking with lions: why there is no role for captive-origin lions Panthera leo in species restoration. Oryx, 47(01), pp.19-24.

IUCN SSC (2012). IUCN SSC Guiding principles on trophy hunting as a tool for creating conservation incentives. Ver. 1.0. IUCN, Gland.

Leigh, K. A. (2005). The ecology and conservation biology of the endangered African wild dog (Lycaon pictus) in the Lower Zambezi, Zambia.

Lindsey, P.A., Balme, G., Becker, M., Begg, C., Bento, C., Bocchino, C., Dickman, A., Diggle, R.W., Eves, H., Henschel, P. and Lewis, D., 2013. The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. Biological Conservation, 160, pp.80-96.

Lindsey, P.A., Nyirenda, V.R., Barnes, J.I., Becker, M.S., McRobb, R., Tambling, C.J., Taylor, W.A., Watson, F.G. and t'Sas-Rolfes, M., 2014. Underperformance of African protected area networks and the case for new conservation models: insights from Zambia. PLoS one, 9(5), p. e94109.

Midlane, N., O'Riain, M. J., Balme, G. A., Robinson, H. S., & Hunter, L. T. B. (2014). On tracks: A spoor-based occupancy survey of lion Panthera leo distribution in Kafue National Park, Zambia. Biological Conservation, 172, 101-108.

Midlane, N., O'Riain, M. J., Balme, G. A., & Hunter, L. T. (2015). To track or to call: comparing methods for estimating population abundance of African lions Panthera leo in Kafue National Park. Biodiversity and Conservation, 24(6), 1311-1327.

Murray, D.L., Smith, D.W., Bangs, E.E., Mack, C., Oakleaf, J.K., Fontaine, J., Boyd, D., Jiminez, M., Niemeyer, C., Meier, T.J. and Stahler, D., 2010. Death from anthropogenic causes is partially compensatory in recovering wolf populations. Biological Conservation, 143(11), pp.2514-2524.

Périquet, S., Fritz, H., & Revilla, E. (2015). The Lion King and the Hyaena Queen: large carnivore interactions and coexistence. Biological Reviews, 90(4), 1197-1214.

Riggio, J. S. (2011). The African lion (Panthera leo leo): a continent-wide species distribution study and population analysis (Doctoral dissertation, Duke University).

Riggio, J., Jacobson, A., Dollar, L., Bauer, H., Becker, M., Dickman, A., Funston, P., Groom, R., Henschel, P., de Iongh, H. and Lichtenfeld, L. (2013). The size of savannah Africa: a lion's (Panthera leo) view. Biodiversity and Conservation, 22(1), pp.17-35.

Riggio, J., Caro, T., Dollar, L., Durant, S.M., Jacobson, A.P., Kiffner, C., Pimm, S.L., & van Aarde, R.J. (2015). Lion populations may be declining in Africa but not as Bauer et al. suggest. Proc. Natl. Acad. Sci. doi: 10.1073/pnas.1521506113.

Rosenblatt, E., Becker, M.S., Creel, S., Droge, E., Mweetwa, T., Schuette, P.A., Watson, F., Merkle, J. and Mwape, H. (2014). Detecting declines of apex carnivores and evaluating their causes: An example with Zambian lions. Biological Conservation, 180, pp.176-186.

Schaller, G. B. (2009). The Serengeti lion: a study of predator-prey relations. University of Chicago Press.

Watson, F. G., Becker, M. S., Milanzi, J., & Nyirenda, M. (2015). Human encroachment into protected area networks in Zambia: implications for large carnivore conservation. Regional Environmental Change, 15(2), 415-429.

Packer, C., Brink, H., Kissui, B. M., Maliti, H., Kushnir, H., & Caro, T. (2011). Effects of trophy hunting on lion and leopard populations in Tanzania. Conservation Biology, 25(1), 142-153.

Watson, F., Becker, M. S., McRobb, R., & Kanyembo, B. (2013). Spatial patterns of wire-snare poaching: Implications for community conservation in buffer zones around National Parks. Biological conservation, 168, 1-9.

White, P. A., & Belant, J. L. (2015). Provisioning of Game Meat to Rural Communities as a Benefit of Sport Hunting in Zambia. PloS one, 10(2), e0117237.

White, P. A., & Belant, J. L. (2016). Individual variation in dental characteristics for estimating age of African lions. Wildlife Biology, 22(3):71-77.

White, P. A., Ikanda, D., Ferrante, L., Chardonnet, P., Mesochina, P., & Cameriere, R. (2016). Age estimation of African Lions Panthera leo by ratio of tooth areas. PLoS ONE, 11(4): e0153648. doi: 10.1371/journal.pone.0153648.

Williams, V. L., Newton, D. J., Loveridge, A. J., & Macdonald, D. W. (2015). Bones of contention: An assessment of the South African trade in African lion Panthera leo bones and other body parts. Cambridge, UK and Wild-CRU, Oxford, UK: TRAFFIC.

Wittemyer, G., Elsen, P., Bean, W. T., Burton, A. C. O., & Brashares, J. S. (2008). Accelerated human population growth at protected area edges. Science, 321(5885), 123-126.

Yamazaki, K. (1996). Social variation of lions in a male-depopulated area in Zambia. The Journal of wildlife management, 490-497.

ZAWA. 2010. Zambia's Conservation Strategy and Action Plan for the African Lion. Chilanga, Zambia.

ZCP (2013), Annual Report to the Zambia Wildlife Authority. Mfuwe, Zambia

ZCP (2014), Annual Report to the Zambia Wildlife Authority. Mfuwe, Zambia

APPENDIX 1 - Assessment of the Zambia DNPW Enhancement and Non-Detriment Findings against the IUCN SSC "Guiding principles on trophy hunting as a tool for creating conservation incentives. Ver. 1.0. IUCN SSC (2012)"

DNPW produced an assessment of its Enhancement and Non-Detriment Finding on Lion in Zambia (2016) against the IUCN SSC GUIDING PRINCIPLES ON TROPHY HUNTING AS A TOOL FOR CREATING CONSERVATION INCENTIVES. VER. 1.0. IUCN SSC (2012), recognizing the importance of the implementation of these principles as best practices to manage trophy hunting as a legal, regulated activity which is a critical tool to secure a sound social, economic and ecological conservation scenario.

Biological Sustainability

Trophy hunting[†] can serve as a conservation tool when it:

#	Principle	Remarks
1	**Does not contribute to long-term population declines of the hunted species or of other species sharing its habitat, noting that a sustainably harvested population may be smaller than an unharvested one;**	***Safari hunting is not a threat to the Zambian lion population because it has not contributed to long-term population declines. Even though some studies in a limited area of the Luangwa valley showed a decline in lions, the moratorium that Zambia imposed in January 2013 has allowed a better understanding of lion population dynamics in certain areas and has driven a new very cautionary quota complemented by a mandatory aging system and monitoring of hunting.***
2	**Does not substantially alter processes of natural selection and ecosystem function; that is, it maintains "wild populations of indigenous species with adaptive gene pools." This generally requires that hunting offtake produces only minor alterations to naturally occurring demographic structure. It also requires avoidance of breeding or culling to deliberately enhance population-genetic characteristics of species subject to hunting that are inconsistent with natural selection;**	***It has been demonstrated by Curry, White & Derr (2015) that the genetic pool of the Zambian lion population is one of the most diverse in Africa. Thus, giving potential evidence that hunting offtake has had no evident effect on the population of Zambian lions.*** ***Zambia has never embarked in breeding programmes for hunting lion and has never done any culling on its lion population. In this regard, Zambia is enacting legislation to prohibit breeding of lions in captivity and hunting of captive bred lions.***

[†] The term "trophy hunting" is used by IUCN to refer to hunting that is: Managed as part of a program administered by a government, community-based organization, NGO, or other legitimate body; Characterized by hunters paying a high fee to hunt an animal with specific "trophy" characteristics (recognizing that hunters each have individual motivations); Characterized by low off-take volume; Usually (but not necessarily) undertaken by hunters from outside the local area (often from countries other than where the hunt occurs).

3	**Does not inadvertently facilitate poaching or illegal trade of wildlife;**	***Hunting in Zambia is an activity legally regulated and contributes to enhancement of habitat conservation and community livelihoods. Zambia has not recorded any confiscations related to lions poached for trophy or export. Community partnership arrangements in GMAs and Open Game Ranches are reducing poaching by increasing community conservation incentives.***
4	**Does not artificially and/or substantially manipulate ecosystems or their component elements in ways that are incompatible with the objective of supporting the full range of native biodiversity.**	***Trophy hunting in Zambia does not manipulate ecosystems in ways that are incompatible with supporting biodiversity. To the contrary, hunting is done in areas, the GMAs, which expand the natural habitat in the buffer zones around National Parks. Further, Open game ranches in Zambia further enlarges the habitat available for wildlife and support the conservation of biodiversity. In this way safari hunting creates financial incentives for wildlife conservation in an area extending nearly 180,000 sq.km (GMAs and Open Game Ranches) and thus providing habitat for a variety of species that conserve biodiversity and ecosystem services.***

Net Conservation Benefit

Trophy hunting can serve as a conservation tool when it:

#	Principle	Remarks
1	**Is linked to identifiable and specific parcels of land where habitat for wildlife is a priority (albeit not necessarily the sole priority or only legitimate use); and on which the "costs of management and conservation of biological diversity [are] internalized within the area of management and reflected in the distribution of the benefits from the use";**	***Hunting in Zambia is linked to clearly identifiable land areas where habitat for wildlife is a priority. These include 36 Game Management Areas covering an area of 177,404 sq.km and 17 Open Game Ranches covering an area of 2,556 sq.km. The cost of management and conservation area as much as possible internalized and a borne by the Safari Operators. These costs include but are not limited to Concession fees, concession financial obligations and camp expenses related to logistics, salaries, administration, anti-poaching, community assistance etc. Therefore, the private sector and the community as landholders bear the majority of the cost to maintain the area. Nevertheless the government through revenues from hunting pays for anti-poaching, community development through the***

		50% generated from animal fees and other conservation activities.
2	**Produces income, employment, and/or other benefits that generate incentives for reduction in pressures on populations of target species, and/or help justify retention, enhancement, or rehabilitation of habitats in which native biodiversity is prioritized. Benefits may create incentives for local residents to co-exist with such problematic species as large carnivores, herbivores competing for grazing, or animals considered to be dangerous or a threat to the welfare of humans and their personal property;**	*Hunting in Zambia has facilitated the creating of over 750 jobs for Community scouts, and benefits from hunting outfitters obligations such as distribution of over 50% of the meat from all carcasses hunted, and the contractual requirement of provision of social and community development initiatives. Moreover, over 1,000 people are employed in the hunting sector. Safari hunting in Zambia has generated from the period 2006 to 2012 more than USD 13 million in revenues for the Government and the communities.* *In 2013 a moratorium on hunting of cats was decided and also several concessions were suspended. The impact on revenues for the Government and communities has been substantial. Revenues from trophy hunting are contributing to the daily wildlife conservation work in Zambia. Revenues from safari hunting contribute to income for local communities and, inter alia, increase tolerance of communities towards problematic wildlife species including lions.*
3	**Is part of a legally recognized governance system that supports conservation adequately and of a system of implementation and enforcement capable of achieving these governance objectives**	*The Wildlife Act of 2015 is the principal legislation guiding the management of wildlife in Zambia, and provides a legally recognized governance system for the promotion of opportunities for the equitable and sustainable use of wildlife. This system is implemented and enforced by the DNPW with assistance from stakeholders such as the communities, the hunting sector and NGOs.* *Lion in Zambia are managed under a Conservation Strategy and Action Plan and guided by several Statutory Instruments that, inter alia, establish an age-based harvest guideline and other "best practices" for lion hunting and conservation.*

Socio-Economic-Cultural Benefit

Trophy hunting can serve as a conservation tool when it:

#	Principle	*Remarks*
1	**Respects local cultural values and practices (where "local" is defined as sharing living space with the focal wildlife species), and is accepted by (and preferably, co-managed and actively supported by) most members of the local community on whose land it occurs;**	***Local communities residing in chiefdoms and geographic areas which are contiguous to any wildlife estate or any open area are registered as Community Resources Boards (CRBs) with the DNPW. Management of all CRBs is done through a democratically elected representation of the local community themselves. The elections are done according to Village Action Groups (VAGs) and it is from those elected in the VAGs that form members of the CRB. The chief of the area is regarded as the patron of such CRBs. All meetings of the CRBs are conducted in a democratic way and decisions are reached through consensus. Minutes of all CRBs transactions and deliberations are recorded.*** ***Co-Management models between private investors and local communities are established in some Open Game Ranches such as the Kaindu Community Game Ranch in the Kafue ecosystem, extending for 15,500 hectares, which is providing an interesting and successful conservation model where the community through the Kaindu Community Resource Trust is managing the area together with private investors.***
2	**Involves and benefits local residents in an equitable manner, and in ways that meet their priorities;**	***The obligations under the hunting concession agreement provide involvement of and benefits to local communities. The concession's obligations are a components of the partnership in conservation of natural resources between the Communities, Safari Operators/professional hunters and the DNPW. No hunting concession agreement is valid without the signature of the Chief/s or CRB.***
3	**Adopts business practices that promote long-term economic sustainability.**	***The lease periods for the hunting blocks is variable and is dependent on the classification of the hunting block. Lease periods range from 7 to 15 years. Hunting Concession Agreements for GMAs are negotiated with DNPW and communities, which gives the communities their own voice and encourages the adoption of business practices that promote long-term sustainability. Long-term economic sustainability of community based programmes involving trophy hunting depends also on the international framework on trade as***

		international trade restrictions can jeopardise conservation programs.

Adaptive Management: Planning, Monitoring, and Reporting

Trophy hunting can serve as a conservation tool when it:

#	Principle	*Remarks*
1	Is premised on appropriate resource assessments and/or monitoring of hunting indices, upon which specific quotas and hunting plans can be established through a collaborative process. Optimally, such a process should (where relevant) include local communities and draw on local/indigenous knowledge. Such resource assessments (examples might include counts or indices of population performance such as sighting frequencies, spoor counts) or hunting indices (examples might include trophy size, animal age, hunting success rates and catch per hunting effort) are objective, well documented, and use the best science and technology feasible and appropriate given the circumstances and available resources;	*Zambia has a participatory quota setting process. The main scientific information used in the quota setting process is derived from aerial surveys which are regularly done in the country and includes many ungulate species. Other information is taken from ground counts, patrol sightings, local and expert opinion. Quota setting is done for each hunting block in GMAs for all types of hunting after close of hunting season and prior to the next hunting season. The quota for lion is set using information from scientific studies, field observations from Professional hunters and field officers and from hunting records. This allows CRBs and DNPW to review the previous hunting season's offtake. DNPW follows a bottom-up approach where CRBs submit a proposal of a quota to DNPW head office for adoption and approval. The final quotas are issued by the licensing unit. The produced quotas are distributed to the CRBs, Hunting companies and DNPW field stations. During the hunting season Wildlife officers accompany hunters on all hunts. The officer records activities related to the hunt on specified forms i.e., Safari Hunting monitoring forms, trophy measurement forms, and a client questionnaire. The officer endorses used licenses ensuring that they cannot be used again. The law requires that all harvested trophies are registered.*
2	Involves adaptive management of hunting quotas and plans in line with results of resource assessments and/or monitoring of indices, ensuring quotas are adjusted in line with changes in the resource base (caused by ecological changes, weather patterns, or anthropogenic impacts, including hunting offtake);	*Zambia has stopped lion hunting in areas were the lion population was low e.g., Chiawa and Tondwa GMAs. Furthermore the 2016 lion quotas have been set below the scientific recommended threshold with management and monitoring scheme including an aging system*
3	Is based on laws, regulations, and quotas (preferably established with local input) that are	*Trophy hunting in Zambia is regulated through the Zambia Wildlife Act and a number of Statutory Instruments with one, in preparation, specifically*

	transparent and clear, and are periodically reviewed and updated;	***targeting lions. Quotas are established in a transparent and participatory way.***
4	**Monitors hunting activities to verify that quotas and sex/age restrictions of harvested animals are being met;**	***DNPW has a long standing monitoring system for all trophy hunting. In 2015 it developed guidelines on lion hunting in Zambia.*** ***DNPW is also introducing a monitoring system specific for lions. This monitoring system will be based on a statutory instrument which is in preparation, which will introduce a mandatory sampling system that requires trophy lions meet or exceed a minimum age as one measure for harvesting trophy lions. The monitoring system will be based on specific forms that will help ensure proper compliance with the provisions of the law, including confirmation of legal licenses and collection of data associated with the hunt including but not limited to location, date, participants, and photos, as requested by DNPW. The monitoring system will be complemented by regular surveys.*** ***Zambia is committed to initiate further scientific surveys of Lions in order to assess the population status. Depending on the availability of funding, DNPW is planning surveys to be conducted in two areas: i) the corridor between South Luangwa National Park and Lower Zambezi National Park, comprising several GMAs and Open Game Ranches and ii) GMAs surrounding the eastern part of North Luangwa National Park. This will supplement the ongoing work of the Zambian Carnivore Programme in selected areas of South Luangwa and Kafue National Parks.***
5	**Produces reliable and periodic documentation of its biological sustainability and conservation benefits (if this is not already produced by existing reporting mechanisms).**	***Several reports are regularly published:*** - ***Reports of aerial surveys*** - ***Reports of other wildlife counts*** - ***DNPW partners in research produces annual report*** - ***Scientific publications*** - ***Community outreach programmes*** - ***DNPW Annual report***

Accountable and Effective Governance

A trophy hunting programme can serve as a conservation tool when it:

#	Principle	*Remarks*
1	**Is subject to a governance structure that clearly allocates management responsibilities;**	***The Zambian government structure for wildlife is described in the Wildlife Act No. 14 of 2015. The Act clearly defines the management responsibilities of the Government Department of National Parks and Wildlife. The Conservation Unit in DNPW monitors and oversees hunting in the country. The CBNRM Unit coordinates CBNRM activities in GMAs and builds capacity of CRBs in Resource monitoring including Safari hunting***
2	**Accounts for revenues in a transparent manner and distributes net revenues to conservation and community beneficiaries according to properly agreed decisions;**	***Revenues generated from trophy hunting are shared with local communities. From the revenues generated, members of local communities have been employed by CRBs as Community Scouts to assist DNPW with protection and monitoring of wildlife resources. These scouts also help assessing crop damage and problem animal controls in their communities, where they also conduct environmental awareness among the local populace.*** ***The revenues the local communities obtain allows them access to social amenities and various rural development projects. The projects span construction of bole- holes, schools, clinics, and feeder roads, as well as crop damage counter-measures including solar and chili pepper fences. More residents benefit indirectly from participating in wildlife management and accessing the resource, depending on the ability of the wildlife sector to generate funds. It has to be noted that local communities have limited benefits from non-consumptive tourism.*** ***Budgets of DNPW and CRBs are audited by the Office of the Auditor General.***

3	**Takes all necessary steps to eliminate corruption;**	***The Anti-Corruption Commission (ACC) is the Agency that is mandated to spearhead the fight against Corruption in Zambia. It was established in 1980 under an Act of Parliament, the Corrupt Practices Act No. 14. Currently the Commission is operating under the Anti-Corruption Act No. 3 of 2012 which has domesticated a number of legal provisions from the international protocols and conventions on corruption.*** ***The worldwide Transparency International ratings (http://www.transparency.org/country/#idx99) of corruption perceptions for Zambia have over the years improved tremendously. This is largely due to various anti-corruption intervention that the Government through the Anti-Corruption Commission and other stakeholders has put in place and continue to execute. (source: http://www.acc.gov.zm/portfolio/transparency-international-corruption-perception-ratings/)*** ***A representative of the Anti-Corruption Commission sits on the Wildlife Licensing Committee***
4	**Ensures compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.**	***The CITES Management Authority of Zambia, working in the DNPW, ensures compliance of the trophy hunting programme to CITES provisions.*** ***The Attorney General sits on Wildlife licensing committee to ensure compliance to national and international regulations.***

APPENDIX 2 - Reference Table to the USFWS Letter and Questionnaire on Lion in Zambia

The attached table cross-references the sections of the foregoing Enhancement and Non-Detriment Findings with the questionnaire directed to ZAWA (now DNPW) from the USFWS, dated 2 February 2016.

Question	Responded to in Section(s)
I. Overview *The lion is listed in Appendix II of CITES. As such, the Scientific Authority of the exporting country must make a determination that the export of a sport-hunted trophy will not be detrimental to the survival of the species (Article III, 2(a)). While the finding that the U.S. Fish and Wildlife Service must go beyond the "Non-detriment" standard, it would be very beneficial to our review if you could provide a copy of a recent "Non-detriment" finding made by your Scientific Authority.*	All sections, especially 10.0
II. MANAGEMENT PLAN (a comprehensive plan addressing specific management goals or actions) *1. Does Zambia currently have a national management plan for lions and, if so, could you please provide a copy? If there is no national plan, have regional plans been developed and adopted, and if so, could you please provide copies?*	3.4 and subsection
2. Is your agency the only government agency that is responsible for managing lions within your country? If not, which other agency or organisation within your national, regional, or local government is responsible?	3.1, 3.5 and subsection, 3.6 and subsections
3. Have you developed a mechanism (i.e., adaptive management approach) for implementing the plan(s) and determining its effectiveness? Could you describe how implementation of the plan is progressing and if there are management or logistical problems that still need to be addressed?	3.4, 3.1 (legislation), 3.3 (statutory instruments), 5.3.2 and 5.3.3 and subsections (adaptive management of quotas)

4. Are there any other management plans or conservation plans that contribute to or interact with the lion management plan(s) (i.e., regional plans, hunting concession plans)?	3.4.1, 7.1.1
III. Population Status *1. What is the status of lion populations within your country (e.g., population numbers; population trends; sex and age classification)?*	2.0 and subsections
2. Do you have a standardized process to conduct population censuses? If so, how often? What areas are censused? Do they include all hunting areas? What is the censusing methodology?	2.0 and subsections, 4.0
3. What is the current distribution of lions within your country (i.e., widespread, environmentally confined to specific areas, confined to national or regional protected areas)?	2 and subsections
4. Even with protection activities and legal intervention, poaching could still occur. Do you have any estimates on the number of specimens lost to illegal killing annually?	5.6, 7.0 and subsections
5. What impact are human-lion conflicts having on local or national populations? Is there a standardized national policy to address such conflicts and problem lion control? If so, does this policy include culling of surplus animals and removal of nuisance animals? Is there domestic harvesting of lions for local consumption or use?	7.2
IV. Conservation and Management *1. Please describe potential threats to the species, such as poaching and human-animal conflicts, and how these threats are being addressed.*	7.0 and subsections, see also 3.5 and subsections

2. Is your agency currently conducting any research efforts addressing conservation issues involving lions? What about other agencies or departments within your national or regional governments and what are their roles? Are you aware of any NGO projects currently underway that involve lion conservation or management? If so, could you describe such projects or provide contact information to the organization carrying out the work?	2.0 and subsections, 4.0 Annex 3
V. Hunting Policies/Regulations *1. Please describe how lion hunting program functions within your country. Specifically, do you have an established national/regional hunting quota? How is this quota determined? Many countries have established age restrictions on harvesting lions. Has your country established such age restrictions and, if so, what are they and how are they implemented?*	3.1,5.0 through 5.3 including subsections
2. What format do you use to manage sport hunting (i.e., establishment of national districts under government control, awarding hunting concessions to privately owned operations)?	5.2 and subsections, 5.4 and subsections
3. If hunting areas/concessions allocated to safari outfitters, how are they allocated? What requirements have been established for the concession holders (i.e., mandatory census activities, assistance to local villages, etc.)? Are concessions awarded on an annual basis or for longer periods? If concession areas are centrally controlled by your government (e.g., several outfitters hunt in the same areas and no one outfitter is responsible for overall management), what mechanism is used to monitor and control outfitter activities?	5.2 and subsections, 5.4 and subsections, 6.0/6.1 and subsections
4. How much do hunting licenses cost foreign hunters? How does your government utilize this revenue? Does a percentage go directly to lion conservation efforts or into more general wildlife management efforts? If so, what percentage is allocated to each? Is any of this revenue provided to local communities? If so, what percentage?	8.0 and subsections, 9.0 and subsections
5. How does the sport-hunting program provide any other tangible benefits, besides revenue, to local communities (i.e., increase employment, jobs in anti-poaching units)?	8.0 and subsections, 9.0 and subsections, see also 7.1.2, 7.1.3

Annex 1 **Zambia Wildlife Act No. 14 of 2015**

This annex is transmitted by email as PDF

Annex 2 Zambia's Conservation Strategy and Action Plan for the African Lion

This annex is transmitted by email as PDF

Annex 3 Contact details for selected Hunting Associations and NGO's in Zambia

a) Hunting Associations

Safari Hunting Outfitters Association of Zambia (SHOAZ)
PO Box 30721, Lusaka, Zambia
Email: barry.bellcross@gmail.com

Professional Hunters Association of Zambia (PHAZ)
P O Box 30106, Lusaka, Zambia
Email: prohunterszambia@gmail.com

Wildlife Producers Association of Zambia (WPAZ)
ZNFU Building,
Farmer's Village,
Show Grounds,
P O Box 30395,
Lusaka, Zambia
Email: admin@wpazambia.com

b) NGO's

Conservation South Luangwa (CLS)
P.O Box 3
Mfuwe, Zambia
rachel@slcszambia.org

Conservation Lower Zambezi (CLZ)
P.O Box 30972
Lusaka 10101
Zambia
ian@conservationlowerzambezi.org

The Nature Conservancy
Zambia Program
Plot 8644 Kudu Road
Kabulonga
P.O. Box 51540
Lusaka, Zambia
vmsiamudaala@tnc.org

Zambia Lion Project
Center for Tropical Research
University of California
Los Angeles, USA
paw@carnivoreconservation.org

WWF – Zambia
Plot 4978 Los Angeles Blvrd
Longacres,
P.O.Box 50551 RW,
Lusaka, Zambia
wwfzambia@wwfzam.org

Frankfurt Zoological Society (FZS)
North Luangwa Conservation Project
P.O Box 450189
Musakanya Drive
Mpika, Zambia
ed.sayer@fzs.org

Zambian Carnivore Programme
P.O Box 80
Mfuwe, Zambia
matt@zambiacarnivores.org

Annex 4 Report on the 2015 aerial census of elephants and other large mammals in Zambia Volume ii: population estimates and statistics for other large mammals and birds

This report is under final review and will be transmitted once completed by email as PDF

Annex 5 **Current fees as set by Statutory Instrument No. 60 of 2007**

This annex is transmitted by email as PDF

THE ZAMBIA WILDLIFE ACT, 2015

ARRANGEMENT OF SECTIONS

PART I

PRELIMINARY

Section

1. Short title and commencement
2. Interpretation
3. Ownership of wild animals
4. Principles of wildlife conservation and management

PART II

THE NATIONAL PARKS AND WILDLIFE DEPARTMENT

5. Establishment of Department
6. Director, Deputy Directors and delegation of functions
7. Wildlife Management Licensing Committee
8. Wildlife officers and wildlife police officers
9. Honorary wildlife police officers
10. International cooperation, agreements and instruments

PART III

THE NATIONAL PARKS, COMMUNITY PARTNERSHIP PARKS AND BIRD AND WILDLIFE SANCTUARIES

11. Declaration of National Parks
12. Establishment of Community Partnership Parks
13. Effect of orders and acquisition of land
14. Declaration of bird and wildlife sanctuaries
15. Prohibition of granting of land in National Park, Community Partnership Park or bird or wildlife sanctuary
16. Grant of mining and other rights in National Park, Community Partnership Park and bird or wildlife sanctuary
17. Traffic on public roads in National Park and Community Partnership Park

Single copies of this Act may be obtained from the Government Printer P.O. Box 30136, 10101 Lusaka. Price K102.00

18. Restrictions on entry into or residence in National Park or Community Partnership Park

19. Prohibition of hunting, etc in National Park or Community Partnership Park

20. Prohibition of weapons, etc. in National Park, Community Partnership Park or bird or wildlife sanctuary

21. Prohibition of introduction of wild animal into National Park, Community Partnership Park or bird or wildlife sanctuary

22. Prohibition of domestic animal in National Park, Community Partnership Park or bird or wildlife sanctuary

23. Prohibition of introduction of vegetation into National Park, Community Partnership Park or bird or wildlife sanctuary

24. Prohibition of removal of wild animal or vegetation from National Park, Community Partnership Park or bird or wildlife sanctuary

25. Prohibition of damage or removal of object of geological or historical interest, etc from National Park, Community Partnership Park or bird or wildlife sanctuary

26. Prohibition of killing, injuring or capturing of wild animal or bird within National Park, Community Partnership Park or bird or wildlife sanctuary

27. Regulations relating to National Parks, Community Partnership Parks, bird and wildlife sanctuaries

PART IV

GAME MANAGEMENT AREAS

28. Declaration of Game Management Areas

29. Settlement in Game Management Areas

30. Restriction on exercise of mining rights within Game Management Area

31. Restriction on hunting wild animals in Game Management Area

PART V

COMMUNITY RESOURCES BOARDS

32. Community resources boards

33. Functions of board

34. Secretariat of board

35. Financial provisions

PART VI

GAME ANIMALS AND PROTECTED ANIMALS

36. Game and protected animals

37. Restriction on hunting game or protected animals

38. Wildlife impact assessment

PART VII

LICENCES AND PERMITS

39. Licences and permits

40. Hunting licence

41. Bird licence

42. Professional hunter's licence

43. Capture permit

44. Fishing permit

45. Professional guide's permit

46. Photographic tour operator's permit

47. Commercial photographic permit

48. Hunting concession

49. Refusal to issue licence or permit

50. Display of licence or permit

51. Prohibition of transfer of licence or permit

52. Amendment or variation of licence or permit

53. Surrender of licence or permit

54. Suspension or revocation of licence or permit

55. Renewal of licence or permit

56. Loss of licence or permit

57. Single licensing

PART VIII

HUNTING OF WILD ANIMALS

58. Duties of licensees and permit holders

59. Duties of holder of professional hunter's licence

60. Counting of hunted game animals or protected animals

61. Limitations upon persons assisting in hunting game or protected animals

62. Prohibition of employment of another person to hunt

63. Prohibition of hunting in open area

64. Hunting in fenced and unfenced private wildlife estate

65. Prohibition of hunting young game animals and females with young

66. Restrictions on use of motor vehicles, aircraft or boats while hunting

67. Restrictions on use of dogs while hunting

68. Prohibition of use of fire in hunting

69. Prohibition of use of poison, bird lime or poisoned weapon in hunting

70. Prohibition of possession, acquisition or use of traps, etc., for hunting

71. Control of use of specified weapons or methods of hunting

72. Prohibition of driving certain game animal or protected animal into water

73. Prohibition of hunting during hours of darkness

74. Game drives

PART IX

KILLING, WOUNDING OR MOLESTING ANIMALS

75. Self-defence
76. Defence of property
77. Game or protected animal killed through accident or error
78. Wounding of game animal or protected animal
79. Wounding of dangerous animal
80. Cruelty to wild animals
81. Possession of maimed wild animal
82. Molesting or provoking game animal or protected animal

PART X

TROPHIES

83. Prohibited dealings in trophies
84. Trophy dealer's permit
85. Records and returns
86. Prescribed trophies
87. Certificate of ownership of trophy and prescribed trophy
88. Importation and exportation of trophy or prescribed trophy
89. Transfer of ownership of prescribed trophy
90. Production of ivory or horn of killed elephant or rhinoceros
91. Production of imported ivory or rhinoceros horn
92. Registration of ivory and rhinoceros horn
93. Prohibition of transfer of ivory or rhinoceros horn before registration
94. Transfer of ownership of ivory or rhinoceros horn
95. Government trophies
96. Report of possession of Government trophy
97. Unlawful possession of, or dealing in, Government trophies

PART XI

TRADE IN WILD ANIMALS AND MEAT OF WILD ANIMALS

98. Prohibited dealings in live wild animals

99. Certificate of ownership of game animal or protected animal or meat of game or protected animal

100. Regulation of trade or movement of meat of game or protected animal

101. Sale of game animal or protected animal or meat of game or protected animal

102. Prohibition of importation of wild animals or meat of wild animal without permit

103. Prohibition of exportation of wild animals or meat of wild animal without permit

104. Application for import or export permit

105. Restriction on import or export of wild animals or meat of wild animal

106. Certificates of ownership of imported wild animal

107. Wild animals, meat and trophies in transit

108. Implementation of international treaties

PART XII

THE WILDLIFE DEVELOPMENT FUND

109. Establishment of Fund

110. Administration of Fund and accounts

111. Annual report and statement of income and expenditure

PART XIII

ENFORCEMENT

112. Powers of authorised officers

113. Power to carry out tests and take statistics

114. Arrest without warrant

115. Power to take photographs, measurements, finger prints, etc

116. Search with warrant

117. Obstruction of authorised officer

118. Demanding production of licence, permit, certificate or authorisation

119. Prosecution by officers

120. Seizure of property

121. Forfeiture and restoration of property

122. Traffic barriers and cordons

123. Use of firearms

124. Compliance with Firearms Act

125. Immunity of authorised officers

PART XIV

OFFENCES AND PENALTIES

126. Prohibition of bush or grass fires in National Parks, Game Management Areas and sanctuaries

127. Hunting or dealing with elephant or rhinoceros

128. Penalty for unlawful hunting in National Park, Community Partnership Park or bird or wildlife sanctuary

129. Illegal possession, purchase or sale of meat of wild animal or trophy

130. Illegal possession, purchase or sale of protected animal, trophy or meat of protected animal or prescribed trophy

131. Malicious damage to infrastructure in public wildlife estate

132. Unauthorised possession or use of uniform or identity of authorised officer

133. Failure to keep registers or furnish returns

134. Alteration, defacement or removal of documents

135. Disclosure of confidential information

136. General penalty
137. Payment of fine without appearing in court
138. Additional powers of court
139. Destruction of game pits, etc., on conviction
140. Forfeiture of property on conviction
141. Disposal of animals and goods seized
142. Portion of fine payable to board
143. Civil remedy reserved
144. Evidence
145. Exhibits

PART XV
GENERAL PROVISIONS

146. Appeals
147. Regulations
148. Repeal of Zambia Wildlife Act, 1998
149. Savings and transitional provisions

FIRST SCHEDULE

SECOND SCHEDULE

GOVERNMENT OF ZAMBIA

ACT

No. 14 of 2015

Date of Assent: 14th August, 2015

An Act to provide for the winding up of the affairs of the Zambia Wildlife Authority; establish the Department of National Parks and Wildlife in the Ministry responsible for tourism; provide for the appointment of a Director and other officers responsible for National Parks and Wildlife; provide for the transfer of the functions of the Authority to the Ministry responsible for tourism, Department of National Parks and Wildlife and Director of National Parks and Wildlife; establish the Wildlife Management Licencing Committee; provide for the establishment, control and management of National Parks, bird and wildlife sanctuaries and for the conservation and enhancement of wildlife eco-systems, biological diversity and objects of aesthetic, pre-historic, historical, geological, archeological and scientific interest in National Parks; provide for the promotion of opportunities for the equitable and sustainable use of the special qualities of public wildlife estates; provide for the establishment, control and co-management of Community Partnership Parks for the conservation and restoration of ecological structures for non-consumptive forms of recreation and environmental education; provide for the sustainable use of wildlife and the effective management of the wildlife habitat in Game Management Areas; enhance the benefits of Game Management Areas to local communities and wildlife; involve local communities in the management of Game Management Areas; provide for the development and implementation of management plans; provide for the

regulation of game ranching; provide for the licensing of hunting and control of the processing, sale, import and export of wild animals and trophies; provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on Wetlands of International Importance especially as Waterfowl Habitat, the Convention on Biological Diversity, the Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora and other international instruments to which Zambia is party; repeal the Zambia Wildlife Act, 1998; and provide for matters connected with, or incidental to, the foregoing.

[14th August, 2015

Enactment

ENACTED by the Parliament of Zambia

PART I

PRELIMINARY

Short title and commencement

1. This Act may be cited as the Zambia Wildlife Act, 2015, and shall come into operation on such date as the Minister may appoint by statutory instrument.

Interpretation

2. In this Act, unless the context otherwise requires —

" aerodrome " means an airport, airfield, heliport, a defined area on land or water, including any buildings, installations and equipment intended to be used either wholly or in part for the arrival, departure or surface movement of aircraft;

" aircraft " includes flying machines, aeroplanes, seaplanes, helicopters, flying boats and other aircraft designed to be heavier than air, airships, microlites, balloons, kites and other aircraft designed to be lighter than air, whether captive, navigable or free and whether controlled by a human agency or not;

" animal " means a vertebrate animal, and includes a mammal, bird, fish, reptile and amphibian and the egg of a bird or reptile, but does not include a human being;

" appointed date " means the date appointed by the Minister under section *one*;

" apprentice professional guide " means a person who has attained the relevant prescribed qualifications and is training to be a professional guide under the supervision of a professional guide;

" apprentice professional hunter " means a person who is training to be a professional hunter under the supervision of a professional hunter but is not qualified to hunt dangerous animals;

" Assistant Director " means an Assistant Director of National Parks and Wildlife appointed in accordance with section *six*;

" authorised officer " means a wildlife police officer, a police officer of the rank of inspector or above, a community scout or an honorary wildlife police officer;

" barrier " means an obstruction placed across a street or road by a wildlife police officer for the purpose of preventing or detecting an offence relating to wildlife under this Act;

" biological diversity " means the variability among living organisms from all sources, including terrestrial ecosystems, aquatic ecosystems and the ecological complexes of which they are part, and diversity within species, among species and of ecosystems;

" bird licence " means a licence issued under section *forty-one;*

" bird sanctuary " means an area declared as a bird sanctuary under section *fourteen*;

" board " means a community resources board established under section *thirty-two*;

" *bona fide client* " means a non-Zambian with a hunting licence who is a client of a hunting outfitter that has a hunting concession or owns an unfenced private wildlife estate;

" capture " means to catch, take or collect live wild animal specimens, including eggs or nests;

" capture permit " means a permit issued under section *forty-three;*

Cap. 287

" Chief " means a person recognised as such under the Chiefs Act;

" client " means a person who is booked on a hunting tour by a holder of a hunting licence or a photographic tour operator;

" commercial photographic permit " means a permit specified under section *forty-seven*;

" Committee " means the Wildlife Management Licensing Committee appointed under section *seven*;

" Community Partnership Park " means an area of land declared a Community Partnership Park in accordance with section *twelve*;

" community scout " means a person employed by a board to enforce this Act within a Community Partnership Park, Game Management Area or open area under the jurisdiction of a board;

" consumptive tourism " means tourism which involves tangible products extracted from the environment, such as fishing and hunting;

" Council " means a city, municipal or district council established under the Local Government Act;

Cap. 281

" court " means a subordinate court or High Court;

"dangerous animal" means an elephant, a rhinoceros, hippopotamus, buffalo, lion, leopard or crocodile, and includes an animal that poses a threat to property or human life;

" Department " means the Department of National Parks and Wildlife established under section *five;*

" Director " means the Director of National Parks and Wildlife appointed in accordance with section *six*;

"domestic animal " means a horse, donkey, mule, camel, cow, sheep, pig, goat, dog, cat or domestic fowl, or any other animal of any kind or species, whether quadruped or not, which is tame or which has been or is being sufficiently tamed to serve some purpose for the use of a human being;

" eco-system " means a living functional system which contains all organisms including human beings, their environment and the relationship that exists between them;

" endemic species " means an indigenous species naturally restricted to Zambia;

" fauna " means all the animal life in a particular area;

" fishing permit " means a permit issued under section *forty-four;*

" flora " means all plants and parts of the plants in a particular area;

" Fund " means the Wildlife Development Fund established under section *one hundred and nine;*

" game animal " means a wild animal *ferae naturae* that is not necessarily threatened or endangered but requires control in order to prevent consumptive uses inimical to its survival and is so specified by regulations issued under section *thirty-six;*

" Game Management Area " means an area of land declared a Game Management Area under section *twenty-eight;*

" general management plan " means a document that sets out the basic management and development philosophy for a protected area and provides strategies for addressing problems and achieving identified management objectives;

" habitat " means a place where a species or ecological community naturally occurs;

" harvest " means non consumptive and consumptive use of game, nongame, protected or unprotected animals;

" honorary wildlife police officer " means a person appointed as such under section *nine;*

" hunt " includes to kill or the doing of an act immediately directed at killing;

" hunting block " means a Game Management Area or an area within a Game Management Area that is set aside for hunting;

" hunting concession " means authority to hunt within a specified hunting block issued under section *forty-eight*;

" hunting licence " means a licence issued under section *forty;*

" hunting outfitter " means a company engaged in the business of conducting safari hunting, which holds a tourism enterprise licence and a hunting concession;

Act No. 11 of 2006

" investor " has the meaning assigned to it in the Zambia Development Agency Act, 2006;

" ivory " means ivory from an elephant, and includes an article derived from the ivory;

" land user-rights fee " means the fee paid by an investor for the use of land in a Game Management Area;

" licensing " means a process to obtain or issue a licence, permit or certificate in accordance with this Act and the Business Regulatory Act, 2014;

Act No. 3 of 2014

" local community " means the residents within a Game Management Area or open area, other than owners of tourist and camp lodges or hunting concessions, who by virtue of their rights over land, including under customary land tenure, invest in and derive benefits from the sustainable utilisation of the wildlife resources in their area;

" meat " includes fat, blood or flesh, whether fresh or dried, pickled or preserved;

" National Park " means an area of land declared a National Park under section *eleven;*

" non-consumptive tourism " means conventional tourist activities such as viewing animals, photographing, bird watching, wilderness walks, walking safaris, angling, canoeing and boat rides;

" open area " means an area other than a National Park, bird or wildlife sanctuary, Community Partnership Park or Game Management Area, where wild animals are found;

" owner " in relation to land, includes the person or persons entitled to the immediate and exclusive possession of land under any right, a licensee in lawful occupation of land under a licence and a person authorised by the owner to act on behalf of the owner in respect of land during the owner's absence from Zambia;

" photographic or viewing safari " means an organised commercial tour for the purpose of taking photographs or viewing of wild animals or scenery;

" photographic tour operator's permit " means a permit issued under section *forty-six*;

" possession " has the meaning assigned to it by section *four* of the Penal Code; Cap. 87

" prescribed qualifying conditions " means such conditions as the Minister may prescribe for purposes of this Act;

" prescribed trophy " means any ivory or rhinoceros horn or any other trophy prescribed by regulations made under section *eighty-six;*

" private wildlife estate " means an area outside public wildlife estates that is reserved by a person or local community for wildlife conservation and management, and includes a game farm, game ranch, reptile farm, aviary, zoo and captive breeding facility;

" professional hunter's licence " means a licence issued under section *forty-two;*

" professional guide's permit " means a permit issued under section *forty-five*;

" protected animal " means a wild animal *ferae naturae* which is endemic, threatened or endangered and is subject to strict control in order to further its survival and is so specified by regulation under section *thirty-six;*

" public body " means the Government, any Ministry or Department of the Government, a local authority, parastatal, board, council, authority, commission or other body appointed by the Government, or established by or under any written law, excluding a professional association or body;

" public road " has the meaning assigned to it in the Public Roads Act, 2002; Act No. 12 of 2002

" public wildlife estate " means a National Park, Community Partnership Park, bird or wildlife sanctuary, Game Management Area and any other area designated for wildlife conservation and management by a public body in accordance with this Act;

" quota " means the number of game animals allocated for harvesting in order to attain wildlife conservation goals;

" regulatory agency " has the meaning assigned to it in the Business Regulatory Act, 2014; Act No. 3 of 2014

" road " means a public or other way, capable of being used by vehicular traffic and to which the public has access, and includes a bridge over which a road passes;

" single licensing system " has the meaning assigned to it in the Business Regulatory Act, 2014;

Act No. 3 of 2014

" species " means a kind of animal, plant or other organism that does not normally interbreed with an animal, plant or organism of another kind, and includes any sub-species, cultivar, variety, geographic race, strain, hybrid or geographically separate population;

" sustainable " in relation to the use of wildlife, means the use of wildlife in a manner and at a rate that—

(a) would not lead to its long-term depletion;

(b) would not disrupt the ecological integrity of the ecosystem in which it occurs; and

(c) would ensure its continued use to meet the needs and aspirations of present and future generations of people;

" sustainable development " means development that meets the needs of the present generation without compromising the ability of future generations to meet their needs;

" trafficking " means illegal trade in smuggling, poaching, capture or collection of, endangered species or protected wildlife, or derivatives or products of endangered species or protected wildlife;

" tourism " has the meaning assigned to it in the Tourism and Hospitality Act, 2015;

Act. No. 13 of 2015

" tourism block " means a National Park, bird sanctuary, wildlife sanctuary, Community Partnership Park, Game Management Area or an area within a National Park, bird sanctuary, wildlife sanctuary, Community Partnership Park or Game Management Area that has been set aside for non-consumptive tourism;

" tourism block concession " means an authority, given by the Committee for a specific period of time, to conduct non-consumptive tourism within a tourism block;

" tourism enterprise licence " means the tourism enterprise licence issued under the Tourism and Hospitality Act, 2015; Act. No. 13 of 2015

" trophy " means a horn, tooth, tusk, bone, claw, hoof, skin, hair, egg, feather or other durable part of a game animal or protected animal, whether added to or changed by the work of a human being or not, that is in such form as to be recognisable as a durable part of a game animal or protected animal, and includes meat;

" trophy dealer " means a person who engages in the buying, selling or processing of trophies, but does not include a person who sells, processes or manufactures an article from a trophy of a game animal or protected animal lawfully hunted by that person under a hunting licence or hunting concession;

" trophy dealer's permit " means a permit to engage in the business of a trophy dealer under section *eighty-four;*

" vegetation " includes any form of vegetation matter, alive or dead;

" wild animal " means an animal *ferae naturae*, and includes a game or protected animal, but does not include a domestic animal;

" wildlife " means wild animals or species of birds that are found in Zambia in a wild state and vegetation which is indigenous to Zambia and grows naturally without cultivation;

" wildlife conservation " means the sustainable management and use of wildlife for its inherent value and for the benefit of human beings and other living things;

" wildlife management " means the practice of maintaining sustainable wildlife populations and diversity through the protecting of game animals and their habitat and the control of their utilisation;

" wildlife officer " means an employee of any rank under the Department, and includes a wildlife police officer and community scout;

" wildlife police officer " means an officer appointed under section *eight;* and

"wildlife sanctuary" means an area declared as a wildlife sanctuary under section *fourteen.*

Ownership of wild animals

3. (1) Subject to the other provisions of this Act, the absolute ownership of every wild animal within Zambia is vested in the President on behalf of the Republic, except that —

(a) where a wild animal, which is not a game animal or protected animal, is captured or killed or reduced into possession by a person in accordance with this Act, the absolute ownership of that animal or the carcass of that animal is transferred to and vested in that person;

(b) where a game animal or protected animal is lawfully captured or killed or reduced into possession by a person in terms of a hunting licence, capture permit, hunting concession or under an authority granted under this Act, the absolute ownership of the game animal or protected animal or the carcass or a trophy of that animal is,subject to the other provisions of this Act and to the terms and conditions of the hunting licence, capture permit, hunting concession or authority, as the case may be, transferred to, and shall vest in, the licensee, permit holder, concessionaire or the person so authorised; and

(c) subject to such regulations as the Minister may prescribe on the advice of the Director, where a wild animal is found resident on any land, the Director may grant the right to harvest the wild animal to the owner of the land.

(2) Notwithstanding subsection (1), the absolute ownership of a wild animal that has been captured or reduced into possession by a person prior to the commencement of this Act, subject to any other written law in force on the date of the capture of the animal or of its reduction into possession, is declared to be vested in the person who, on the commencement of this Act, whether directly or through an agent, is in actual lawful possession of the animal.

(3) Except as provided by subsection (1), nothing in this section shall be deemed to transfer to a person the ownership of a game animal or protected animal that is found dying or dead, or of any found carcass, part of a carcass, trophy or meat of a game animal or protected animal.

(4) Notwithstanding any other provision of this section, where a person hunts or reduces into possession a game animal or protected animal in contravention of this Act, the absolute ownership of that game animal or protected animal or the carcass or trophy of the animal shall not be transferred, or be deemed to have been transferred, to that person or to any other person by reason of its having been so hunted or reduced into possession.

(5) The Committee may, in writing, transfer to any person the absolute ownership of a game animal or protected animal which has been hunted or reduced into possession by any other person in contravention of this Act and such other person shall forthwith deliver up the game animal, protected animal or carcass of the animal together with every trophy of the animal to the person to whom the ownership has been transferred in terms of this subsection.

Principles of wildlife conservation and management

4. The following principles shall apply to wildlife conservation and management—

(a) wildlife shall be conserved and managed as an asset for present and future generations and to achieve economic growth;

(b) wildlife utilisation, management and conservation shall protect biological diversity, preserve the integrity and ensure the sustainability of the ecosystem and biological diversity;

(c) wildlife conservation and management shall be integrated, because all the elements of the environment are linked and inter-related;

(d) the equitable and effective participation of local communities and traditional leaders shall be promoted taking into account their interest and needs;

(e) wildlife utilisation shall promote equitable access to, and fair distribution of, the economic, social, health and environmental benefits derived from wildlife;

(f) wildlife utilisation shall promote opportunities and benefits for sustainable development and ensure the potential yield of economic, social and environmental benefits of wildlife conservation and management;

(g) global and international responsibilities in wildlife conservation and management shall be discharged in the national interest; and

(h) traditional knowledge shall be recognised in wildlife management and incorporated in management plans.

PART II

THE NATIONAL PARKS AND WILDLIFE DEPARTMENT

Establishment of Department

5. (1) There is established in the Ministry responsible for tourism the Department of National Parks and Wildlife which shall be responsible for the administration of this Act under the general direction of the Permanent Secretary of the Ministry.

(2) Subject to the other provisions of this Act, the functions of the Department are to —

(a) control, manage, conserve, protect and administer National Parks, Community Partnership Parks, bird and wildlife sanctuaries and Game Management Areas and coordinate activities in these areas;

(b) in partnership with local communities, share the responsibilities of management in Community Partnership Parks and Game Management Areas;

(c) adopt methods to ensure the sustainability, conservation and preservation in the natural state of eco-systems and biological diversity in the National Parks, Community Partnerships Parks, bird and wildlife sanctuaries and Game Management Areas;

(d) encourage the general development of National Parks, Community Partnership Parks, bird and wildlife sanctuaries and Game Management Areas, including the development of facilities and amenities within these areas in accordance with the management plans for those areas;

(e) sensitise and educate the general public on the necessity of wildlife conservation and the importance of wildlife to foster appreciation of the economic and aesthetic value of wildlife as natural assets;

(f) undertake measures to ensure the proper balance between the sustainable use of wildlife and the management of eco-systems in National Parks, Community Partnership Parks, bird and wildlife sanctuaries and Game Management Areas;

(g) enhance the economic and social well-being of local communities in or around Community Partnership Parks and Game Management Areas;

(h) prepare and implement management plans for National Parks, Community Partnership Parks, bird and wildlife sanctuaries and Game Management Areas in consultation with relevant stakeholders;

(i) issue licences, certificates and permits under this Act;

(j) in partnership with local communities, grant hunting concessions to hunting outfitters and non-consumptive tourism operators in Game Management Areas;

(k) assist and advise the boards in the management of human and natural resources in Game Management Areas and open areas which fall under their jurisdiction;

(l) formulate and advise the Minister on the regulations for the preparation and implementation of general management plans for National Parks, Community Partnership Parks, bird and wildlife sanctuaries and Game Management Areas;

(m) ensure the systematic management of financial, human and natural resources for wildlife conservation so that the abundance and diversity of species is maintained at optimum level;

(n) advise the Minister on the regulations required to conserve, protect and manage wildlife in National Parks, Community Partnership Parks, bird and wildlife sanctuaries, Game Management Areas, open areas and private wildlife estates;

(o) pay out monies into a fund established by a board and regulate the use of the funds from profits accrued from the revenues payable under this Act in respect of licences, certificates and permits issued, hunting concessions granted and services rendered from the use of wildlife within an area of a board as the Minister may prescribe, in consultation with the Director;

(p) regulate trophy hunting operations and non-consumptive tourism operations in Game Management Areas;

(q) grant and regulate tourism block concessions in tourism blocks;

(r) co-operate with persons and organisations with an interest in the activities of the Department and are prepared to assist the Department on a voluntary basis and comply with the requirements set by the Ministry;

(s) regulate private wildlife estates;

(t) carry out commercial activities related to consumptive and non-consumptive tourism; and

(u) carry out any other activities relating to wildlife conservation and management that are necessary to the performance of its functions under this Act.

Director, Assistant Directors and delegation of functions

6. (1) The Public Service Commission shall appoint as a public officer the Director of National Parks and Wildlife who shall be responsible for the administration of the provisions of this Act, subject to the general or special directions of the Minister and the Permanent Secretary in the Ministry that are consistent with the provisions of this Act.

(2) The Director may, subject to the other provisions of this Act and to the general or special directions of the Permanent Secretary, delegate any of the Director's functions to an Assistant Director, a wildlife officer, a member of the Department, a board or to a committee of a board.

(3) The Public Service Commission shall appoint such Assistant Directors and other officers as may be necessary for the administration of this Act.

(4) An Assistant Director shall exercise such functions and duties as are delegated to the Assistant Director by the Director.

Wildlife Management Licensing Committee

7. (1) There is established the Wildlife Management Licensing Committee which shall—

(a) consider applications for licences, permits and certificates and grant, renew or refuse to grant or renew licences, permits and certificates;

(b) terminate, suspend or revoke licences, permits and certificates;

(c) amend the terms and conditions of licences, permits and certificates;

(d) perform the functions of the Department relating to licensing;

(e) advise the Minister, the Permanent Secretary and the Director on matters relating to its functions under this Act; and

(f) perform any other function conferred on the Committee by or under this Act.

(2) The Committee shall consist of the following part-time members who shall be appointed by the Minister:

(a) one representative each of the Ministries responsible for —

(i) the environment;

(ii) land;

(iii) fisheries;

(iv) forests;

(v) finance;

(vi) tourism;

(vii) chiefs; and

(viii) mines;

(b) a representative of the Attorney-General;

(c) a representative of a security agency;

(d) a representative of the Anti-Corruption Commission;

(e) a representative of the Zambia Environmental Management Agency;

(f) a representative of the Tourism Council of Zambia; and

(g) the Director, as an *ex-officio* member.

(3) A person shall not be appointed as a member of the Committee if that person—

(a) is an undischarged bankrupt;

(b) has been convicted of an offence under this Act or any other relevant written law five years precedent to the date of the nomination or appointment;

(c) has been convicted of an offence involving fraud or dishonesty; or

(d) has a mental or physical disability that makes the person incapable of performing the functions of a member.

(4) The Minister shall, where practicable, ensure equitable gender representation when appointing the members of the Committee.

(5) The Minister shall appoint the Chairperson of the Committee and the members shall elect the Vice-Chairperson of the Committee from amongst themselves.

(6) The Committee may delegate its functions to the Director, an Assistant Director or wildlife officer on such terms and conditions as it may determine.

(7) The provisions of the First Schedule apply to the Committee.

Wildlife officers and wildlife police officers

8. (1) The Public Service Commission shall appoint as public officers such number of wildlife officers and wildlife police officers as are necessary for the administration of the provisions of this Act.

(2) A wildlife police officer shall, on being employed, be attested to serve as a wildlife police officer for such period and on such conditions as may be prescribed.

(3) A wildlife officer and wildlife police officer shall exercise such functions and perform such duties as are conferred upon the wildlife officer or wildlife police officer by this Act or as may be delegated or assigned to the wildlife officer or wildlife police officer by the Director.

(4) A wildlife officer or wildlife police officer who ceases to be a member of staff of the Department shall surrender to the Director, or the officer-in-charge, all arms, ammunition, uniforms and other apparatus which were supplied to the wildlife officer or wildlife police officer for purposes of this Act and which are the property of the Government.

(5) A wildlife officer or wildlife police officer who fails to surrender the arms, ammunition, uniforms or other apparatus in possession of that officer commits an offence and is liable, upon conviction, to a fine not exceeding three hundred thousand penalty units or to imprisonment for a term not exceeding four years, or to both, and the court that convicts that officer may issue a warrant to search for, and seize, all arms, ammunition, uniforms and other apparatus not surrendered in accordance with this section.

Honorary wildlife police officers

9. (1) The Minister may, in consultation with the Director, by notice in the *Gazette,* on such terms and conditions as the Minister may specify in the notice, appoint any suitably qualified person as an honorary wildlife police officer.

(2) The appointment of an honorary wildlife police officer may be—

(a) general, so that the honorary wildlife police officer is empowered to act in any part of the Republic, in a public wildlife estate or other area specified in the notice of appointment; or

(b) limited, so that the honorary wildlife police officer is empowered to act in a public wildlife estate as may be specified in the notice of appointment.

(3) Subject to the provisions of this Act and the terms of the notice of appointment, an honorary wildlife police officer shall, within the terms of appointment, perform the functions and duties of an authorised officer.

International cooperation, agreements and instruments Cap. 1

10. (1) The Minister shall ensure cooperation with other countries in enhancing the role of the wildlife sector for international cooperation and regional integration.

(2) Subject to the Constitution and this Act and notwithstanding any other law, the Ministry responsible for wildlife may, on behalf of the Government—

(a) enter into bilateral or multi-lateral agreements with a foreign State or organisation relating to wildlife conservation and management;

(b) in liaison with other relevant Government Ministries, develop national, regional or international legal instruments for the protection and conservation of wildlife and encourage sustainable wildlife utilisation;

(c) establish or strengthen research and development programmes at national, subregional, regional and international levels for the assessment of activities with impact on wildlife and the environment and monitor such research and development programmes to ensure that they are appropriate for wildlife conservation and management;

(d) set up mechanisms for the sharing of appropriate knowledge and technology for the collection of data for the development of the wildlife sector;

(e) increase cooperation with international organisations established or constituted under international instruments;

(f) in cooperation with other foreign States, formulate strategies and undertake joint promotional and enforcement programmes; and

(g) participate in, and support, regional institutions that increase regional cooperation and promote regional development of the wildlife sector.

(3) The Minister shall, by statutory instrument, give effect to any international or regional agreement on wildlife conservation and management to which Zambia is a State Party.

PART III

THE NATIONAL PARKS, COMUNITY PARTNERSHIP PARKS AND BIRD AND WILDLIFE SANCTUARIES

Declaration of National Parks

11. Whenever the President considers that the conservation or protection and enhancement of wildlife, eco-systems, biological diversity and natural beauty so demands, the President may, after consultation with the Minister and the local community in the area, by statutory order, declare an area of land within the Republic to be a National Park for the purposes of this Act and may, in like manner, declare that a National Park shall cease to be a National Park or that the boundaries of a National Park shall be altered or extended.

Establishment of Community Partnership Parks

12. (1) The Minister may, on the application of a local community, a person, institution or organisation declare, by statutory instrument, an area that has an environmental, ecological or scientific value or significance to be a Community Partnership Park for environmental education and recreation or for the purpose of conserving, preserving and restoring genes, species or biological diversity and natural amenities and their underlying ecological structure, and may, in like manner, declare that any Community Partnership Park shall cease to be a Community Partnership Park or that the boundaries of a Community Partnership Park shall be altered or extended.

(2) A person, local community, institution or organisation may apply to the Committee, in the prescribed manner and form, to enter into a partnership agreement with the Department in respect of a Community Partnership Park.

(3) The Committee shall, in determining an application made under sub-section (2), consider the current and potential uses of the area and the capacity of the applicant to ensure sustainable wildlife conservation and management.

(4) The Minister may, by statutory instrument—

(a) designate an area in respect of which a partnership agreement is concluded;

(b) prescribe the rights and obligations of the parties to partnership agreements;

(c) prescribe the content, terms and conditions of partnership agreements; and

(d) provide for the assignment, amendment and termination of partnership agreements.

(5) A party to a partnership agreement shall—

(a) protect, conserve and manage the Community Partnership Park in respect of which it is made pursuant to the partnership agreement and the general management plan for the Community Partnership Park;

(b) administer the traditional user rights of the local community in accordance with sustainable wildlife management and conservation;

(c) in consultation with the relevant authority, protect objects of aesthetic, pre-historical geological, archaelogical and scientific interest in the Community Partnership Park;

(d) assist the Director in enforcing the provisions of this Act in relation to illegal wildlife harvesting and trafficking;

(e) with the written approval of the Director, enter into partnerships with other persons for the purposes of ensuring efficient and sustainable wildlife conservation and management;

(f) keep the Director informed of any development, change and occurrence within the Community Partnership Park that is critical for the conservation of biological diversity;

(g) help in fire fighting within and around the Community Partnership Park; and

(h) do any other thing that is necessary for the efficient conservation and management of the Community Partnership Park.

Effect of orders and acquisition of land Cap. 189

13. (1) Where a person has any right in or over any land which is included in an area subject to an order made under section *eleven* or *twelve*, that land may, for the purpose of the extinguishment of such right, be acquired by the President in accordance with the Lands Acquisition Act.

(2) For the purposes of this section,"right in or over any land" includes any right of way, easement, franchise, profit, claim, privilege, exemption or immunity of any person in, over or under that land, but does not include any mining rights or communal fishing right enjoyed under customary law by any person or body of persons.

Declaration of bird and wildlife sanctuaries

14. The Minister may, by statutory instrument, after consultation with the Director, declare an area a bird or wildlife sanctuary and provide for the control of entry into, and regulate the activities of persons within, the bird or wildlife sanctuary.

Prohibition of granting of land in National Park, Community Partnership Park or bird or wildlife sanctuary

15. (1) A person shall not acquire a certificate of title in respect of any land in a National Park, Community Partnership Park or bird or wildlife sanctuary.

(2) A person who contravenes subsection (1) commits an offence and is liable, upon conviction, to a fine not exceeding one hundred thousand penalty units or to imprisonment for a term not exceeding one year, or to both.

Grant of mining and other rights in National Park, Community Partnership Park and bird or wildlife sanctuary

16. (1) Subject to subsection (2), nothing in this Act shall be construed as preventing or restricting the granting in respect of any land within a National Park, Community Partnership Park or bird or wildlife sanctuary—

(a) of any mining right or other right, title, interest or authority necessary or convenient for the enjoyment of a mining right; or

(b) for any purpose consistent with this Act of a right, title, interest or authority under any other written law.

(2) A mining right shall not be granted in a National Park, Community Partnership Park or bird or wildlife sanctuary without an environmental impact assessment conducted in accordance with procedures specified by the Environmental Management Act, 2011, and which procedures shall take into account the need to conserve and protect—

Act No. 12 of 2011

(a) the air, water, soil, flora, fauna, fish, fisheries and scenic attractions in or on the land over which the right is sought; and

(b) features of aesthetic, cultural, architectural, archaeological, historical or geological interest in or on the land over which the right is sought.

(3) The exercise of a mining right in respect of any land comprised in a National Park, Community Partnership Park or bird or wildlife sanctuary shall be subject to section *thirty-eight.*

(4) The exercise of a right, interest or authority granted under paragraph (b) of subsection (2) shall be subject to any conditions which the Minister may impose.

Traffic on public roads in National Park and Community Partnership Park

17. (1) The Minister may, by statutory instrument, on the recommendation of the Director and after consultation with the Minister responsible for transport, provide for—

(a) the control and regulation of traffic on or over public roads within a National Park or Community Partnership Park, and such regulations may specify the speed limits to be observed over any specified part of the public roads; and

(b) the points on public roads at which persons or vehicles may enter or leave a National Park or Community Partnership Park and the routes along the public roads which they may follow in passing through or over the National Park or Community Partnership Park.

(2) Any regulations made under subsection (1) may prescribe penalties for any contravention of the regulations of a fine not exceeding two hundred thousand penalty units or imprisonment for a term not exceeding two years, or to both.

(3) The Director may, with the approval of the Minister and after consultation with the relevant highway authority, cause traffic signs or signals to be placed and maintained on or near a public road within a National Park or Community Partnership Park, and the instructions conveyed by the traffic sign shall, in relation to a public road within a National Park or Community Partnership Park, prevail over any contrary instructions appearing on any other traffic sign or signal.

(4) Subsections (8), (9) and (10) of section *thirty-three of* the Public Roads Act, 2002, shall apply in respect of a traffic sign or signal placed on or near a public road under subsection (3).

Act No. 12 of 2002

(5) The Director, a wildlife police officer or honorary wildlife police officer may, where it is necessary to do so, cause a person or vehicle using a public road within or leading to, or from, a National Park or Community Partnership Park to stop for search, examination or questioning for the purposes of the enforcement of this Act, and may, for such purposes, erect and control barriers or check points on the public road.

(6) A person who fails to comply with an order or direction to stop, or who fails to stop at a barrier or check point erected in terms of subsection (5) commits an offence.

Restrictions on entry into or residence in National Park or Community Partnership Park

18. (1) A person who, except in accordance with this Act, enters into or resides in, or purports to enter into or reside in, a National Park or Community Partnership Park commits an offence.

(2) This section shall not apply to—

(a) an officer of the Ministry in connection with the duties of the officer;

(b) an authorised officer or public officer on specified duties requiring the presence of that officer in a National Park or Community Partnership Park;

(c) an honorary wildlife police officer who is entitled to be present in a National Park or Community Partnership Park under the terms of the instrument appointing the officer;

(d) a person travelling through a National Park or Community Partnership Park along a public road within the confines of the road reserve;

(e) a person in possession of a permit to enter or reside in the National Park or Community Partnership Park issued by the Director or an officer duly authorised, in writing, by the Director to issue the permit;

(f) a person who enters a National Park or Community Partnership Park with authority granted under any provision of this Act;

(g) the employees of persons referred to in paragraphs *(e)* and *(f)*;

(h) a person admitted under any regulation made under section *twenty-seven*; and

(i) a person who enters a National Park as part of that person's official duties for a board.

(3) The persons referred to in paragraphs (f) to (h), inclusive, of subsection (2) shall be subject to any relevant regulations made under section *twenty-seven* and to any regulation providing for the payment of a charge or fee for permission to enter or reside in a National Park or for the admission of a motor car or other vehicle into a National Park or Community Partnership Park.

Prohibition of hunting, etc in National Park or Community Partnership Park

19. (1) A person commits an offence who, without a hunting licence, capture permit or fishing permit issued under this Act —

(a) hunts or disturbs a wild animal or fish in a National Park or Community Partnership Park;

(b) disturbs a bird's nest in a National Park or Community Partnership Park; or

(c) removes a wild animal, fish, bird's nest,stone, vegetation or other object, whether animate or inanimate, from a National Park or Community Partnership Park.

(2) If the Minister determines that a wild animal within a National Park or Community Partnership Park should be hunted for the better preservation of other animal life, or for other good and sufficient reason, the Minister may direct the Committee to issue a hunting licence to a person authorising that person, under the direction of the Director, to hunt the animal within the National Park or Community Partnership Park.

Prohibition of weapons, etc, in National Park, Community Partnership Park or bird or wildlife sanctuary

20. (1) A person commits an offence who, without a permit issued under subsection (2) or (3), or who in breach of an express condition of a permit or regulation made under this Act—

(a) conveys into a National Park, Community Partnership Park or bird or wildlife sanctuary a firearm, dart gun, spear, bow, arrow or other weapon, explosive, snare, net trap or poison; or

(b) being within the confines of a National Park, Community Partnership Park or bird wildlife sanctuary is in possession of, carries or uses for any purpose, any firearm, dart gun, spear, bow, arrow or other weapon, explosive, snare, net trap or poison.

(2) Subject to any regulations made under this Act, a person may, while travelling through a National Park, Community Partnership Park, bird or wildlife sanctuary or on a public road, convey into and through the National Park, Community Partnership Park, bird or wildlife sanctuary in the course of that journey, a firearm, dart gun, spear, bow, arrow or other weapon or an explosive, snare, net trap or poisonous substance.

(3) The Director, or a wildlife police officer duly authorised in writing by the Director, may subject to such conditions as the Director considers fit, issue a permit to a person to convey into a National Park, Community Partnership Park, bird or wildlife sanctuary, or within the confines of a National Park, Community Partnership Park or bird or wildlife sanctuary or to possess, carry or use for any purpose expressly stated in the permit, a firearm, dart gun, spear, bow, arrow or other weapon or an explosive, snare, net, trap or poisonous substance and that permit shall be valid for the period specified in it.

(4) This section shall not apply to a wildlife officer, honorary wildlife police officer, community scout or other police officer in the performance of duties under this Act or any other relevant written law.

Prohibition of introduction of wild animal into National Park, Community Partnership Park or bird or wildlife sanctuary

21. (1) A person commits an offence who, without the written consent of the Director—

(a) drives, conveys or introduces a wild animal into a National Park, Community Partnership Park or bird or wildlife sanctuary; or

(b) drives or conveys a wild animal out of a National Park, Community Partnership Park or bird or wildlife sanctuary.

(2) A wildlife police officer, community scout or honorary wildlife police officer who finds within the confines of a National Park, Community Partnership Park, bird or wildlife sanctuary a wild animal which was driven, conveyed or introduced into the National Park, Community Partnership Park, bird or wildlife sanctuary in contravention of subsection (1) may kill the wild animal.

Prohibition of domestic animal in National Park, Community Partnership Park or bird or wildlife sanctuary

22. (1) A person commits an offence who, being the owner of a domestic animal or the person in charge or control of it, without the written consent of the Director—

(a) drives, conveys or introduces the domestic animal into a National Park, Community Partnership Park or bird or wildlife sanctuary or causes or permits the domestic animal to be driven, conveyed or introduced into a National Park, Community Partnership Park or bird or wildlife sanctuary;

(b) permits or suffers the domestic animal to stray into or within the confines of a National Park, Community Partnership Park or bird or wildlife sanctuary; or

(c) permits or suffers the domestic animal to worry, harass or interfere with a wild animal within the confines of a National Park, Community Partnership Park or bird or wildlife sanctuary.

(2) The court may, upon the conviction of a person for an offence under this section, on application by the prosecution and in addition to any other penalty imposed, declare or order the domestic animal to be —

(a) forfeited;

(b) destroyed without compensation; or

(c) forfeited and destroyed without compensation.

(3) Notwithstanding subsection (2), a wildlife police officer, honorary wildlife police officer or community scout who discovers any domestic animal worrying, harassing or otherwise interfering with a wild animal within the confines of a National Park, Community Partnership Park or bird or wildlife sanctuary may destroy the domestic animal, and its owner shall not be entitled to any compensation whether convicted of an offence or not under this section.

Prohibition of introduction of vegetation into National Park, Community Partnership Park or bird or wildlife sanctuary

23. (1) A person who, without the written consent of the Director, introduces any vegetation or causes any vegetation to be introduced into a National Park, Community Partnership Park or bird or wildlife sanctuary, commits an offence.

(2) A wildlife police officer, honorary wildlife police officer or community scout who finds within a National Park, Community Partnership Park or bird or wildlife sanctuary any vegetation introduced into the National Park, Community Partnership Park, bird or wildlife sanctuary, in contravention of subsection (1), may destroy the vegetation or offer it to be destroyed.

Prohibition of removal of wild animal or vegetation from National Park, Community Partnership Park or bird or wildlife sanctuary

24. Except as is otherwise provided by this Act, a person commits an offence who, without the written consent of the Director, removes a trophy, vegetation or wild animal, whether alive or dead, from a National Park, Community Partnership Park or bird or wildlife sanctuary or causes or permits the trophy, vegetation or wild animal to be so removed.

Prohibition of damage or removal of object of geological or historical interest, etc. from National Park, Community Partnership Park or bird or wildlife sanctuary

25. Except as is otherwise provided by this Act, a person commits an offence who, without the written consent of the Director, removes from, moves within, defaces or damages within, a National Park, Community Partnership Park or bird or wildlife sanctuary an object of geological, pre-historic, archaeological, historical or scientific interest, or who causes or permits the object to be damaged or removed.

Prohibition of killing, injuring or capturing of wild animal or bird within National Park, Community Partnership Park or bird or wildlife sanctuary

26. Except as is otherwise provided by this Act, a person commits an offence who, without the relevant licence or permit, is in possession of, kills, injures, captures or disturbs a wild animal or removes or destroys an egg, a nest or habitat of a bird, reptile or fish within the confines of a National Park, Community Partnership Park, bird or wildlife sanctuary or Game Management Area.

Regulations relating to National Parks, Community Partnership Parks, bird and wildlife sanctuaries

27. (1) The Minister may, by statutory instrument, in consultation with the Director, make regulations for—

(a) the conditions under which a person, vehicle, boat, aircraft or animal may enter into, travel through, reside or be kept within a National Park, Community Partnership Park or bird or wildlife sanctuary or any part of the National Park, Community Partnership Park, bird or wildlife sanctuary;

(b) the conditions under which any building, lodge or aerodrome may be considered within a National Park, Community Partnership Park or bird and wildlife sanctuary;

(c) the conditions under which a person travelling through or within a National Community Partnership Park or bird and wildlife sanctuary or on a public road may have in that person's possession, or under the control of that person, a firearm or other weapon, ammunition, explosive, game meat, trophy, trap or poison;

(d) the conditions under which a wild animal or species of wild animal may be photographed within a National Park, Community Partnership Park or bird and wildlife sanctuary;

(e) the regulation or prohibition of the lighting of fires within a National Park, Community Partnership Park or bird and wildlife sanctuary;

(f) the conditions under which a domestic animal may be brought into or maintained within a National Park, Community Partnership Park or bird and wildlife sanctuary or the charging of fees for the bringing of domestic animals into a National Park, Community Partnership Park or bird or wildlife sanctuary;

(g) the prohibition or control of the bringing of a wild animal or domestic animal into a National Park, Community Partnership Park or bird and wildlife sanctuary;

(h) the prohibition or control of the introduction of any vegetation, whether alive or dead into, the cutting or damaging within, or the removal from, a National Park, Community PartnershipPark or bird or wildlife sanctuary;

(i) the prohibition or control of destruction, damaging, defacing or removal of any thing, whether animate or inanimate, within or from a National Park, Community Partnership Park or bird or wildlife sanctuary;

(j) the fees and charges for entering into a National Park, Community Partnership Park or bird or wildlife sanctuary or any part of it and the fees for any services and amenities provided by the Department for the general public in a National Park, Community Partnership Park or bird or wildlife sanctuary;

(k) the fees for fishing and the conditions under which a person may fish within a National Park, Community Partnership Park or bird or wildlife sanctuary;

(l) the prohibition or control of the low flying of aircraft over a National Park, Community Partnership Park or bird or wildlife sanctuary;

(m) the rules of conduct and behaviour of persons while within a National Park,Community Partnership Park or bird or wildlife sanctuary;

(n) the regulation of traffic on a road within a National Park, Community Partnership Park or bird or wildlife sanctuary;

(o) the carriage of passengers and goods within a National Park, Community Partnership Park or bird or wildlife sanctuary, whether for hire or otherwise;

(p) the points at which persons or vehicles may enter or leave and the routes by which they may pass through or over a National Park, Community Partnership Park or bird or wildlife sanctuary on roads other than public roads;

(q) the prohibition, control or regulation of any trade or business carried on within a National Park, Community Partnership Park or bird or wildlife sanctuary, without prejudice to the provisions of the Tourism and Hospitality Act, 2015; and

Act No. 13 of 2015

(r) generally, for the efficient control and management of a National Park, Community Partnership Park or bird and wildlife sanctuary.

(2) The Minister may, on the advice of the Director, in making regulations under subsection (1), provide differently for different National Parks, Community Partnership Parks, bird or wildlife sanctuaries and categories of businesses and premises for purposes of this Act.

(3) Any regulation made under this section may prescribe, for a breach of the regulations, a fine not exceeding two hundred thousand penalty units or imprisonment for a term not exceeding two years, or to both.

PART IV

GAME MANAGEMENT AREAS

Declaration of Game Management Areas

28. (1) The President may, after consultation with the Minister and the local community, by statutory order, declare an area of land within the Republic to be a Game Management Area for the sustainable utilisation of wildlife and for the purposes of this Act, and may, in like manner, define or alter or extend the limits of the area or order the area to cease to be a Game Management Area.

(2) Any land within any declared or extended Game Management Area that is held under a leasehold title shall not, except with the written consent of the occupier, be affected by the declaration or extension made under subsection (1) and shall be deemed to be excluded from it.

(3) The Minister may, upon application made to the Director, in writing, by the occupier of any land held under a leasehold title, recommend to the President that the land be declared to be, or be included within, a Game Management Area under subsection (1).

(4) Notwithstanding the provisions of any written law, a person may obtain leasehold title within a Game Management Area in accordance with the provisions of the general management plan for the Game Management Area.

(5) Nothing in this section shall prevent the Minister from granting concession agreements within a Game Management Area and land user-rights fees shall be payable to the Ministry by an investor within the Game Management Area which shall be shared between the Ministry and the local community, on such terms as may be prescribed.

Settlement in Game Management Areas

29. A person who settles or lives in a Game Management Area shall comply with the provisions of a general management plan for the Game Management Area.

Restriction on exercise of mining rights within Game Management Area

30. (1) A person who holds any mining rights in, over, under or in respect of any land comprised in a Game Management Area may enter and exercise the mining right within the Game Management Area upon that person giving prior written notice to the Director of the person's intention to enter the Game Management Area and to exercise that person's right upon compliance with any conditions which the Minister may impose.

(2) Without prejudice to the generality of the powers of the Minister to impose conditions, the Minister may impose conditions relating to the exercise of any mining rights in accordance with the measures specified under an environmental impact assessment approved by the Zambia Environmental Management Agency, including the number of persons to be employed within a Game Management Area and the conditions to be observed by such persons.

(3) A person to whom subsection (1) applies who enters a Game Management Area without giving prior notice to the Director or fails to comply with any condition imposed by the Minister commits an offence and is liable, upon conviction, to a fine not exceeding one hundred thousand penalty units or to imprisonment for a term not exceeding six months, or to both.

Restriction on hunting wild animals in Game Management Area

31. Except as otherwise provided by this Act, a person who, not being the holder of a hunting licence, capture permit or hunting concession issued under this Act relevant to such hunting, hunts a game or protected animal, except elephant and rhinoceros, in any Game Management Area commits an offence and is liable, upon conviction, to a fine not exceeding four hundred thousand penalty units or to imprisonment for a term not exceeding five years, or to both.

PART V

COMMUNITY RESOURCES BOARDS

Community resources boards

32. (1) A local community along geographic boundaries contiguous to a chiefdom in a Game Management Area, an open area or a particular chiefdom with common interest in the wildlife and natural resources in that area, may apply to the Minister for registration as a community resources board.

(2) The Minister shall register as a board, a local community which, in addition to the pre-requisites described in subsection (1), meets the requirements of subsection (3) and shall, in consultation with that board, develop management plans for the Game Management Area, open area or any part of the Game Management Area or open area which is under its jurisdiction.

(3) A board registered under subsection (2) shall serve for a fixed term of three years and shall comprise—

(a) not more than ten but not less than seven representatives from the local community who shall be elected by the local community;

(b) one representative of the Council in the area;

(c) a representative of a Chief in whose area a board is established to represent that Chief; and

(d) a person seconded by the Minister in accordance with subsection (2) of section *thirty-four*.

(4) Notwithstanding subsection (2), a board may invite a person whose presence is, in its opinion, desirable to attend and to participate in the deliberations of a meeting of the board, but that person shall not vote on any matter.

(5) A Chief in whose area a board is established shall be a patron of that board.

(6) The Minister may, in consultation with the Director and the particular board, determine the allowances and honorarium that shall be payable to a Chief referred to in subsection (5).

(7) The Director shall, in consultation with the Minister and the majority of the members of the local community represented by a board, if satisfied that the board is no longer—

(a) able to perform its functions under this Act, dissolve that board; or

(b) viable in the area, de-register that board.

(8) Subject to the other provisions of this Act, a board may regulate its own procedure, and shall cause minutes to be kept of the proceedings of every meeting of the board.

(9) A board may convene any meeting at any time for the conduct of its business under this Act.

Functions of board

33. (1) The functions of a board are to promote and develop an integrated approach to the management of human and natural resources in a Community Partnership Park, Game Management Area or an open area falling under its jurisdiction.

(2) Without prejudice to the generality of subsection (1), a board may —

(a) negotiate, in conjunction with the Department, co-management agreements with hunting outfitters and photographic tour operators;

(b) manage the wildlife under its jurisdiction within quotas specified by the Department;

(c) appoint community scouts to exercise and perform the duties of a wildlife police officer under the supervision of a wildlife police officer in the area falling under the board's jurisdiction;

(d) in consultation with the Director, develop and implement management plans which reconcile the various uses of land in areas falling under the board's jurisdiction; and

(e) perform such other functions as the Minister or Director may direct or delegate to it.

(3) The preparation and implementation of general management plans in Community Partnership Parks, Game Management Areas and open areas shall be in accordance with such regulations as the Minister may prescribe, in consultation with the Director.

Secretariat of board

34. (1) There shall be a secretariat for each board which shall consist of such appropriately qualified officers as the board may appoint on such terms and conditions as it may determine.

(2) The Minister shall second an officer to the board who shall serve as part of the secretariat.

Financial provisions

35. (1) A board shall establish a fund to enhance the economic and social well being of the local community within the area described in section *thirty-two*.

(2) There shall be paid into the fund of a board, in addition to the revenues referred to in paragraph (o) of subsection (2) of section *five*, such monies as the board may, with the approval of the Minister, accept by way of grants and donations from any source within or outside Zambia.

(3) A board shall cause to be kept proper books of account and other records relating to its accounts.

(4) The accounts referred to in subsection (3) shall be open for inspection by the Minister, the Director or any other member of that local community.

(5) A board shall, not later than ninety days after the end of the financial year, submit to the Minister, through the Director —

(a) an audited balance sheet;

(b) an audited statement of income and expenditure; and

(c) a report concerning its activities during that financial year.

(6) A person who misuses any money belonging to a board shall —

(a) be liable to a surcharge; and

(b) commits an offence and is liable, upon conviction, to a fine not exceeding one hundred thousand penalty units or to imprisonment for a term not exceeding one year, or to both.

(7) A board shall submit quarterly reports to the Director.

(8) The accounts of a board shall be audited annually by independent auditors appointed by the board with the approval of the Minister.

PART VI

GAME ANIMALS AND PROTECTED ANIMALS

Game and protected animals

36. (1) For the purposes of this Act, the Minister shall, by statutory order, in consultation with the Director and on the advice of a board specify, including by scientific name, a wild animal as a game animal or protected animal and in like manner specify a game animal as a protected animal.

(2) A game animal shall be specified as a protected animal under this section —

(a) to preserve a viable population of the species when it becomes rare, threatened or endangered;

(b) for its role in the maintenance and assessment of the health of an eco-system;

(c) for its economic significance in a local or national economy; or

(d) to preserve populations of endemic species.

(3) Where the Minister specifies a wild animal as a protected animal under an order made under subsection (1), the order may—

(a) prohibit or regulate the hunting of the protected animal generally or during a specified period and throughout the Republic or in a specified area of the Republic; or

(b) apply to all wild animals within the area specified or to a wild animal or species, class or variety of a class of wild animal specified in the order and may make different provisions for different sexes of the specified wild animal.

(4) Except as otherwise provided by this Act, a person who hunts or is found in circumstances showing that the person intends to hunt a protected animal commits an offence.

Restriction on hunting game or protected animals

37. Except as otherwise provided by this Act, a person who hunts a game animal or protected animal, except under or in accordance with the conditions of a hunting licence, commits an offence.

Wildlife impact assessment

38. (1) A person who has reasonable grounds to believe that a proposed or existing government plan or activity of the Government, an organisation or person may have an adverse effect on wildlife in a National Park, Community Partnership Park, bird or wildlife sanctuary, Game Management Area or open area, may request the Minister through the Director that a wildlife impact assessment be conducted.

(2) Where the Minister requires an environmental impact assessment to be conducted, it shall be conducted in accordance with the procedures specified under the Environmental Management Act, 2011, taking into account—

Act No. 12 of 2011

(a) existing or anticipated impact upon wildlife that may be threatened; and

(b) any endangered or endemic species which are or may be affected.

PART VII

Licences and Permits

Licences and permits

39. (1) The following classes of licences shall be issued under this Part—

(a) hunting licence;

(b) bird licence; and

(c) professional hunter's licence.

(2) The following permits shall be issued under this Part—

(a) fishing permit;

(b) capture permit;

(c) professional guide's permit;

(d) photographic tour operator's permit; and

(e) commercial photographic permit.

(3) The Minister may, by statutory instrument, in consultation with the Committee, prescribe—

(a) the form of, and the terms and conditions attaching to, each class of licence and permit;

(b) the species, variety of species or the sex of game animal or protected animal which may be hunted or captured under each class of licence or permit;

(c) the method of hunting to be employed under each licence, the number of game animals or protected animals of each prescribed species, variety or sex which may be hunted;

(d) the area or areas in which each licence or permit shall be valid and the validity of each licence or permit;

(e) the time or times of the year during which any specified species, variety or sex of game animal or protected animal may be hunted or captured pursuant to the licence or permit; and

(f) the fee payable in respect of each class of licence or permit issued under this Part.

(4) The Minister may, on the advice of the Committee, make different provisions for different areas and for different species, varieties and sexes of game animals or protected animals.

Hunting licence

40. (1) The Committee may, upon application made by a person to the Committee in the prescribed manner and form and upon payment of the prescribed fee, issue a hunting licence to that person.

(2) Subject to this Act and the terms and conditions prescribed for a hunting licence, the hunting licence shall authorise the licensee to hunt such animals as are specified in the hunting licence in such areas and for such period as may be prescribed.

(3) The Committee may, by way of endorsement on a hunting licence issued under this section, authorise the licensee to employ a Zambian, for reward or otherwise, to hunt or assist in hunting, on behalf of the licensee, the animal specified in the hunting licence, except that the Committee's endorsement under this subsection shall not be unreasonably withheld.

(4) It shall not be necessary that a person employed under subsection (3) be the holder of a hunting licence under this Part.

Bird licence

41. (1) The Committee may, upon application made by a person to the Committee in the prescribed manner and form and upon payment of the prescribed fee, issue a bird licence to that person.

(2) Subject to the other provisions of this Act and to the terms and conditions prescribed for a bird licence, the bird licence shall authorise the licensee to hunt such birds as are prescribed for the bird licence and in the numbers stated in the bird licence.

Professional hunter's licence

42. (1) The Committee may, upon application made by a person to the Committee in the prescribed manner and form and upon payment of the prescribed fee, issue a professional hunter's licence to that person.

(2) Subject to the other provisions of this Act and to the terms and conditions prescribed for a professional hunter's licence, a professional hunter's licence shall —

(a) authorise the licensee to carry on business as a professional hunter;

(b) allow the licensee to be employed by a hunting outfitter with a hunting concession or with an unfenced private wildlife estate;

(c) engage and supervise such number of apprentice professional hunters on such terms and conditions as may be prescribed; and

(d) while accompanied by a *bona fide* client, authorise the licensee to hunt such animals as are specified in the hunting licence issued to the *bona fide* client and in the numbers so prescribed.

(3) A person commits an offence who, without a professional hunter's licence —

(a) carries on business as a professional hunter;

(b) holds oneself out to the general public to be a professional hunter;

(c) advertises oneself publicly, by any means, as a professional hunter;

(d) solicits from a person a contract or commission to act in the capacity of a professional hunter for that person or for any other person; or

(e) except as provided by subsection (3) of section *forty*, for gain or reward, assists another person in the hunting of a game animal in a capacity other than as a tracker, gunbearer or beater as provided by section *sixty-one*.

Capture permit

43. (1) Notwithstanding any other provision of this Act, the Minister may, in consultation with the Committee, upon such terms and conditions as the Minister may impose, issue a capture permit to —

(a) a person, body of persons or institution authorising the person or institution, for purposes of scientific research or the collection of specimens for zoological gardens, museums or education, to hunt in a stated area or part of the Republic such game animal or protected animal as may be specified in the permit;

(b) a person or institution authorising the person or institution to rear a wild animal and for such purposes to capture for rearing in a stated area or part of the Republic such game animal or protected animal as may be specified in the permit;

(c) a person permitting that person to collect crocodile eggs, bird's nest or eggs or any other reptile eggs in such quantities, in such area and for such period as may be specified in the permit; or

(d) a Chief or other person approved by theMinister, authorising the Chief or that person to hunt, in any stated area or part of the Republic, such game animal or protected animal as may be specified in the permit.

(2) The Minister may, by way of endorsement on a capture permit issued under this section, authorise the holder to employ for reward or otherwise, any other person to hunt or assist in hunting, or to capture or assist in capturing for rearing, on behalf of the holder, a game animal or protected animal specified in the capture permit.

(3) It shall not be necessary that a person employed as provided by sub-section (2) be the holder of a hunting licence or capture permit under this Part.

(4) Where a person employed by the holder of a capture permit commits an offence under this Act during and in the course of such employment or contravenes a term or condition of the permit, the holder of the capture permit shall be deemed to have committed the same offence that the employed person commits, and the holder of the capture permit may be joined as a defendant with the employed person in any prosecution brought against the employed person for that offence.

Fishing permit

44. (1) The Committee, or a wildlife police officer duly authorised, in writing, by the Committee, may issue a fishing permit to authorise a person to fish for non-consumptive purposes in a National Park or Community Partnership Park and shall impose such conditions upon the use of the fishing permit as the Minister may prescribe.

(2) A fishing permit issued under subsection (1) shall specify the species and number of fish which may be caught under the fishing permit.

Professional guide's permit

45. (1) The Committee may, upon application made to the Committee in the prescribed manner and form, and upon payment of the prescribed fee, by a person who ordinarily resides in Zambia and who complies with the prescribed qualifying conditions, issue to that person a professional guide's permit.

(2) Subject to the other provisions of this Act and to the terms and conditions prescribed for the professional guide's permit, a professional guide's permit shall be in the prescribed form and shall authorise the holder of the permit to—

(a) conduct or offer to conduct for reward, a photographic or viewing safari; and

(b) take out clients for game drives and walks as may be specified in the permit.

(3) A person commits an offence who, not being a holder of a professional guide's permit—

(a) conducts for reward in a National Park, Community Partnership Park, bird sanctuary, wildlife sanctuary, Game Management Area or game ranch any photographic or viewing safari;

(b) offers to conduct for reward any photographic or viewing safari;

(c) advertises publicly by any means that the person is a professional guide;

(d) solicits from any person a contract or commission to act in the capacity of a professional guide for that person or for any other person; or

(e) holds out to the general public that the person is a professional guide.

(4) A person who employs any other person to carry out the functions of a professional guide without a professional guide's permit commits an offence.

Photographic tour operator's permit

46. (1) The Committee may, upon application made to the Committee, in the prescribed manner and form and upon payment of the prescribed fee, by a person holding a tourism enterprise licence, issue to that person a photographic tour operator's permit.

(2) Subject to the other provisions of this Act and to the terms and conditions prescribed for a photographic tour operator's permit, a photographic tour operator's permit shall be in the prescribed form and shall authorise the holder to carry on business as a photographic tour operator.

Commercial photographic permit

47. (1) The Committee may, upon application made by a person to the Committee in the prescribed manner and form and upon payment of the prescribed fee, issue a commercial photographic permit to that person.

(2) Subject to the other provisions of this Act and to the terms and conditions prescribed for a commercial photographic permit, the commercial photographic permit shall authorise the holder to make paintings or take films or video for commercial purposes in a National Park or Community Partnership Park.

Hunting concession

48. (1) Subject to subsection (2), the Committee may, upon application by a hunting outfitter in the prescribed manner and form and upon payment of the prescribed fee, grant the hunting outfitter a hunting concession.

(2) A hunting concession shall authorise a hunting outfitter to—

(a) hunt within a Game Management Area or part of a Game Management Area on such terms and conditions as may be prescribed; and

(b) sell a hunting quota to any person to hunting in the concession area.

Refusal to issue licence or permit

49. (1) The Committee may refuse to issue a licence or permit under this Part if—

(a) the applicant fails to comply with any prescribed conditions precedent to the issue of the licence or permit;

(b) a licence or permit formerly held by the applicant is revoked by the Committee;

(c) the applicant has been or is convicted of an offence under this Act;

(d) the Committee is satisfied that the applicant is not a fit or proper person to hold the licence or permit;

(e) the applicant for a photographic tour operator's permit or a hunting concession, is not the holder of a tourism enterprise licence;

(f) the Committee is satisfied that in the interest of wildlife management, the licence or permit should not be issued; or

(g) the applicant has been convicted of an offence relating to hunting outside Zambia or the applicant's licence or permit was withdrawn by the wildlife authority of another country.

(2) The Committee shall notify the applicant, in writing, of the refusal to issue a licence or permit and shall state the reasons for the refusal.

Display of licence or permit

50. A licensee or permit holder shall display the licence or permit issued in accordance with this Act, or a certified copy of the licence or permit, in a conspicuous place at the principal place of business and at every subsidiary premises where the licensee or permit holder carries out business.

Prohibition of transfer of licence or permit

51. (1) Except as is otherwise provided by this Act, a licence or permit issued under this Part shall be used solely by the licensee or permit holder and is not transferable to another person.

(2) A person who transfers a licence or permit issued to that person or accepts the transfer of a licence or permit from any person commits an offence.

Amendment or variation of licence or permit

52. (1) A licensee or permit holder may, at any time during the validity of the licence or permit, if there are any changes to the licensee's or permit holder's business operations, apply to the Committee for the amendment or variation of the terms and conditions of the licence or permit.

(2) The Committee may approve the amendment of a licence or permit to accommodate any variations requested by the licensee or permit holder and approved by the Committee.

(3) The Committee shall endorse and date any variation, approved in accordance with subsection (2), on the licence or permit.

Surrender of licence or permit

53. (1) Where a licensee or permit holder decides not to continue operating the licensed or permitted business or activity, the licensee or permit holder shall notify the Committee, in writing, and surrender the licence or permit to the Committee.

(2) Where a licence or permit is surrendered in accordance with subsection (1), the Committee shall cancel the licence or permit subject to such conditions as it may impose with respect to the winding up of the licenced or permitted business or activity.

Suspension or revocation of licence or permit

54. (1) Subject to subsection (2), the Committee may suspend or revoke a licence or permit if the licensee or permit holder—

(a) obtained the licence or permit on the basis of fraud, negligence or misrepresentation;

(b) assigns, cedes or otherwise transfers the licence without the prior approval of the Committee;

(c) fails to comply with any term or condition of the licence or permit; or

(d) operates the licensed or permitted business activity in contravention of this Act or any other relevant written law.

(2) The Committee shall, before suspending or revoking a licence or permit, in accordance with subsection (1), notify the licensee or permit holder of its intention to suspend or revoke the licence or permit, giving reasons for its decision and requesting the licensee or permit holder to show cause, within such reasonable period as may be specified in the notice, why the licence or permit should not be suspended or revoked.

(3) The Committee shall, where a licensee or permit holder fails to correct the contravention within the period specified under subsection (2), suspend or revoke the licence or permit as it considers appropriate in the circumstances of the case.

(4) Where a licence or permit is revoked, in accordance with this section, the licensee or permit holder shall surrender the licence or permit to the Committee and the Committee shall cancel the licence or permit, subject to such conditions as it may impose with respect to the winding up of the licensed or permitted business or activity.

Renewal of licence or permit

55. (1) A licensee or permit holder may, sixty days prior to the expiration of the period of validity of the licence or permit, apply to the Committee for the renewal of the licence or permit in the prescribed manner and form upon payment of the prescribed fee.

(2) The Committee shall, within thirty days of receiving an application for the renewal of a licence or permit, approve or reject the application and give reasons where it rejects the application for renewal of the licence or permit.

(3) A licensee or permit holder who submits an application for the renewal of a licence or permit in accordance with subsection (1), shall continue to operate the licensed or permitted business or activity until a decision is made by the Committee on the application for renewal of the licence or permit.

Loss of licence or permit

56. (1) A person who loses a licence or permit or whose licence or permit is damaged shall inform the authorised officer within fourteen days of the loss or damage and shall, after a further period of fourteen days, apply to the Committee for the issuance of a duplicate licence or permit.

(2) On application under subsection (1), the Committee may —

(a) issue a duplicate licence or permit on such terms and conditions as it may determine; or

(b) refuse the application and notify the licensee or permit holder, in writing, and gives reasons for the refusal.

Single licensing

Act No. 3 of 2014

57. (1) Subject to this Act, the Department shall operate a single licensing system for the wildlife sector in accordance with the Business Regulatory Act, 2014.

(2) A regulatory agency shall not issue or grant a licence, permit, certificate or other authorisation for the doing of an activity by a person, which may have an adverse effect on wildlife management and conservation, before the regulatory agency first consults the Department whether the issuing or the grant of the licence, permit, certificate or other authorisation will have an adverse effect on wildlife management and conservation.

(3) The Department may, where consulted under subsection (1), impose such conditions or stipulate such requirements as it considers necessary to maintain the wildlife estate or protect wildlife and the wildlife habitat, including conditions relating to the strict compliance of any provision of this Act.

(4) Where the Department imposes any conditions or stipulates any requirement under subsection (3), a regulatory agency shall endorse such condition or requirement on a licence, permit, certificate or authorisation issued to a person whose activities under the licence, permit, certificate or authorisation will affect wildlife conservation and management.

(5) A regulatory agency shall, when requested to do so by the Department, give to the Department any advice or assistance or submit such information as may be necessary for the performance of its functions under this section.

(6) A contravention of a condition or requirement endorsed on a licence, permit, certificate or authorisation under subsection (3), shall be a ground for the revocation of the licence, permit, certificate or authorisation issued by a regulatory agency under the relevant law.

PART VIII

HUNTING OF WILD ANIMALS

Duties of licensees and permit holders

58. (1) A licensee and permit holder shall—

(a) have the licence or permit in actual possession at all times while hunting a game animal or protected animal under the licence or permit;

(b) produce the licence or permit for inspection and give the licensee's or permit holder's full names and address, in writing, to an authorised officer, upon request;

(c) be accompanied by a wildlife police officer or community scout while hunting; and

(d) keep, in the prescribed form, a true record of all game animals or protected animals, other than birds, hunted by that person during the validity of the licence or permit.

(2) A person who contravenes sub-section (1) commits an offence.

Duties of holder of professional hunter's licence

59. (1) A holder of a professional hunter's licence issued under section *forty-two* shall—

(a) have the licence in actual possession, at all times, while engaged in hunting a game animal or protected animal as a professional hunter;

(b) produce the licence for inspection, and give the licensee's full names and address, in writing, to an authorised officer, upon request;

(c) keep, in the prescribed form, a record of each client whereby the professional hunter accepted engagement by the client as a professional hunter, together with a true record of the game animal or protected animal, other than birds, hunted by, or on behalf of, that client under the licence;

(d) be accompanied by a wildlife police officer or community scout during hunting; and

(e) immediately after each hunt ensure that a client in relation to whom the professional hunter is engaged for that hunt completes a certificate in the prescribed form, specifying the game animal or protected animal killed or wounded.

(2) A person who contravenes any of the provisions of sub-section (1) commits an offence.

Counting of hunted game animals or protected animals

60. (1) For the purpose of—

(a) computing the numbers of game animals or protected animals authorised to be hunted under a hunting licence;

(b) computing the numbers of game animals or protected animals permitted to be hunted or captured in a National Park,Community Partnership Park, Game Management Area or open area under a hunting licence granted under section *forty* or a capture permit granted under section *forty-three*; or

(c) recording the numbers of hunted animals or protected animals in a record required to be kept under section *fifty-nine*; only the game animals or protected animals killed, wounded or captured shall be counted.

(2) Subject to subsection (3) and (4), if a game animal or protected animal is killed, in any circumstances, by a licensee or permit holder under this Act whose licence or permit entitles the licensee or permit holder to hunt a game animal or protected animal of that species, or by a person accompanying or assisting the licensee or permit holder, such animal shall count as having been hunted under the licence or permit.

(3) Where a person accompanying or assisting a licensee or permit holder is in possession of a licence or permit entitling the person to hunt a game animal or protected animal of the species killed by that person, the animal shall count as having been hunted under the licence or permit of the person accompanying or assisting the licensee or permit holder.

(4) Nothing in subsection (2) or (3) shall apply to a game animal or protected animal killed or wounded in accordance with section *seventy-eight*.

Limitations upon persons assisting in hunting game or protected animals

61. (1) Subject to section *forty*, a person who is not a holder of a hunting licence or capture permit issued under this Act may assist, for gain or reward or otherwise, a licensee under a hunting licence or a permit holder under a capture permit, to hunt a game animal or protected animal solely in the capacity of a tracker, gun bearer or beater.

(2) A person who contravenes this section commits an offence.

Prohibition of employment of another person to hunt

62. (1) A person who employs, causes or induces another person to hunt a game animal or protected animal on that person's behalf commits an offence.

(2) This section shall not apply where the person employed —

(a) is a licensed professional hunter employed to hunt game or protected animals on behalf of a licensee under a hunting licence while the licensed professional hunter is accompanied by the licensee; or

(b) is employed by a licensee under a hunting licence or a permit holder under a capture permit to hunt a game animal or protected animal in accordance with an authorisation to that effect endorsed on the hunting licence or capture permit.

Prohibition of hunting in open area

63. (1) Except as otherwise provided by this Act, a person who is not a holder of a hunting licence or capture permit under this Act, who hunts a game animal or protected animal in an open area commits an offence and is liable, upon conviction, to a fine not exceeding four hundred thousand penalty units or to imprisonment for a period not exceeding five years, or to both.

(2) This section does not apply to a person who, within an open area —

(a) hunts an animal which is not a game animal or protected animal;

(b) is the owner of the land and is in possession of a hunting licence or hunting concession authorising that person to hunt the game animal or protected animal;

(c) has previously sought and obtained the written consent of the owner to do so and is in possession of a hunting licence authorising that person to hunt a game animal or protected animal; or

(d) is an authorised officer while acting under instructions in performance of that officer's duties in the exercise of powers under this Act.

Hunting in fenced and unfenced private wildlife estate

64. (1) A person who, without the written consent of the owner of a fenced private wildlife estate or other authorised person, hunts a game or protected animal in a private wildlife estate commits an offence and is liable, upon conviction, to a fine not exceeding four hundred thousand penalty units or imprisonment for a term not exceeding four years, except that this section does not apply to the owner of the private wildlife estate.

(2) Notwithstanding subsection (1), a person found in possession of meat of a game or protected animal hunted in a fenced private wildlife estate without the written consent of the owner of the private wildlife estate commits an offence and is liable, upon

conviction, to a fine not exceeding four hundred thousand penalty units or to imprisonment for a term not exceeding five years, or to both.

(3) A person who, not being a holder of a hunting licence or capture permit, hunts a game or protected animal in an unfenced private wildlife estate commits an offence and is liable, upon conviction, to a fine not exceeding four hundred thousand penalty units or to imprisonment for a term not exceeding four years, or to both.

(4) A person found in possession of meat of a game or protected animal hunted in an unfenced private wildlife estate without a written consent issued by the owner of the private wildlife estate commits an offence and is liable, upon conviction, to a fine not exceeding three hundred thousand penalty units or to imprisonment for a period not exceeding three years, or to both.

Prohibition of hunting young game animals and females with young

65. (1) Except as may be authorised under a capture permit or permitted under section *seventy-six*, a person commits an offence who hunts—

(a) the dependent young of a game animal or protected animal; or

(b) a female game animal or protected animal accompanied by her dependent young.

(2) For the purposes of this section,"dependent young" means a young animal relying upon its parent for sustenance and protection.

Restrictions on use of motor vehicle, aircraft or boat while hunting

66. (1) Except as provided by subsection (2), a person commits an offence who —

(a) uses a motor vehicle, boat or aircraft for purposes of hunting a game animal or protected animal or who uses it in such manner as to drive or stampede a game animal or protected animal, other than a bird, for any purpose; or

(b) discharges a firearm or other weapon at a game animal or protected animal, other than a bird, from a motor vehicle, aircraft, boat or other conveyance, or discharges the firearm or other weapon from a point within two hundred and fifty metres' distance of a motor vehicle, aircraft, boat or other conveyance.

(2) Nothing in this section shall prohibit the use of a motor vehicle, aircraft, boat or other conveyance for—

(a) hunting a game animal or protected animal under a hunting licence or hunting concession issued under Part VII or under any permit issued under this Act where those means are expressly permitted under the terms of the licence or permit; or

(b) driving away a game animal or protected animal from any aerodrome by a person concerned with the maintenance of the aerodrome, or driving a game animal or protected animal by a person off any land being used, or about to be used, as an aerodrome in case of an emergency, when necessary, to ensure the safety of an aircraft which is about to alight on or take off from the land.

Restrictions on use of dogs while hunting

67. (1) Except as provided by subsection (2), a person who, without the written permission of the Committee, uses dogs for the purpose of hunting a game animal or protected animal commits an offence.

(2) The Minister may, by statutory instrument, on the advice of the Committee, prescribe a game animal or protected animal in the hunting of which dogs may be used.

(3) A person who contravenes any of the provisions of this section commits an offence.

Prohibition of use of fire in hunting

68. A person who, for the purpose of hunting or assisting in hunting a game animal or protected animal, causes a fire or drives or surrounds a game animal or protected animal with fire commits an offence.

Prohibition of use of poison, bird lime or poisoned weapon in hunting

69. Except with the written permission of the Committee, a person who, for the purpose of, or in connection with, hunting or assisting in hunting a game animal or protected animal, prepares, compounds, sells, buys, uses or has in possession any poison, bird-lime or like injurious substance or any poisoned weapon commits an offence.

Prohibition of possession, acquisition or use of traps, etc., for hunting

70. Except with the written permission of the Committee, or as authorised under a hunting licence or capture permit or as otherwise provided under this Act, a person who, for the purpose of, or in connection with, hunting a game animal or protected animal, possesses, makes, buys, sells or uses any gin or similar trap or any mist net, snare or similar contrivance capable of killing or capturing a game animal or protected animal commits an offence.

Control of use of specified weapons or methods of hunting

71. (1) The Minister may, by statutory instrument, on the advice of the Committee—

(a) prohibit the hunting of a wild animal, generally or in a specified area, by means of a game pit, pitfall, trench or similar excavation, fence or enclosure or other device fixed to the ground or other specified method, means, instrument, weapon, missile or explosive; or

(b) impose such conditions or restrictions in respect of the use of a game pit, pitfall, trench or similar excavation, fence or enclosure or other device fixed to the ground or other specified method, means, instrument, weapon, missile or explosive.

(2) The Minister may, on the advice of the Committee, revoke, amend or alter any statutory instrument made under sub-section (1) or suspend, in an area specified in the statutory instrument for any specified period, any regulation where it is necessary to do so in the interest of good wildlife management, for the protection of life, property or the protection of human, animal or plant health.

(3) A person commits an offence who —

(a) hunts a wild animal in contravention of any regulation made under this section; or

(b) possesses, makes, buys or sells, for the purpose of hunting or assisting in the hunting of a wild animal, an instrument, weapon, missile or explosive the use of which for such purpose is prohibited by any regulation made under this section.

Prohibition of driving certain game animal or protected animal into water

72. (1) A person who drives a game animal or protected animal, other than an amphibious animal, into water for the purpose of incapacitating, killing or capturing that game animal or protected animal commits an offence.

(2) The Minister may, by regulation, on the advice of the Committee, suspend the operation of this section in a specified area for a specified period of time or in respect of a specified game or protected animal.

(3) A person who prevents an animal or bird to have access to water or introduces poisonous substances into water commits an offence.

Prohibition of hunting during hours of darkness

73. (1) Except with the written permission of the Committee, a person commits an offence who, during the hours of darkness —

(a) hunts a wild animal; or

(b) for the purpose of or in connection with hunting, or assisting in hunting a wild animal, uses any torch, flare, headlamp or any other artificial light.

(2) For the purpose of this section, "hours of darkness" means the period between one half-hour after sunset and one half-hour before sunrise.

Game drives

74. (1) Except with the written permission of the Committee, a person who uses a motor vehicle to drive or stampede a game animal, other than a drive of birds, commits an offence.

(2) The Minister may, by regulation, on the advice of the Committee, suspend the operation of this section in respect of an area for a specified period of time.

PART IX

KILLING, WOUNDING OR MOLESTING WILD ANIMALS

Self-defence

75. (1) Notwithstanding anything to the contrary in this Act, a person may, if it is necessary, kill a wild animal in defence of oneself or in defence of another person.

(2) Nothing in this section shall exonerate a person who, at the time of killing a wild animal in self-defence or in defence of another person, is or was committing an offence under this Act.

(3) Except as is otherwise provided by this Act or by the terms and conditions of a licence or permit issued under this Act, the killing of a game animal or protected animal in accordance with subsection (1) shall not be deemed to transfer to a person the absolute ownership of the animal or the carcas, trophy or meat of the animal.

(4) Where a game animal or protected animal is killed in accordance with subsection (1), the person who has killed the animal shall, within a period of twenty-four hours, make a report of the facts to the nearest authorised officer and shall, unless otherwise entitled to retain the animal under this Act or under a licence or permit issued under this Act, hand over to the authorised officer the carcas, trophy or meat of the animal as the authorised officer may direct.

(5) A person who fails to comply with subsection (4) commits an offence.

Defence of property

76. (1) Notwithstanding any provision to the contrary in this Act—

(a) an owner or owner's employee where it is necessary for—

(i) the protection of the owner's land or a building on it;

(ii) the protection of a part of the owner's land, which is under cultivation, and for the protection of any crops growing upon that part of the land;

(iii) the protection of any livestock upon any part of that person's land, whether fenced or enclosed or not, which for the time being is in use for the grazing or herding of domestic stock;

(b) an owner of any crops lawfully cultivated on land leased by any other person or held under customary law, or an employee of the owner of the crops; or

(c) an owner of any livestock lawfully grazed or herded upon land leased by any other person or held under customary law, whether the lands are fenced or enclosed or not, or an employee of the owner of the livestock;

may kill a game animal, non-game animal, protected or non- protected animal that is identified as causing or has caused material damage to the land, building, crops or livestock, as the case may be, and a report shall be made to the nearest authorised officer.

(2) Except as is otherwise provided by this Act or by the terms and conditions of a licence or permit issued under this Act, the killing of a game or protected animal in accordance with subsection (1) shall not be deemed to transfer the absolute ownership to any person of the game animal or protected animal, or the carcas, trophy or meat of the game or protected animal.

(3) Where a game animal or protected animal is killed in accordance with subsection (1), the person who has killed that animal shall, within a period of twenty-four hours, make a report of the fact to the nearest authorised officer and shall, unless otherwise entitled to retain the animal under this Act or under a licence or permit issued under this Act, hand over to the authorised officer the carcas, trophy or meat of that animal as the authorised officer may direct.

(4) An authorised officer may grant the person referred to in subsection (3) ownership of the carcas, trophy or meat of the animal as compensation for any damage to the land, building, crops or livestock caused by the game animal, protected non-game animal or non-protected animal.

(5) A person who fails to comply with subsection (3) commits an offence.

(6) Nothing in this section shall authorise a person to use in the killing of a wild animal a method of hunting prohibited under Part VIII or by any regulation made under this Act.

Game or protected animal killed through accident or error

77. (1) A person who kills a game animal or protected animal through accident or error shall, within a period of twenty-four hours, make a report of the facts to the nearest authorised officer and shall hand over to the authorised officer the carcas, trophy or meat of the game or protected animal as the authorised officer may direct.

(2) Nothing in subsection (1) shall apply to a person who kills a game animal or protected animal through accident or error if—

(a) that person is entitled under a licence or permit issued under this Act to hunt a game animal or protected animal of that species and sex; and

(b) no offence under this Act has been committed in relation to the killing of the animal.

(3) Section *sixty* applies to a game animal or protected animal killed by accident or error.

(4) A person who fails to comply with subsection (1) commits an offence.

Wounding of game animal or protected animal

78. (1) A person who, in any circumstances, wounds a dangerous animal and fails without reasonable cause to use all reasonable effort to kill the animal at the earliest possible opportunity commits an offence, except that a person shall not follow a wounded game animal or protected animal into a National Park, Community Partnership Park or Game Management Area in which the hunting of the animal is prohibited or onto any land held by a person under a leasehold title.

(2) A person who has, or who believes that that person has, wounded a game animal or protected animal that in such wounded condition has entered a National Park, Community Partnership Park or Game Management Area in which the hunting of the animal is prohibited shall, within a period of twenty-four hours of the wounding of the animal, make a report of the facts and circumstances to the nearest authorised officer.

(3) A person who has, or who believes that the person has, wounded a game animal or protected animal that in such wounded condition has entered land held by a person under a leasehold title and upon which land that person has no permission to enter shall, within a period of twenty-four hours of the wounding of the animal, make a report of the facts and circumstances to the occupier of the land and to the authorised officer.

Wounding of dangerous animal

79. (1) A person who, in any circumstances, wounds a dangerous animal and fails to kill or recover the animal within twenty-four hours after its wounding shall, within forty-eight hours of the wounding of the animal, report the circumstances of the wounding to the nearest authorised officer.

(2) A report made under subsection (1) shall specify—

(a) the species of dangerous animal wounded;

(b) the date, time and place of the wounding;

(c) the type of wound, if known;

(d) the weapon by which the wound was inflicted;

(e) the efforts made to kill the animal after it was wounded;

(f) the time and place at which the animal was lost or escaped; and

(g) any other information which might be of use in locating or identifying the animal.

(3) If the dangerous animal wounded, but not killed, is an elephant or rhinoceros, the report made under subsection (1) shall, in addition, be made to the Committee within forty-eight hours of the wounding of the animal.

(4) Where a dangerous animal is found dead and the Committee determines that it is an animal which was wounded, but not killed, by the holder of a licence or permit that entitles the holder to hunt the animal, and that the licensee or permit holder—

(a) made the requisite report; and

(b) after wounding the animal, used every possible endeavour to kill it;

the Committee may direct that a trophy of the animal be delivered to the licensee or permit holder.

(5) A report required to be made under subsection (1) or (3) shall, whenever possible, be made in person by the person who wounded the dangerous animal or, on that person's instructions, by a person accompanying or assisting that person at the time when the wounding took place.

(6) A person who is required by subsection (5) to make a report under subsection (1) or (3) and who fails to do so, or who does not make the report within forty-eight hours of the loss of the wounded dangerous animal, commits an offence and is liable, upon conviction, to a fine not exceeding fifty thousand penalty units or to imprisonment for a term not exceeding three months, or to both.

(7) Where a dangerous animal has been wounded by the holder of a licence or permit issued under this Act entitling the holder to hunt the animal, the absolute ownership of the animal shall not be deemed to pass under the provisions of this Act to the licensee or permit holder, as the case may be.

Cruelty to wild animals

80. A person who, in any circumstances, causes unnecessary or undue suffering to a wild animal commits an offence.

Possession of maimed wild animal

81. (1) Subject to subsection (2), a person who, without the permission of the Committee, is in possession of, or has in that person's control or keeping, a live wild animal that has been orphaned, maimed, mutilated or incapacitated commits an offence.

(2) This section does not apply to a veterinary surgeon or a person assisting a veterinary surgeon, or any other person, who has in actual possession, control or keeping an orphaned, maimed or mutilated wild animal for purposes of medical care, treatment, scientific or educational purposes in accordance with the written authority of the Committee.

Molesting or provoking game animal or protected animal

82. Except as provided for by, or for the purposes of, sections *seventy-five, seventy-six, seventy-eight* and *seventy-nine*, a person commits an offence who willfully—

(a) molests or provokes a game animal or protected animal in any manner which results in the destruction of the game animal or protected animal; or

(b) molests or provokes an animal in any manner that results in the harassment or destruction of a game animal or protected animal.

PART X
TROPHIES

Prohibited dealings in trophies

83. (1) A person who, in the course of trade, buys, sells or processes or otherwise deals in a trophy, or manufactures an article from a readily recognisable part of it, without a trophy dealer's permit commits an offence.

(2) This section does not apply to a person who, for purposes of gain, sells, processes or manufactures an article from a trophy of a game animal or protected animal which was lawfully hunted by that person and the ownership of which licence is vested in that person under section *three* or any other provision of this Act.

Trophy dealer's permit

84. (1) The Committee may, upon application to the Committee made by a person in the prescribed manner and form, and upon payment of the prescribed fee, issue to the person a trophy dealer's permit, in the prescribed form, on such terms and conditions as the Committee shall specify.

(2) A trophy dealer's permit shall authorise the permit holder to buy, sell, deal in, process or manufacture articles from trophies.

(3) The Committee may—

(a) grant or refuse to grant, suspend for a period of time or revoke a trophy dealer's permit;

(b) make the granting of a trophy dealer's permit subject to any condition that it considers fit to impose; or

(c) limit a trophy dealer's permit to, or exclude from, a specific trophy or class of trophies.

(4) The Committee shall, where it—

(a) refuses to grant a trophy dealer's permit;

(b) suspends, revokes or cancels a trophy dealer's permit;

(c) makes the granting of the trophy dealer's permit subject to any condition; or

(d) limits the trophy dealer's permit to, or excludes from it, any specific trophy or class of trophy;

notify the applicant of the decision, in writing, and shall give reasons for the decision.

Records and returns

85. (1) A trophy dealer shall keep and maintain such records, and make such returns, of the trophy dealer's trading in trophies as the Minister may prescribe, by statutory instrument, after consultation with the Committee.

(2) A trophy dealer who fails to keep or maintain a record or make a return prescribed under subsection (1) commits an offence.

Prescribed trophies

86. (1) Subject to subsection (2), the Minister may, on the advice of the Committee, by statutory instrument, prescribe any trophy or class of trophy as being "prescribed trophy" for the purposes of controlling, prohibiting or limiting any dealings in the trophy or class of trophy, except in accordance with the provisions of this Act.

(2) Ivory and rhinoceros horn are prescribed trophies for the purposes of this Act.

Certificate of ownership of trophy and prescribed trophy

87. (1) The Committee may, upon application by a person and upon being satisfied that the person is in lawful possession of a trophy, issue to that person, in the prescribed form, a certificate of ownership of that trophy.

(2) Subject to sections *eighty-eight, ninety* and *ninety-one* in respect of the import and registration of ivory and rhinoceros horn, a person who imports a prescribed trophy shall, within one month from the date of the import of the prescribed trophy, apply to the Committee for a certificate of ownership in respect of the prescribed trophy under this section.

(3) The Committee may, where satisfied that a certificate of ownership referred to in subsection (1) or (2) was issued through error, or through the misrepresentation or fraud of any person, revoke it and the person to whom the certificate of ownership was issued shall cause the certificate to be returned to the Director for cancellation.

(4) A person who has in that person's possession a trophy or prescribed trophy without the certificate of ownership issued in respect of the trophy or prescribed trophy commits an offence.

Importation and exportation of trophy or prescribed trophy

88. (1) A person who intends to import or export a trophy or prescribed trophy shall apply for an import permit or export permit, respectively, in the prescribed manner and form, upon payment of the prescribed fee.

(2) A person who contravenes subsection (1) commits an offence.

(3) The Committee may, upon application made by a person in the prescribed manner and form and upon payment of the prescribed fee, with the approval of the Minister and subject to such conditions as the Minister may determine, issue an import or export permit in respect of a prescribed trophy.

(4) A permit issued under this section shall not be deemed to relieve a person from a restriction on, or prohibition of, the import or export of a trophy or prescribed trophy imposed by or under any other written law.

Transfer of ownership of prescribed trophy

89. (1) A person who transfers, or purports to transfer, the ownership of a prescribed trophy to another person, whether by way of gift, sale or otherwise, shall, at the time of the transfer or purported transfer, be in actual possession of the certificate of ownership issued in respect of the prescribed trophy.

(2) Subject to section *ninety-three*, a person who intends to transfer a certificate of ownership of a prescribed trophy to another person shall apply to the Committee for the transfer in the prescribed manner and form.

(3) The Committee shall, where it approves the application made under subsection (2), withdraw the original certificate of ownership from the transferor and upon payment of the appropriate fee by the transferor, issue a new certificate of ownership in the name and address of the transferee for the prescribed trophies as recorded on the original certificate of ownership.

(4) A person who intends to transfer only part of the trophies indicated on the original certificate of ownership held by that person to another person shall apply to the Committee for the transfer, in the prescribed manner and form, indicating the number and type of trophies to be transferred to that other person.

(5) The Committee shall, upon approval of the application referred to in subsection (4) and upon payment of the prescribed fee, withdraw the original certificate of ownership from the transferor and shall issue two separate certificates of ownership, one in the name of the transferor indicating the remaining trophies, and the other in the name of the transferee indicating the number and type of trophies which have been transferred.

(6) Subject to section *ninety-three*, a person who, by way of gift, purchase or otherwise, obtains or purports to obtain from any other person the ownership of a prescribed trophy, shall ensure that the certificate of ownership for that trophy has been lawfully transferred to that person as provided for in subsections (2), (3), (4) and (5).

(7) Subject to section *ninety-three*, a person who, by way of gift, purchase or otherwise, obtains or purports to obtain from any other person the ownership of a prescribed trophy shall, at the time such ownership is, or is purported to be, transferred to that person obtain from the transferor the certificate of ownership issued in respect of the prescribed trophy endorsed as prescribed by subsection (3).

(8) The transferor shall bear the cost of carrying out an inspection where required under this section.

Production of ivory or horn of killed elephant or rhinoceros

90. (1) A person who, except as provided under section *seventy-five* or *seventy-six*, kills an elephant or rhinoceros shall, within forty-eight hours from the date of the killing, produce the ivory or rhinoceros horn of the animal to a wildlife police officer or to such other person as may be nominated, in writing, in that regard by the Director, for the purpose of weighing and registering the ivory and rhinoceros horn.

(2) A person who fails to comply with subsection (1) commits an offence.

Production of imported ivory or rhinoceros horn

91. (1) Subject to any regulations made under subsection (1) of section *eighty-six*, a person who imports ivory or rhinoceros horn into the Republic shall, within forty-eight hours from the date of importation, produce the ivory or rhinoceros horn to a wildlife police officer, or to a person authorised, in writing, by the Director, for the purpose of weighing and registering the ivory or rhinoceros horn.

(2) A person who fails to comply with subsection (1) commits an offence.

Registration of ivory and rhinoceros horn

92. (1) If, after such inquiry as the wildlife police officer may consider necessary, the wildlife police officer or other person to whom any ivory or rhinoceros horn is produced under section *ninety* or *ninety-one,* is satisfied that the ivory or rhinoceros horn is lawful property, under this Act, of the person who killed the animal from which it was procured, or is the lawful property of, and has, subject to the regulations made under subsection (1) of section *eighty-six,* been lawfully imported by the person who produced the ivory or rhinoceros horn, as the case may be, the wildlife police officer shall cause it to be weighed, marked and registered in the manner prescribed and shall thereafter return it to the person who produced it for such purpose and shall issue to that person a certificate of ownership in the prescribed form.

(2) If, after such inquiry as is referred to in subsection (1), the wildlife police officer or other person to whom the ivory or rhinoceros horn is produced under section *ninety or ninety-one* is not satisfied that the ivory or rhinoceros horn is the lawful property of the person who produced it, or that it was lawfully imported, the wildlife police officer or person may retain the ivory or rhinoceros horn pending, and for the purposes of, any proceeding which may be instituted in respect of it under this Act.

(3) Where any proceeding is not instituted within three months from the date of production of the ivory or rhinoceros horn, the wildlife police officer or other person shall weigh, mark and register the ivory or rhinoceros horn and shall return it to the person who produced it together with a certificate of ownership in respect of it as provided by subsection (1).

(4) A person shall not be entitled to compensation of any kind in respect of the retention of an ivory or rhinoceros horn under subsection (2).

Prohibition of transfer of ivory or rhinoceros horn before registration

93. A person who, by way of gift, sale, purchase or otherwise, transfers or obtains any ivory or rhinoceros horn before it has been weighed, marked and registered under section *ninety-two* commits an offence.

Transfer of ownership of ivory or rhinoceros horn

94. (1) The provisions of section *eighty-nine* shall apply to a transfer of ownership of ivory or rhinoceros horn, and in lieu of the endorsement required under subsection (2) of that section, both the transferor and the transferee shall endorse upon the certificate of ownership in respect of the ivory or rhinoceros horn a memorandum of transaction of transfer of ownership bearing the date of the transaction, and both parties shall sign their names at the foot of the endorsed memorandum.

(2) A person who fails to comply with subsection (1) commits an offence.

Government trophies

95. A trophy to which absolute ownership has not passed to any person under section *three,* or under any other provision of this Act, shall be a Government trophy for the purposes of this Act.

Report of possession of Government trophy

96. (1) A person who obtains possession of a Government trophy shall, as soon as practicable after obtaining possession of it, make a report of the person's possession of the trophy to the nearest wildlife police officer or such other person authorised, in writing, by the Director, and shall, if so required, deliver up, within forty-eight hours of such notice, the Government trophy to the wildlife police officer or other person.

(2) A person who fails to comply with subsection (1) commits an offence.

Unlawful possession of, or dealing in, Government trophies

97. (1) A person who unlawfully possesses or who purports to buy, sell or otherwise transfer or deal in a Government trophy commits an offence.

(2) For the purposes of this section, possession of a trophy by a person without the relevant licence or certificate of ownership in respect of the trophy shall be *prima facie* evidence of the trophy being a Government trophy and of the unlawful possession of it by the person.

PART XI

TRADE IN WILD ANIMALS AND MEAT OF WILD ANIMALS

Prohibited dealings in live wild animals

98. Except with the written permission of the Director or as is otherwise provided by this Act, a person commits an offence who possesses, buys or sells a live game or protected animal or meat of the game or protected animal, or who is found in circumstances showing that it is that person's intention to buy or sell a live game or protected animal or meat of the game or protected animal.

Certificate of ownership of game animal or protected animal or meat of game or protected animal

99. (1) The Director may, in the prescribed form, issue to a person who is in lawful possession of a game animal or protected animal or who intends to sell the meat of a game animal or protected animal a certificate of ownership of the meat, game animal or protected animal.

(2) The Director shall revoke a certificate of ownership where the Director determines that the certificate of ownership issued under subsection (1) was issued through error or through the misrepresentation or fraud of a person.

(3) The Director shall, upon the revocation of a certificate of ownership under subsection (2), notify the holder of the revocation, in writing, and the person to whom the certificate of ownership was issued shall cause the certificate of ownership to be returned to the Director for cancellation.

(4) A person who fails to comply with subsection (3) commits an offence.

Regulation of trade or movement of meat of game or protected animal

100. (1) The Minister may, on the advice of the Director, by statutory instrument—

(a) control, or make subject to any condition, the trade in live or game animal or protected animal or the trade in carcases, meat and skins of such animals; and

(b) prohibit, limit, control or make subject to a condition, the movement of the meat of a game animal or protected animal from a specified area for a period of time specified in the order, or may, by like order exclude, in respect of a specified area, the meat of a game animal or protected animal specified in the order from the provisions of this Part or any provision of the order.

(2) A condition imposed by the Minister under subsection (1) may be applicable generally throughout the Republic or may be applicable to the meat of all game animals or protected animals or to all persons, or it may be limited to such specified areas, or to the meat of specified game animal or protected animal or to such specified classes of persons as the Minister may determine, on the advice of the Director.

(3) A statutory instrument made under subsection (1) may provide that for a contravention of the Regulations a person commits an offence and shall be liable, upon conviction, to a fine not exceeding two hundred thousand penalty units or to imprisonment for a term not exceeding two years, or to both.

Sale of game animal or protected animal or meat of game or protected animal

101. (1) A person who sells a game animal or protected animal or any meat of a game animal or protected animal shall, at the time of the sale, be in actual possession of a certificate of ownership issued in respect of the game or protected animal or the meat of a game animal or protected animal, as the case may be, and a permit to sell the game or protected animal or the meat of the game or protected animal.

(2) Except as may otherwise be prescribed, a seller shall, upon the sale of a game animal or protected animal or any meat of a game animal or protected animal, endorse upon the certificate of ownership issued in respect of the game animal or protected animal, or of the meat of a game animal or protected animal, such details of the authority to sell the animal as may be prescribed, and the seller shall deliver up to the buyer the endorsed certificate of ownership, or a note of such certificate and endorsement, in the prescribed form, before or at the time of the delivery of the game animal or protected animal, or of the meat of a game animal or protected animal, as the case may be.

(3) If the seller has not previously delivered to the buyer the endorsed certificate of ownership of a game animal or protected animal or of any meat of a game animal or protected animal, as the case may be, or the prescribed note of the certificate and endorsement required under subsection (2), the buyer shall, at the time of delivery of the game animal or protected animal or the meat of a game animal or protected animal, under the sale, obtain from the seller the duly endorsed certificate of ownership or other prescribed note of such certificate and endorsement.

(4) A person who contravenes or fails to comply with any of the provisions of this section commits an offence.

Prohibition of importation of wild animal or meat of wild animal without import permit

102. (1) A person shall not import a wild animal or meat of a wild animal without an import permit issued under this Part.

(2) A person who contravenes subsection (1) commits an offence.

Prohibition of exportation of wild animal or meat of wild animal without export permit

103. (1) A person shall not export a wild animal or meat of a wild animal without an export permit issued under this Part.

(2) A person who contravenes subsection (1) commits an offence.

Application for import or export permit

104. (1) A person may apply to the Committee in the prescribed manner and form upon payment of the prescribed fee for a permit to import or export a wild animal or meat of a wild animal.

(2) The Committee shall, where the applicant meets the requirements of this Act, issue an import or export permit, as the case may be, on such terms and conditions as it may determine.

(3) A permit issued under this section shall—

(a) be valid for the period of time specified in the permit; or

(b) not authorise the export of a protected animal.

(4) A permit issued under this section shall not be deemed to relieve a person from a restriction on, or prohibition of, the import or export of a wild animal or meat of a wild animal imposed by or under any other written law.

Restriction on import or export of wild animals or trophies

105. (1) A person shall import or export a wild animal, trophy or prescribed trophy through a customs port of entry or exit, as applicable, and shall produce to a customs officer —

(a) a valid import or export permit, as the case may be; and

(b) in the case of an importation of a wild animal, trophy or prescribed trophy, documentary evidence that the wild animal, trophy or prescribed trophy has been lawfully exported from the country of origin.

(2) A person who contravenes subsection (1) commits an offence.

(3) A customs officer may, where an importer or exporter fails at the time of the import or export to comply with the requirements of paragraph *(a)* or *(b)* of subsection (2), give the importer or exporter three months from the date of the attempted import or export to comply with the requirements.

(4) A customs officer shall detain the wild animal, trophy or prescribed trophy to which subsection (3) applies and the cost incurred in connection with the detention and storage of the wild animal, trophy or prescribed trophy shall be borne by the importer or exporter, as the case may be, and be recoverable from the importer or exporter as a civil debt to the Government.

(5) Where the country from which a wild animal or meat of a wild animal is exported is not the country of origin, it shall be sufficient for the purposes of paragraph *(b)* of subsection (1) if the importer produces to the customs officer documentary evidence that the wild animal or meat of a wild animal was lawfully exported from the country of export.

Certificate of ownership of imported live wild animal

106. A person who imports any live wild animal shall, within one month from the date of the importation of the live wild animal, apply to the Director for a certificate of ownership in respect of the live wild animal.

Wild animals and trophies in transit

107. (1) This Part does not apply to a wild animal, trophy or prescribed trophy—

(a) in transit through Zambia, if the wild animal, trophy or prescribed trophy is accompanied by the necessary transit customs documents issued in the country of origin or of export of the wild animal, trophy or prescribed trophy and enters through a customs port of entry; or

(b) accompanied by a person who is in possession of, and surrenders to a customs officer, a certificate issued by the country of origin or of export of the wild animal, trophy or prescribed trophy, stating that the person is lawfully authorised to export the wild animal, trophy or prescribed trophy and the person satisfies the customs officer that—

(i) the certificate was issued to that person; and

(ii) the person is exporting the wild animal, trophy or prescribed trophy, as the case may be, from the country of origin or export.

(2) A person who contravenes or fails to comply with subsection (1) commits an offence.

Implementation of international treaties

108. Notwithstanding the other provisions of this Act, the Minister may, on the advice of the Director and in consultation with the Minister responsible for trade and industry and the Minister responsible for veterinary services, by statutory instrument, regulate the import, export or re-export of any game or protected animal and the regulations may incorporate the requirements of the Convention on International Trade in Endangered Species of Wild Fauna and Flora and the Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora.

PART XII
THE WILDLIFE DEVELOPMENT FUND

Establishment of Fund

109. (1) There is established the Wildlife Development Fund for purposes of wildlife development, research, conservation and management.

(2) The Fund shall consist of—

(a) such monies as may be appropriated by Parliament for the purposes of the Fund;

(b) monies collected from such fees and levies as the Minister responsible for finance may prescribe, in consultation with the Minister;

(c) such monies as may be received by the Fund from donations and grants from any source, with the approval of the Minister;

(d) such other monies as may vest in or accrue to the Fund; and

(e) such other monies as may, by or under any other law, be payable to the Fund.

Administration of Fund and accounts

110. (1) Subject to subsection (3), the Fund shall be managed and administered by the Ministry responsible for wildlife for the purposes specified under subsection (1) of section *one hundred and nine.*

(2) The Ministry responsible for wildlife shall ensure that prudent controls are established for the Fund relating to—

(a) fiscal controls and accounting procedures governing the Fund;

(b) reporting procedures for matters relating to the Fund; and

(c) investment of the monies of the Fund.

(3) Subject to subsections (1) and (2), the Fund shall be administered by a Fund committee consisting of seven members appointed by the Minister.

(4) The Fund committee constituted, in accordance with subsection (3), shall comprise one representative each of—

(a) the Ministries responsible for wildlife and finance;

(b) the Department;

(c) the Tourism Council of Zambia;

(d) the Zambia Institute of Chartered Accountants; and

(e) an institution and association, in the private sector, which the Minister considers to be beneficial to the objectives of the Fund.

(5) The Ministry responsible for wildlife shall cause to be kept proper books of account and other records relating to the accounts of the Fund.

(6) The Fund shall be audited annually by the Auditor-General.

Annual report and statement of income and expenditure

111. (1) As soon as practicable, but not later than ninety days after the end of the financial year, the Ministry responsible for wildlife shall submit to the Minister responsible for finance a report concerning the activities relating to the Fund during the financial year.

(2) The report referred to in subsection (1) shall include information on the financial affairs of the Fund and there shall be appended to the report—

(a) an audited balance sheet;

(b) an audited statement of income and expenditure; and

(c) such other information as the Minister responsible for finance may require.

(3) The Minister responsible for finance shall, not later than seven days after the first sitting of the National Assembly next after the receipt of the report referred to in subsection (1), lay the report before the National Assembly.

PART XIII

ENFORCEMENT

Powers of authorised officers

112. (1) Subject to the other provisions of this Act, an authorised officer may—

(a) at any reasonable time, enter upon and inspect any land, building, premises, tent, vehicle, boat, aircraft or other conveyance where any wild animal, trophy or prescribed trophy may be found or processed, for the purposes of inspection and data collection;

(b) demand from any person the production of a licence, permit, certificate or authorisation for an act done or omitted by that person in a public wildlife estate or in relation to which a licence, permit, certificate or authorisation is required under this Act;

(c) require a person found within a public wildlife estate who has in that person's possession any wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light to give an account of the manner in which the person came in its possession and where the account given is not satisfactory, arrest and take that person before a court;

(d) require the person in charge of any vehicle, boat, aircraft or other conveyance entering Zambia to furnish a list of the names of persons in the vehicle, boat, aircraft or other conveyance and such other prescribed information which is within the power of such person to furnish;

(e) search any person whom the authorised officer has reasonable grounds to believe is carrying any wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light in contravention of this Act or carrying out an activity contrary to this Act;

(f) require any person to produce for inspection any wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light, appliance, article, device or any other thing in relation to or in connection with which, the authorised officer has reason to believe, an offence has been committed or is likely to be committed;

(g) seize any wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light, appliance, equipment, device or other material in connection with which an offence appears to have been committed;

(h) seize or order the seizure of a vehicle, boat, aircraft or other conveyance carrying any wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation or object in contravention of this Act or any other written law;

(i) seize and detain any domestic animal found in a public wildlife estate without a permit;

(j) take all reasonable steps to prevent the commission of an offence under this Act;

(k) apply or order the application of measures which are necessary or prescribed for the control or prevention of the spread of animal infections or diseases in consultation with other relevant institutions;

(l) destroy or order the destruction of any wild animal, trophy or prescribed trophy which is moved or used contrary to the provisions of this Act; and

(m) order the adoption of measures prescribed to ensure the protection of public wildlife estates and wildlife.

(2) An owner of any land, building, premises or conveyance shall afford an authorised officer access to the land, building, premises or conveyance and shall give such information and provide such reasonable assistance as the authorised officer may require for the purposes of data collection and carrying out an inspection.

(3) An authorised officer may, in the performance of any functions under this section, be accompanied and assisted by a police officer.

(4) An authorised officer may, in the course of an inspection carried out under this section—

(a) recall, destroy, detain or otherwise dispose of any wild animal, trophy, prescribed trophy or vegetation or order that any such action be taken at the expense of the owner;

(b) obtain a sample of a wild animal, trophy, prescribed trophy or vegetation as the authorised officer considers necessary for purposes of this Act;

(c) order a person to produce for inspection or for purposes of obtaining extracts or copies, any book, document or other information concerning any matter relevant to the administration of this Act; and

(d) suspend one or more activities or temporarily, partially or completely close inspected premises.

(5) A person who contravenes an order made pursuant to this section commits an offence and is liable, upon conviction, to a fine not exceeding three hundred thousand penalty units or to imprisonment for a period not exceeding three years, or to both.

(6) Where a person fails or refuses to do anything which that person is required to do under an order made under this section, an authorised officer may do or cause such thing to be done.

(7) The cost of anything which an authorised officer does or causes to be done under subsection (6) shall be recoverable by the Director from the person who failed or refused to comply with the order.

(8) The Government shall not be liable for any loss or damage which occurs to any property during an act of seizure by an authorised officer or whilst the property is detained under this Act, unless the authorised officer caused the loss or damage negligently, maliciously or fraudulently.

Power to carry out tests and take statistics

113. (1) An authorised officer may, for the purposes of this Act—

(a) take or cause a sample or specimen to be taken from any wild animal, trophy or prescribed trophy;

(b) take or cause a sample or specimen to be taken from any land, building, premises, tent, vehicle, boat, aircraft or other conveyance; or

(c) conduct such other tests as the authorised officer considers necessary.

(2) An authorised officer may, for the purpose of obtaining statistics, weigh, measure and check any wild animal, trophy or prescribed trophy and any person in charge of the wild animal, trophy or prescribed trophy shall, on demand being made to that person by an authorised officer, produce that wild animal, trophy or prescribed trophy to the authorised officer for that purpose.

Arrest without warrant

114. (1) An authorised officer may arrest a person, without warrant, where the authorised officer has reasonable grounds to believe that the person—

(a) has committed an offence under this Act;

(b) is about to commit an offence under this Act and there is no other way to prevent the commission of the offence; or

(c) is wilfully obstructing the authorised officer in the execution of the officer's duties.

(2) An authorised officer who makes an arrest under subsection (1) shall, without undue delay, have the person arrested brought to a police station.

Power to take photographs, measurements, finger prints, etc

115. (1) A wildlife police officer may, on the prescribed form, take or cause to be taken in the presence of that officer, for the purpose of record and identification, the measurements, photographs, fingerprints, hand prints and footprints of a person in lawful custody.

(2) A wildlife police officer acting in accordance with subsection (1) shall certify on the form prescribed that the fingerprints have been taken by the officer or that the officer has caused them to be taken in the presence of that officer, in accordance with the instructions contained on the form, and that the particulars entered on the form are, to the best of the officer's knowledge and belief, accurate and true.

(3) For the purposes of this section "person in lawful custody" means a person taken into custody under section *one hundred and twelve.*

Search with warrant

116. (1) Subject to subsection (2), an authorised officer may, where the authorised officer suspects that a person has committed an offence or is in possession of any wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light in relation to or in connection with which an offence has been committed, with a warrant—

(a) enter upon and inspect the land, building, tent, structure or enclosure on or in which the wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light which is the subject of an offence may be found; or

(b) search any baggage, package, parcel, vehicle, boat, aircraft or other conveyance under the control of that person or the employee or agent of that person.

(2) Notwithstanding subsection (1), a private dwelling shall not be entered into except in the presence of the occupier or person over the apparent age of eighteen years who resides in the private dwelling as a member of the occupier's family.

Obstruction of authorised officer

117. A person who—

(a) willfully delays or obstructs an authorised officer in the carrying out of the officer's duties under this Act;

(b) knowingly or negligently gives an authorised officer, in relation to information which the officer is entitled to under this Act, false or misleading information;

(c) refuses to furnish an authorised officer with information to which the officer is entitled; or

(d) impersonates or falsely represents oneself to be an authorised officer or to be a person acting under an authorised officer's orders;

commits an offence and is liable, upon conviction, to a fine not exceeding two hundred thousand penalty units or to imprisonment for a period not exceeding two years, or to both.

Demanding production of licence, permit, certificate or authorisation

118. An authorised officer may demand from a person engaged in doing or causing to be done anything for which a licence, permit, certificate or authorisation is required under this Act to produce the licence, permit, certificate or authorisation and if that person fails to produce it, restrain that person and the employees and agents of that person from doing such thing until the licence, permit, certificate or authorisation is produced.

Prosecution by officers

119. (1) The Director of Public Prosecutions may, at the request of the Director, in writing, appoint by name or rank a wildlife officer to undertake the prosecution of any offence alleged to have been committed under this Act.

(2) A wildlife officer shall, in undertaking prosecution under subsection (1), act in accordance with the general or special instructions of the Director of Public Prosecutions.

Seizure of property

120. Where there is reason to believe that an offence has been committed under this Act, any tool, instrument, machinery, equipment, vehicle and other property suspected of having been used in the commission of the offence may be seized by an authorised officer and detained until an order of the court is made regarding the disposal thereof.

Forfeiture and restoration of property

121. (1) The Director shall, where a person from whom a wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light or other property has been seized under section *one hundred and twenty*—

(a) is found not guilty or the proceedings against that person are withdrawn, without unnecessary delay, restore the wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light or property to that person; or

(b) cannot be found or is unwilling to receive back the wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light or property, apply to the court for an order of forfeiture of the wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light or property.

(2) The court shall not make an order of forfeiture under subsection (1) unless—

(a) the Director has given notice, by publication in the *Gazette* and in one daily newspaper of general circulation in Zambia, to the effect that the wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light or property which has been seized under this Act shall vest in the State if it is not claimed within three months from the date of publication of the notice; and

(b) three months after the giving of the notice under paragraph *(a)*, the wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light or property remains unclaimed.

(3) Where a claim is made, in writing, by any person that is lawfully entitled to the wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light or property seized under this Act that the wild animal, trophy,

prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light or property is not liable to forfeiture under this Act, the Director may order its release to the claimant if satisfied that there is no dispute concerning its ownership and that it is not liable to forfeiture.

(4) The Director shall refer a claim to the High Court where a claim of ownership is made in relation to any wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow, explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light or property seized under this Act and the Director finds that—

(a) there is dispute regarding its ownership;

(b) there is insufficient evidence to determine its ownership; or

(c) the Director is unable to ascertain whether it is liable to forfeiture or not.

Traffic barriers and cordons

122. (1) Notwithstanding the provisions of any other law, if a wildlife police officer of a prescribed rank considers it necessary to do so for the prevention and detection of an offence relating to wildlife, the wildlife police officer may —

(a) erect or place or cause to be erected or placed barriers in or across any street, or cause a cordon to be placed on or around any public place in such manner as the officer may think fit; or

(b) cause a cordon to be placed in or across or around any public place or private property in such manner as the officer may think fit, and for the purpose, the wildlife police officer forming the cordon may, without the consent of any person, enter any property and do an act or thing necessary for the effective formation of the cordon.

(2) Where a barrier has been erected or placed or a cordon formed under subsection (1), a wildlife police officer may take all reasonable steps to prevent a person passing or a vehicle being driven past the barrier or cordon.

(3) The driver of a vehicle who fails to comply with any reasonable signal of a wildlife police officer requiring that driver to stop the vehicle before reaching any barrier erected or placed or cordon formed under subsection (1), commits an offence and is liable, upon conviction, to a fine not exceeding one hundred thousand penalty units or to imprisonment for a term not exceeding one year, or to both.

(4) A person who breaks through or attempts to break through a barrier erected or placed or cordon formed, under subsection (1) commits an offence and is liable, upon conviction, to a fine not exceeding fifty thousand penalty units or to imprisonment for a term not exceeding six months, or to both.

Use of firearms

123. (1) An authorised officer may, subject to subsections (2) and (3), use a firearm which has been issued to the authorised officer against a person—

(a) in lawful custody charged with or convicted of an offence under this Act when that person is escaping or attempting to escape;

(b) who by force rescues or attempts to rescue any other person from lawful custody; or

(c) who by force prevents or attempts to prevent the lawful arrest of that person or of any other person.

(2) An authorised officer shall not use a firearm—

(a) as authorised under paragraph *(a)* of subsection (1) unless the authorised officer has —

(i) reasonable grounds to believe that the officer cannot otherwise prevent the escape; and

(ii) given a warning to the person that the officer is about to use a firearm against the person and the warning is unheeded;

(b) as authorised under paragraph *(b)* or *(c)* of subsection (1) unless the authorised officer has —

(i) reasonable ground to believe that the officer or any other person is in danger of grievous bodily harm; and

(ii) cannot otherwise effect the arrest or prevent the rescue.

(3) An authorised officer shall not, in the presence of a superior officer, use a firearm against a person except under the orders of that superior officer.

(4) The use of firearms under this section shall, as far as possible, be to incapacitate and not to kill.

(5) The authority vested in a wildlife police officer by subsection (1) shall be in addition to, and not in substitution for, any authority to use firearms vested in a wildlife police officer by any other written law.

Compliance with Firearms Act Cap. 110

124. Nothing in this Act shall exempt any person from compliance with the Firearms Act.

Immunity of authorised officer

125. An authorised officer shall not be held liable for damages or otherwise for an act done or omitted to be done in good faith in the performance of the duties and exercise of authorised powers of the authorised officer under this Act.

PART XIV

OFFENCES AND PENALTIES

Prohibition of bush or grass fires in public wildlife estate

126. A person, other than a person authorised in writing by the Director, who causes a bush or grass fire in any public wildlife estate commits an offence.

Hunting or dealing with elephant or rhinoceros

127. (1) A person who hunts, wounds, molests or reduces into possession an elephant or rhinoceros in contravention of any provision of this Act commits an offence and is liable, upon conviction—

(a) for a first offence, to a term of imprisonment of not less than five years but not exceeding twenty years, without the option of a fine; and

(b) for a second or subsequent offence, to a term of imprisonment of not less than ten years but not exceeding twenty-five years, without the option of a fine.

(2) If the court is satisfied that an offence, referred to in subsection (1), was committed for the purpose of, or in connection with, illegal trafficking in ivory or rhinoceros horn, the offender shall be liable, upon conviction—

(a) for a first offence, to a term of imprisonment of not less than seven years but not exceeding twenty years, without the option of a fine; and

(b) for a second or subsequent offence, whether or not the previous offence involved illegal trafficking, to a term of imprisonment of not less than fifteen years but not exceeding twenty-five years, without the option of a fine.

Penalty for unlawful hunting in National Park, Community Partnership Park or bird or wildlife sanctuary

128. A person who hunts in a National Park, Community Partnership Park or bird or wildlife sanctuary in contravention of this Act is liable, upon conviction—

(a) for a first offence, to a term of imprisonment of not less than three years but not exceeding ten years, without the option of a fine; and

(b) for a second or subsequent offence, to a term of imprisonment of not less than five years but not exceeding fifteen years, without the option of a fine.

Illegal possession, purchase or sale of meat of wild animal or trophy

129. (1) Subject to section *one hundred and thirty,* a person who is in possession of, sells, buys, imports or exports or attempts to sell, buy, import or export a trophy or meat of a wild animal in contravention of this Act is liable, upon conviction, to a fine of not less than three hundred thousand penalty units but not exceeding six hundred thousand penalty units, or to imprisonment for a term not exceeding seven years, or to both.

(2) A person who commits an offence under subsection (1) for the purpose of, or in connection with, illegal trafficking of trophy is liable, upon conviction —

(a) for a first offence, to a fine of not less than one hundred and fifty thousand penalty units but not exceeding five hundred thousand penalty units or to a term of imprisonment of not less than three years but not exceeding five years, or to both; and

(b) for a second or subsequent offence, to a fine of not less than two hundred thousand penalty units but not exceeding six hundred thousand penalty units or to a term of imprisonment of not less than five years but not exceeding seven years, or to both.

Illegal possession, purchase or sale of protected animal, trophy or meat of protected animal or prescribed trophy

130. (1) A person who is in possession of, sells, buys, imports or exports or attempts to sell, buy, import or export, a protected animal or trophy or meat of a protected animal in contravention of this Act commits an offence and is liable, upon conviction, to imprisonment, without the option of a fine, for a term of not less than five years but not exceeding ten years.

(2) A person who is in possession of, sells, buys, imports or exports or attempts to sell, buy, import or export a prescribed trophy in contravention of this Act is liable, upon conviction —

(a) for a first offence, to a term of imprisonment, without the option of a fine, of not less than five years but not exceeding ten years; and

(b) for a second or subsequent offence, to a term of imprisonment, without the option of a fine, of not less than seven years but not exceeding fifteen years.

Malicious damage to infrastructure in public wildlife estate

131. Subject to any other written law, a person who intentionally damages any machinery, equipment, road, track, tramway, bridge, water installation, power line, telephone line, drain or other infrastructure in any public wildlife estate commits an offence.

Unauthorised possession or use of uniform or identity of authorised officer

132. A person who, without authority, wears or is in possession of any uniform or part of a uniform or any badge, mark or identity document issued by or on behalf of the Director to be worn or possessed by an authorised officer commits an offence.

Failure to keep registers or furnish returns

133. (1) A person commits an offence who, when required by or under this Act to keep a register or furnish a return or information to the Director—

(a) fails to keep a register or to furnish a return or information;

(b) fails to make an entry in the register or to furnish the return or information within the prescribed time; or

(c) with intent to mislead, makes an entry in the register or furnishes a return or information which is false in a material particular.

(2) A person who is required to surrender a licence, permit, certificate or authorisation to the Director under this Act who fails to surrender the licence, permit, certificate or authorisation commits an offence.

Alteration, defacement or removal of documents

134. (1) A person commits an offence who, without lawful authority, alters, defaces or removes—

(a) a register, index or other official record maintained under or for purposes of this Act or an order, requirement, regulation or rule; or

(b) an entry appearing in a register, index or other official record.

(2) A person who alters, forges, utters, fabricates or defaces a licence, permit, authority, certificate, register, return, record or other document prescribed, issued, furnished or kept for purposes of and under this Act commits an offence.

Disclosure of confidential information

135. A person who—

(a) being a person employed for the purposes of this Act, publishes or communicates, without lawful authority, to another person information acquired by that person in the course of that person's employment; or

(b) being in possession of information which, to the person's knowledge, had been disclosed in contravention of this Act, publishes or communicates that information to another person;

commits an offence and is liable, upon conviction, to a fine not exceeding two hundred thousand penalty units or to a term of imprisonment not exceeding two years, or to both.

General Penalty

136. A person who commits an offence under this Act for which a penalty is not provided is liable, upon conviction—

(a) for a first offence, to a fine of not less than four hundred thousand penalty units but not exceeding six hundred thousand penalty units or a term of imprisonment not exceeding seven years, or to both; and

(b) for a second or subsequent offence, to a fine of not less than five hundred thousand penalty units or to a term of imprisonment of not less than six years but not exceeding ten years, or to both.

Payment of fine without appearing in court

137. (1) An authorised officer may, where satisfied that a person has committed an offence for which the penalty does not exceed two hundred thousand penalty units or where a person has admitted the commission of an offence under this Act for which the penalty does not exceed two hundred thousand penalty units, summarily demand from the person the payment of a fine not exceeding one hundred thousand penalty units in respect of the offence.

(2) An authorised officer shall, where the authorised officer demands a payment under subsection (1), inform the person against whom the demand is made of the right to admit or dispute the liability.

(3) A person from whom payment of a fine has been demanded under subsection (1) may elect to admit liability and pay the fine or dispute liability.

(4) The payment of a fine shall operate as a bar to any further criminal proceedings against the person making the payment in respect of the offence concerned.

(5) An authorised officer who receives payment of a fine shall give a receipt to the person making the payment in such form as may be prescribed.

(6) An authorised officer who receives a payment under this section and—

(a) fails to issue a receipt to the person making the payment as required under subsection (5);

(b) fails to account for any payment made under this section; or

(c) in any manner, misuses or puts to personal use any payment made under this section;

commits an offence and is liable, upon conviction, to a fine not exceeding three hundred thousand penalty units or to imprisonment for a period not exceeding three years, or to both.

Additional powers of court

138. (1) The court may, where a person is convicted of an offence, in addition to any other penalty provided for in this Act—

(a) order the cancellation and surrender of the licence, permit, certificate or authorisation held by that person;

(b) assess the amount of compensation for the loss or damage caused by that person in the commission of the offence and cause the compensation to be recovered from that person as if it were a debt due and payable to the Government;

(c) order the removal or demolition, within such time as the court may determine, of any unauthorised buildings, structures, machinery, equipment, crops and other works set up or grown by that person, and the restoration, as far as practicable, of all areas and things to their former state, and if the removal, demolition and restoration is not effected within the time fixed by the court, the Director shall cause it to be done and the cost incurred shall be recovered by the Director from the convicted person; or

(d) order the confiscation or forfeiture of any wildlife, object, item or article in respect of which the offence was committed and of any livestock, tools, machinery, equipment, vehicles or other property used in the commission of the offence.

(2) The Director may sell or otherwise dispose of any property confiscated or forfeited under subsection (1) and handed over to the Director by order of the court, and any moneys received from the sale or disposal of the property shall be paid into the general revenues of the Republic.

Destruction of game pits, etc., on conviction

139. Where a person is convicted of an offence under this Act in respect of any game-pit, pitfall, trench or similar excavation, fence, enclosure or other device fixed to the ground, which the person has made, used or had in the possession of that person, for the purpose of hunting in contravention of the provisions of this Act, the court shall, in addition to any other punishment, order the game-pit, pitfall, trench, excavation, fence, enclosure or device to be destroyed in such manner as the court may specify, and any expenditure incurred on account of that order shall be recoverable from such person as a civil debt to the Government.

Forfeiture of property on conviction

140. (1) Upon the conviction of any person of an offence under this Act, the court may, in addition to any other penalty imposed, declare any wild animal, trophy, prescribed trophy, nest, habitat, stone, vegetation, object, firearm, dart gun, ammunition, spear, bow, arrow explosive, snare, net trap, poison, bird-lime, gin, mist net, contrivance, missile, torch, flare, headlamp or other artificial light, vehicle, boat, aircraft or other conveyance with which the offence was committed, or which was used in, or for the purpose of, or in relation to, or in connection with, the commission of the offence, to be forfeited to the State without compensation and shall order the same to be disposed of as the State considers fit.

(2) Where the prosecution applies for an order of forfeiture in respect of any vehicle, boat, aircraft or other conveyance, the court shall make an order, to the effect that unless any person other than the convicted party claims, under this section, any right of ownership in the vehicle, boat, aircraft or other conveyance within three months of the date referred to in subsection (5), the prosecution may apply to the court, *ex parte*, for an order of forfeiture under subsection (1), and the court shall make the order.

(3) Upon the making of an order under subsection (2), the Director shall, within one month thereafter, cause to be published in the *Gazette* and in at least one daily newspaper of general circulation in the place where the offence was committed, a notice of the making of the order, which shall be in the prescribed form, or if no form is prescribed, in a form approved by the court.

(4) If under any written law requiring the registration of a vehicle, boat, aircraft or other conveyance referred to in subsections (1) and (2), the vehicle, boat, aircraft or other conveyance is registered in Zambia in the name of any person other than the person convicted, the Director shall, within seven days of the date of publication of the notice in the *Gazette,* cause a copy to be sent by registered post in a sealed envelope addressed to the person at the address appearing on the register, and the registration of the letter shall be conclusive evidence of service of the notice upon that person.

(5) A person who claims a right to a vehicle, boat, aircraft or other conveyance may, within three months from the date of the making of the order referred to in subsection (2), serve upon the Director and lodge with the clerk of the court an application, in writing, for the discharge of the order setting out the claim of ownership in the vehicle, boat, aircraft or other conveyance, whereupon the clerk of the court shall fix a date, of one month or more from the date of the lodgement of the application for a hearing and shall, within seven days from the date of the lodgement, cause notice of the hearing of the application to be served upon the Director.

(6) In any proceedings brought under subsection (5), the burden of proof shall be on the applicant and the court shall not discharge the order made under subsection (2) unless the applicant has adduced evidence and proved to the satisfaction of the court that the applicant was not in any way privy to the offence and that the vehicle, boat, aircraft or other conveyance was, at the time of the commission of the offence, being used for such purpose without the knowledge or consent of the applicant and without any negligent disregard on the part of the applicant, of its use by the convicted person.

(7) Where, upon an application made under subsection (5), the court is satisfied that the conveyance is owned jointly by the claimant and the convicted party, or is the subject matter of a hire-purchase agreement between the claimant and the convicted party, and the claimant has discharged the burden of proof referred to under subsection (6), the court shall declare forfeited all of the estate or interest of the convicted person in and to the conveyance, or all of the rights therein accrued to that person under the hire-purchase agreement or pursuant to the Hire-Purchase Act and order the estate, or interest or rights to be disposed of as the State may consider fit. Cap. 399

(8) Except with the consent of the State, any right vested in any claimant under any hire-purchase agreement or pursuant to the Hire-Purchase Act to repossess a vehicle, boat, aircraft or other conveyance which is subject to an order made under subsection (2), shall be suspended pending the determination of any application brought under subsection (5), and in the event of the court declaring the rights therein accrued to the convicted party to be forfeited, the accrued right to repossess the conveyance shall not be exercisable against the State. Cap. 399

Disposal of animals and goods seized

141. (1) Where a trophy, prescribed trophy firearm or other weapon, trap, net, poison or instrument, vehicle, aircraft, boat or other conveyance, material or article is seized under this Act or any other written law, in relation to or in connection with the commission of an offence under this Act and—

(a) the person suspected of having committed the offence is unknown;

(b) the person suspected of having committed the offence cannot be found for the purpose of service of the court process charging that person with the offence; or

(c) having been served with such process, the person suspected of having committed the offence fails to appear in answer to the charge;

the Director may, one month from the date of publication of a notice of intention to apply for a court order for forfeiture in one issue of a daily newspaper of general circulation in the district in which the offence is alleged to have been committed, apply by way of original application, *ex parte,* to the court for an order declaring the trophy, firearm or other weapon, trap, net, poison or instrument, vehicle, aircraft, boat, conveyance, material or article, as the case may be, to be forfeited without compensation and ordering it to be disposed of as the Director may consider fit.

(2) If a person claims any right of ownership in any vehicle, aircraft, boat or other conveyance, to which a notice published under subsection (1) applies, the person may, within one month from the date of publication, lodge with the clerk of the court a notice of claim of ownership and serve a copy of the notice upon the Director, and the provisions of subsections (4) to (8) of section *one hundred and forty* shall apply, with the necessary modifications, to the claim of ownership.

(3) If a wild animal or trophy is seized under this Act or any written law in relation to or in connection with the commission of an offence under this Act or such other written law, the Director may apply to the court by way of original application, *exparte*, for an order for the immediate disposal by sale or otherwise of the wild animal or trophy, and the court may order the sale and in the event of a sale of the wild animal or trophy, the proceeds shall be held by the Director pending the determination of any proceedings brought in respect of the offence and shall be dealt with by the Director as the court may direct or, if the person suspected of having committed the offence is unknown or cannot be found for the purposes of service of the process of the court, subsection (1) shall apply with necessary modifications to the proceedings.

Civil remedy reserved

142. (1) Nothing in this Act shall be construed as taking away or interfering with the right of the Republic or any person to sue for and recover, at common law or otherwise, compensation for or in respect of any damage or injury caused by the commission of an offence.

(2) The court shall, in assessing the compensation take into account the amount of any compensation recovered under section *one hundred and thirty-eight.*

Evidence

143. Where in any proceedings under this Act a question arises whether any wildlife is the property of the Republic, it shall be presumed to be the property of the Republic unless the contrary is proved.

Exhibits

144. Where in any proceedings under this Act it becomes necessary for an authorised officer to produce in evidence any wildlife and, in the opinion of that authorised officer, production of the wildlife would be impracticable or involve unnecessary expense or undue delay, it shall be sufficient for the authorised officer to produce in the court any piece or sample of the wildlife.

PART XV
GENERAL PROVISIONS

Appeals

145. (1) A person who is aggrieved with the decision of the Director or Committee under this Act may appeal to the Minister within thirty days of the receipt of the decision of the Director or Committee.

(2) The decision of the Minister on an appeal under this section shall be subject to appeal to the High Court within thirty days of the receipt of the decision of the Minister.

Regulations

146. (1) The Minister may, after consultation with the Director, by regulation, prescribe anything required to be prescribed under this Act and for the better carrying out of the provisions of this Act.

(2) Without prejudice to the generality of subsection (1), the regulations made under that subsection may make provision for—

(a) returns to be furnished to the Department or to the Director by holders of licences, permits or certificates issued under this Act;

(b) the terms and conditions of the licences, permits and certificates issued under this Act;

(c) the numbers and sex of each species which may be hunted under a licence or permit, the times of the year in which a species of game or protected animal may be hunted generally or in any specified area, the type of weapons prohibited or permitted and such other matters in respect of hunting as may be necessary;

(d) the hearing and determination of appeals by the Minister;

(e) the control or prohibition of entry into, passage through, settlement or residence and the regulation of the activities of persons in a Game Management Area;

(f) the permitting, controlling or prohibiting the burning, cutting, felling or removal of vegetation from a Game Management Area;

(g) the control or prohibition of hunting of wild animal and protected animals or a species or variety or sex of wild animal or protected animals in a Game Management Area, Community Partnership Park or open area;

(h) the control, regulation or prohibition of land development or mining within a National Park, Game Management Area or Community Partnership Park and the imposition of terms and conditions under which land development or mining may be undertaken in such areas;

(i) the control of the sale or movement of a game or protected animal, meat of a game or protected animal, or of any trophy, from a National Park, Game Management Area, wildlife sanctuary or bird sanctuary;

(j) the fees to be paid for anything to be done under this Act and the remission of any fees payable under this Act;

(k) the terms and conditions of wildlife conservation and management on private wildlife estates;

(l) the sealing of firearms in areas where the hunting of animals is prohibited or controlled;

(m) the terms and conditions under which wild animals lawfully owned may be kept on private wildlife estates, including specifications as to the size and design of enclosures for such wild animals;

(n) the preparation of general management plans for National Parks, Community Partnership Parks and Game Management Areas;

(o) the payment of rewards to finders of trophies;

(p) the functions of a Chief as patron of a board and the conduct of business of boards, including the tenure of such boards;

(q) the terms and conditions under which an honorary wildlife police officer may exercise the functions of a wildlife police officer;

(r) the implementation of the Convention on Wetlands of International Importance Especially as Waterfowl Habitat, the Lusaka Agreement on Cooperative Enforcement Operation Directed at Illegal Trade in Wild Flora and Fauna and the Convention on Biological Diversity; and

(s) the terms and conditions of co-operation with a person or organisation carrying out the functions of the Department.

(3) The Minister may, on the advice of the Director, in any regulations made under this section, prescribe in respect of the contravention of a provision of the regulations—

(a) a penalty not exceeding four hundred thousand penalty units or a term of imprisonment for a period not exceeding five years, or both;

(b) the forfeiture of anything which was the subject matter of the contravention or with which the offence was committed or which was used in, for the purpose of, in relation to, or in connection with, the contravention; and

(c) in the case of a continuing offence, an additional penalty not exceeding fifty thousand penalty units for each breach.

Repeal of Zambia Wildlife Act, 1998 Act No. 12 of 1998

147. The Zambia Wildlife Act, 1998, is repealed.

Savings and transitional provisions

148. (1) The savings and transitional provisions set out in the Second Schedule apply to the winding up of the Zambia Wildlife Authority.

Act No. 12 of 1998

(2) Notwithstanding the provisions of this Act, a National Park, bird or wildlife sanctuary and Game Management Area established under the repealed Act continues to exist as if established under this Act.

FIRST SCHEDULE
(*Section* 7(7))

THE WILDLIFE MANAGEMENT LICENSING COMMITTEE

Tenure of office and vacancy

1. (1) Subject to the other provisions of this Act, a member of the Committee shall hold office for a term of three years from the date of appointment and may be re-appointed for a further term of three years.

(2) On the expiration of the term for which a member is appointed, the member shall continue to hold office until another member is appointed, but in no case shall an extension of the period exceed three months.

(3) The office of a member becomes vacant—

(a) on the member's death;

(b) if the member is adjudged bankrupt;

(c) if the member is absent, without reasonable excuse, from three consecutive meetings of the Committee of which the member had notice, without the prior approval of the Committee;

(d) upon the expiry of one month's notice of the member's intention to resign, given by the member, in writing, to the Minister;

(e) if the member becomes mentally or physically incapable of performing duties as a member of the Committee; or

(f) if the member is convicted of an offence under this Act or any other written law.

Filling of casual vacancy

2. The Minister may, where the office of a member becomes vacant before the expiry of the term of office, appoint another member in the place of the member who vacates office, but that member shall hold office for the unexpired part of the term.

Proceedings of Committee

3. (1) Subject to the other provisions of this Act, the Committee may regulate its own procedure.

(2) The Committee shall meet as often as is necessary to perform its functions and at such places and times as the Chairperson may determine.

(3) The Chairperson may, upon giving notice of not less than fourteen days, call a meeting of the Committee and shall call a special meeting to be held within fourteen days of receipt of a written request to the Chairperson by at least five members of the Committee.

(4) If the urgency of any particular matter does not permit the giving of the notice required under sub-paragraph (3), a special meeting may be called by the Chairperson on giving a shorter notice.

(5) The quorum at a meeting of the Committee shall be half of the members of the Committee.

(6) There shall preside at a meeting of the Committee—

(a) the Chairperson;

(b) in the absence of the Chairperson, the Vice-Chairperson; and

(c) in the absence of both the Chairperson and the Vice-Chairperson, such member as the members present may elect from amongst themselves for the purpose of that meeting.

(7) A decision of the Committee on any question shall be by the majority of votes of the members present and voting at the meeting and, in the event of an equality of votes, the person presiding at the meeting shall have a casting vote, in addition to the person's deliberative vote.

(8) The Committee may invite any person whose presence is in its opinion desirable to attend and participate in the deliberations of a meeting of the Committee but such a person shall not have a vote.

(9) The validity of any proceedings, act or decision of the Committee shall not be affected by a vacancy in the membership of the Committee or by a defect in the appointment of a member or by reason that a person not entitled to do so, took part in the proceedings.

(10) The Committee shall cause minutes to be kept of the proceedings of every meeting of the Committee and every meeting of a sub-committee established by the Committee.

Sub-committees of Committee

4. (1) The Committee may, for the purpose of performing its functions, constitute such sub-committees as it considers necessary for the effective performance of the functions of the Committee.

(2) The Committee may appoint, as members of a sub-committee, persons who are or are not members of the Committee, except that at least one member of the Committee shall be a member of a sub-committee.

(3) A person serving as a member of a sub-Committee shall hold office for such period as the Committee may determine.

(4) Subject to any specific or general direction of the Committee, a sub-committee may regulate its own procedure.

Allowances of members

5. The members of the Committee or any sub-committee of the Committee shall be paid such allowances as the Committee may determine with the approval of the Minister.

Disclosure of interest

6. (1) A member or person who is present at a meeting of the Committee or a sub-committee of the Committee at which a matter is the subject of consideration and in which matter that member or person or the member's or that person's associate or relative, is directly or indirectly interested in a private capacity shall, as soon as is practicable, after the commencement of the meeting, declare that interest and shall not, unless the Committee or the sub-committee otherwise directs, take part in any consideration or discussion of, or vote on any question relating to, that matter.

(2) A declaration of interest made under this paragraph shall be recorded in the minutes of the meeting at which it is made.

(3) In this paragraph—

(a) " associate ", in relation to a person means—

(i) a nominee or an employee of that person;

(ii) a former spouse or conjugal partner of that person;

(iii) a firm of which that person, or that person's nominee, is a partner or a person in charge or in control of its business or affairs;

(iv) a company in which that person, or that person's nominee, is a director or is in charge or in control of its business or affairs, or in which that person, alone or together with that person's nominee, holds a controlling interest or shares amounting to more than thirty percent of the total share capital; or

(v) the trustee of a trust, where the trust has been created by that person or the total value of the assets contributed by that person before or after the creation of the trust amounts, at any time, to twenty percent or more of the total value of the assets of the trust; and

(b) " relative " in relation to a person means—

(i) a parent, son, daughter, brother, sister, niece, uncle, aunt, grandparent or cousin of that person; or

(ii) that person's spouse or the spouse of a person mentioned in sub-item (i).

Prohibition of publication or disclosure of information to unauthorised persons

7. (1) A person shall not, without the consent in writing, given by or on behalf of the Committee, publish or disclose to an unauthorised person, otherwise than in the course of duties of that person, the contents of any document, communication or information, which relates to or which has come to the knowledge of that person in the course of that person's duties under this Act.

(2) A person who contravenes sub-paragraph (1) commits an offence and is liable, upon conviction, to a fine not exceeding two hundred thousand penalty units or to imprisonment for a period not exceeding two years, or to both.

(3) A person who, having any information which to the knowledge of that person has been published or disclosed in contravention of sub-paragraph (1), unlawfully publishes or communicates the information to any other person commits an offence and is liable, upon conviction, to a fine not exceeding two hundred thousand penalty units or to imprisonment for a period not exceeding two years, or to both.

Immunity

8. An action or other proceeding shall not lie or be instituted against a member of the Committee or sub-committee in respect of an act or thing done or omitted to be done in good faith in the exercise or performance of any of the powers or functions conferred under this Act.

SECOND SCHEDULE
(*Section* 148 (1))

SAVINGS AND TRANSITIONAL PROVISIONS

Interpretation

1. In this Act unless the context otherwise requires—

" appointed date " means such date as the Minister shall appoint by statutory instrument;

"Authority" means the Zambia Wildlife Authority established under section *four* of the Zambia Wildlife Act, 1998, before the commencement of this Act; and

Act No. 12 of 1998

" Secretary to the Treasury " means the Secretary to the Treasury appointed under section *six* of the Public Finance Act, 2004;

Act No. 15 of 2004

Winding up of affairs of Authority

2. (1) From the commencement of this Act, the Authority shall exist only for the purpose of winding up its affairs and for no other purpose.

Act No. 15 of 2004

(2) After the commencement of this Act, the Secretary to the Treasury shall, pursuant to section *forty-three* of the Public Finance Act, 2004, constitute a committee consisting of not less than five members, two of whom shall be Government officers, to wind up the affairs of the Authority.

(3) The committee constituted in accordance with subsection (2) shall ensure that—

(a) the assets of the Authority are properly inventoried, valued and disposed of subject to the instructions of the Secretary to the Treasury;

(b) ensure that all debts due to the Authority are properly recovered;

(c) ensure that the claims of all creditors, including employees and tax liabilities, if any, are proved and settled in full;

(d) any balance remaining after the conclusion of transactions referred to in paragraphs *(b)* and *(c)* is credited to Government revenue; and

(e) any asset considered strategic by Government in the public interest reverts to the ownership of the Government at no cost to Government.

(4) Notwithstanding anything to the contrary contained in this Act or in any other written law, the Authority shall, subject to the instructions of the Secretary to the Treasury have, for the purpose of winding up its affairs, power to do anything which is necessary or expedient for the purpose or which is incidental thereto, including in particular, without prejudice to the generality of that power, power to enter into and carry out agreement and arrangements for the transfer of its property, rights, liabilities and obligations to the Government.

(5) When the Minister is satisfied, on the advice of the Secretary to the Treasury, that all necessary agreements and arrangements have been made for the winding up of the affairs of the Authority, the Minister shall, by statutory instrument, order that the Authority be dissolved on such date as may be appointed in the statutory instrument.

Registration of property to be transferred

3. (1) Whenever in pursuance of this Act, any property, rights, liabilities and obligations of the Government through the Authority are deemed transferred to the Government in respect of which transfer a written law provides for registration, the Minister shall make an application in writing to the appropriate authority for registration of the transfer.

(2) The registration authority referred to in sub paragraph (1) shall make such entries in the appropriate register as shall give effect to such transfer and, where applicable, issue to the transferee concerned with a certificate of title in respect of the property or make necessary amendments to the register, as the case may be, and shall make endorsement on the deeds relating to the title, right or obligation concerned and no registration fees or other duties shall be payable in respect thereof.

Transfer of employees

4. (1) On or after the appointed date, the Public Service Commission shall appoint as officers of the Department public officers who were employed on permanent and pensionable conditions of service under the Authority, to continue their service under the conditions of the Public Service Pensions Act. Cap. 260

(2) Where an employee of the Authority is appointed to the Department, the terms and conditions of service with the Department shall not be less favorable than those the employee enjoyed with the Authority.

(3) On or after the appointed date, employees of the Authority who were employed under contract shall have their contracts terminated and be paid their gratuity and terminal benefits payable under the contract, but such employees may apply to the Government for employment.

Legal proceedings

5. (1) Without prejudice to the other provisions of this Act, where any right, liability or obligations vests in the Government by virtue of this Act, the Government and all other persons have the same rights, powers and remedies, and in particular the same rights relating to the instituting or defending of legal proceedings or the making or resisting of applications to any Authority, for ascertaining, perfecting that right, liability or obligation as they would have had if it had all times been a right, liability or obligation of the Government.

(2) Any legal proceedings or application of any authority pending immediately before the commencement of this Act by or against the Government in respect of the Authority may be continued by or against the Government.

(3) After the commencement of this Act, proceedings in respect of any right, liability or obligations which was vested in, held, enjoyed, incurred or suffered by the Government in respect of the Authority may be instituted by or against the Government.

Republic Of Zambia

ZAMBIA'S CONSERVATION STRATEGY AND ACTION PLAN FOR THE AFRICAN LION



Zambia Wildlife Authority

Ministry of Tourism, Environment and Natural Resources

JUNE 2009

CITATION

Zambia's Conservation Strategy and Action Plan for the African Lion

Zambia Wildlife Authority
P/B I
Chilanga
Tel. +260 01 278524
E-mail: info@zawa.org.zm
www.zambiawildlife.org.zm

Policy Technical Team
Mr. Wilbroad C. Chansa
Mr. Chuma C. Simukonda
Mrs. Priscilla Sichone Mukanga
Mrs. Francesca Chisangano Zyambo

Internal Reviewers
Dr. Lewis Saiwana
Dr. Victor M. Siamudaala

External Reviewers
Dr. Henry, K. Mwima, Jastis Consulting Firm
Dr. Harry, N. Chabwela University of Zambia
Dr. Paula White, Lion Conservation
Dr. M. Becker, Large Carnivore Research
Mrs. Dora Kamweneshe WWF
Mr. Steve McBride
Mr. Acme, N. Mwenya

February 2009

APPROVAL PAGE

The Chairperson of the ZAWA Board of Directors approved on behalf of the Government of the Republic of Zambia, the Zambia's Conservation Strategy and Action Plan for the African Lion

.....

Date.....

Dr. Mwenda
CHAIRPESON – ZAWA BOARD OF DIRECTORS

ACKNOWLEDGEMENTS

The Government of the Republic of Zambia through its wildlife agency, the Zambia Wildlife Authority (ZAWA), wishes to applaud the team of experts that coordinated the formulation of this conservation strategy. Undoubtedly, the assignment was taxing and demanded for sacrifice of staff time and other resources. ZAWA is therefore, grateful to its staff for their dedication and enthusiasm during the course of the assignment. Special tribute is paid to Chansa, W., Simukonda, C., Mukanga, P. S. and Chisangano, F.C. for the literature review, write up and providing existing challenges related to the conservation and management of the African lion in Zambia. ZAWA is indebted to the following experts for their insightful and technical review and criticism of the policy which resulted in the finalization of a widely accepted policy. These comprised Dr. Lewis Saiwana and Dr. Victor, M. Siamudaala as internal reviewers and; Dr. H.K. Mwima, Dr. H.N. Chabwela, Dr. Paula White and Dr. M. Becker as external reviewers. Others are Mrs. D. Kamweneshe, Messrs Steve McBride and A.N. Mwenya.

In addition, ZAWA wishes to thank Mrs. Florence Nyambe and Mwape Sampa Nyasah for the secretarial services and management of logistics during the period of the assignment. Chaka Kaumba displayed his outstanding Geographical Information Systems (GIS) skills in preparing the map, for which he is applauded.

The Zambian Government appreciates the financial and material support provided by both the Safari Club International Foundation (SCIF) and the individual safari hunting outfitters in the country towards the completion of the assignment.

LIST OF ACRONYMS

CBD	Convention on Biological Diversity
COP	Conference of the Parties
CITES	Convention on International Trade in Endangered species of Wild Fauna and Flora
CMS	Convention on Migratory Species
CRB	Community Resource Board
DNA	Deoxyribonucleic Acid
GMA	Game Management Area
GIS	Geographical Information System
GPS	Global Positioning System
IUCN	The World Conservation Union
KNP	Kafue National Park
MEA	Multilateral Environmental Agreement
NGO	Non Governmental Organization
NP	National Park
NPWS	National Parks and Wildlife Service
PA	Protected Area
PAC	Problem Animal Control
PHAZ	Professional Hunters Association of Zambia
SADC	Southern African Development Community
SHOAZ	Safari Hunters Operators Association of Zambia
TFCA	Transfrontier Conservation Area
ZAWA	Zambia Wildlife Authority

TABLE OF CONTENTS

CITATION ii
APPROVAL PAGE iii
ACKNOWLEDGEMENTS iv
LIST OF ACRONYMS v
TABLE OF CONTENTS vi
FOREWORD vii
EXECUTIVE SUMMARY viii
1.0 INTRODUCTION 1
2.0 DISTRIBUTION AND POPULATION STATUS OF LION IN ZAMBIA 1
2.1 Factors Determining Present Distribution Patterns 4
2.1.1 Encroachment and Destruction of Habitat 4
2.1.2 Prey density 4
3.0 MAJOR PROBLEMS AND ISSUES RELATING TO LION CONSERVATION IN ZAMBIA 4
3.1 Human – lion conflicts 4
3.1.1 Conflict with Livestock 4
3.1.2 Snaring 4
3.2 Human Encroachment and Destruction of Wildlife Habitat 5
3.3 Inter- and Intra-specific Competition 5
3.4 Population isolation 5
3.5 Lack of protocols for problem lion control 5
3.6 Negative Value Placed on the African Lion 5
3.7 Inadequate Scientific Data on the African Lion 6
3.8 Inadequate Data from Hunting Statistics 6
3. 9 Unknown Impact of Trophy Hunting on Lion Population Structure 6
4.0 MANAGEMENT STRATEGY FOR THE CONSERVATION OF THE AFRICAN LION 7
4.1 Vision Statement 7
4.2 Mission Statement 7
4.3 Goal 7
5.0 OBJECTIVES 7
5.1 Research and Management 7
5.2 Mitigation of Human – Lion Conflicts 9
5.3 Local Community Benefits from Lion Utilisation 10
5.4 Land Use Planning and Zoning 11
5.5 Managing Conservation Politics at Local, National and International Levels 11
5.6 Trade in the African Lion 12
6.0 IMPLEMENTATION OF THE LION CONSERVATION STRATEGY 13
7.0 REVIEW OF LION CONSERVATION STRATEGY 13
BIBLIOGRAPHY ..... Error! Bookmark not defined.
APPENDIX I 15

FOREWORD

The Government of the Republic of Zambia attaches great importance to the conservation and management of the African lion *(Panthera leo* Linnaeus, 1758) because of its immense ecological and socio-economic significance. Ecologically, it plays a critical role in the predator-prey relationship and consequently, in the maintenance of ecological stability. As one of the famous 'big five' it contributes significantly to the national and local economies through various tourism enterprises. In Zambia the African lion is one of the most sought after species by our tourists. Sightings of the lion during game viewing and successful hunt of the lion results generally in overall customer satisfaction and in some cases customer loyalty. Recent publications (Whitman, 2002) indicate that Zambia is among the top four lion-trophy producing countries in the world making it (the lion) an important source of revenue for the country. Currently Zambia's lion strong holds are the protected areas especially National Parks and Game Management Areas (GMAs). And it is expected that this situation will remain like this for sometime given other socio-economic activities outside protected areas such as large-scale commercial farming and mining.

The African lion occupies a central position in Zambia's culture as reflected in many traditional beliefs and cultural art works. Over the years, the lion has emerged as a brand icon among business institutions in the country. Despite its socio-economic significance, the lion has often than not come into conflict with human interests through predation on humans and livestock resulting in loss of human life or permanent injury. In areas where there is no wildlife-based tourism the lion is considered a vermin that needs to be exterminated.

This conservation strategy and action plan for the African lion in Zambia will assist the country in ensuring that the long-term survival of the species is guaranteed based on stakeholder partnerships and harmonization of the needs of lion conservation and various facets of socio-economic development (including tourism). It is hoped that ZAWA will in the foreseeable future provide holistic population estimates and maintain viable populations in all the key lion range areas.

ZAWA is now delighted to launch this Conservation Strategy and Action Plan.

Dr. Lewis Saiwana
DIRECTOR GENERAL – ZAMBIA WILDLIFE AUTHORITY

EXECUTIVE SUMMARY

The African lion, *Panthera leo,* has recently emerged as a species of global conservation concern (McCarthy, 2004) given the precipitous decline of its population from ca. 20,000 – 40,000 (Bauer and van der Merwe, 2002; Chardonnet, 2002) from population about 100,000 lions less than ten years ago (Nowell and Jackson, 1996) over much of its former range (Chardonnet, 2002, Packer et al. 2003). The conservation of the African lion has continued in an environment of inadequate reliable data regarding the current status of the species throughout its range. The continued inadequate and reliable quantifiable information has created difficulties to range states and international organizations such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) whether to continue or suspend the consumptive utilization of the lion as the case was in October 2004 at CITES 13th Conference of the Parties (COP 13) in Bangkok Thailand.

Zambia's centralized geographic location, vast tracts of high-quality habitat, and relatively low rural human population density makes it a potential stronghold for remaining lion populations in southern Africa. Like in many other African countries additional data is required to comprehensively understand the current status of lions in Zambia. There are conflicting statements on the national population estimates with Bauer and van de Merwe estimating the lion population in Zambia at 1,500 $\pm$ 500 individuals whilst Chardonnet (2002) estimated the population at 3,575. These conflicting estimates clearly demonstrate the urgent need of investment in scientific studies to determine the country's (and the region's) lion population[1], its socio-economic significance and identify existing and potential threats to the population and prescribe practical solutions to the challenges.

It is the conviction of the Zambian government that healthy lion populations can support sustainable trophy hunting and subsequently contribute to socio-economic development[2] of rural populations as an incentive for rural communities to tolerate and help conserve the African lion. The government is also mindful that, unsustainable levels of trophy hunting especially the untimely removal of breeding males can trigger lion population decline through social disruption and infanticide. It is against this background that Government through ZAWA wishes to establish a science-based Conservation Strategy and Action Plan for the African Lion. The key areas of focus will include *inter alia* promotion of age-based harvesting of lions and setting of hunting quotas based on empirical biological data in addition to the on-going collection of trophy measurements. Specific issues addressed in this overall framework are:

i. Standardization of lion survey methods and conducting baseline survey of lion numbers;
ii. Setting of sustainable lion off take quotas;

[1] Spatial and temporal occurrence, distribution, and abundance
[2] Employment creation, Community-based conservation enterprises and sharing of revenue between ZAWA and Communities

iii. Monitoring and Evaluation of the Lion Population in the context of existing Conservation and Tourism programmes;
iv. Management of human – lion conflicts based on a Problem Lion Control Protocol;
v. Preparation and implementation of field age determination techniques;
vi. Establishment of DNA mapping database;and
vii. Development of area-specific lion management strategies especially for GMAs.

Zambia's Conservation Strategy and Action Plan for the African Lion was formulated based on stakeholder consultation. The stakeholders involved in the formulation of the document include Government line Ministries, Conservation based Non Governmental Organizations (NGOs), individuals with relevant expertise, and the Private Sector. The proceedings from the National Stakeholders Consultative Workshop provided a framework for the preparation of this document as provided for under the East and Southern African regional lion strategy framework. The strategy identifies major problems and challenges and provides guidelines on how to address them. It is hoped that implementation of this document will help in achieving a viable lion population in Zambia.

1.0 INTRODUCTION

In 2004 at the CITES 13th CoP in Bangkok, Thailand Zambia together with other Southern African Development Community (SADC) countries contested the proposal from Kenya to transfer the African Lion from Appendix II to Appendix I of CITES. Countries in the SADC region committed themselves to assess the current data on the status and distribution of lion in their respective countries and prepare regional and country-specific lion conservation strategies. Zambia has attended all the regional workshops and commissioned a study to assess the status of lion in the country in addition to the formulation of this Conservation Strategy and Action Plan for the African Lion.

The conservation strategy and action plan will improve the management of the species at both national and protected area levels and harmonize the conservation and tourism needs of the lion. It is therefore, in the interest of Zambia as a country to ensure that the lion is protected and viable populations are maintained to enhance biodiversity conservation and support the growing tourism industry and to support local community livelihoods.

In view of the above, ZAWA initiated the process of formulating a National Conservation Strategy and Action Plan as a way of bringing on board other stakeholders and tap into their professional expertise and experience, as well as their capacity to mobilize funds to leverage the long-term conservation of the species. This Conservation Strategy and Action Plan provides a Vision, Mission, Goal and a set of objectives, intended to address management challenges, mitigation of human-lion conflicts, economics and socio-politics and other cross-cutting issues such as international trade.

Additionally the Strategy has a provision for an Action Plan that will guide lion conservation in Zambia for the next ten years or more and will be accompanied by an action plan, which will be reviewed, on a regular basis taking into account contemporary changes in conservation such as regional wildlife protocols, resolutions and decisions from Multilateral Environmental Agreements (MEAs) and the need to comply with such changes that may arise from time to time.

2.0 DISTRIBUTION AND POPULATION STATUS OF LION IN ZAMBIA

Historically, lion occurred throughout Zambia. Prior to 1962 the species was considered a vermin in the country. Consequently, hunters were rewarded for controlling lions that came into conflict with humans. Only lion populations in protected areas especially National Parks were secure from extermination under the Problem Animal Control (PAC) Programme. The protected areas have continued to be the major lion conservation areas in the country. Currently, major lion populations occur in the Luangwa Valley, Kafue and Lower Zambezi Ecosytems - Figure 1 below. Outlier populations are distributed in Liuwa Plains, Sioma Ngwezi and associated GMAs, West Lunga and surrounding GMAs, Nsumbu Mweru wa Ntipa, - Lusenga ecosystem and other adjoining areas.

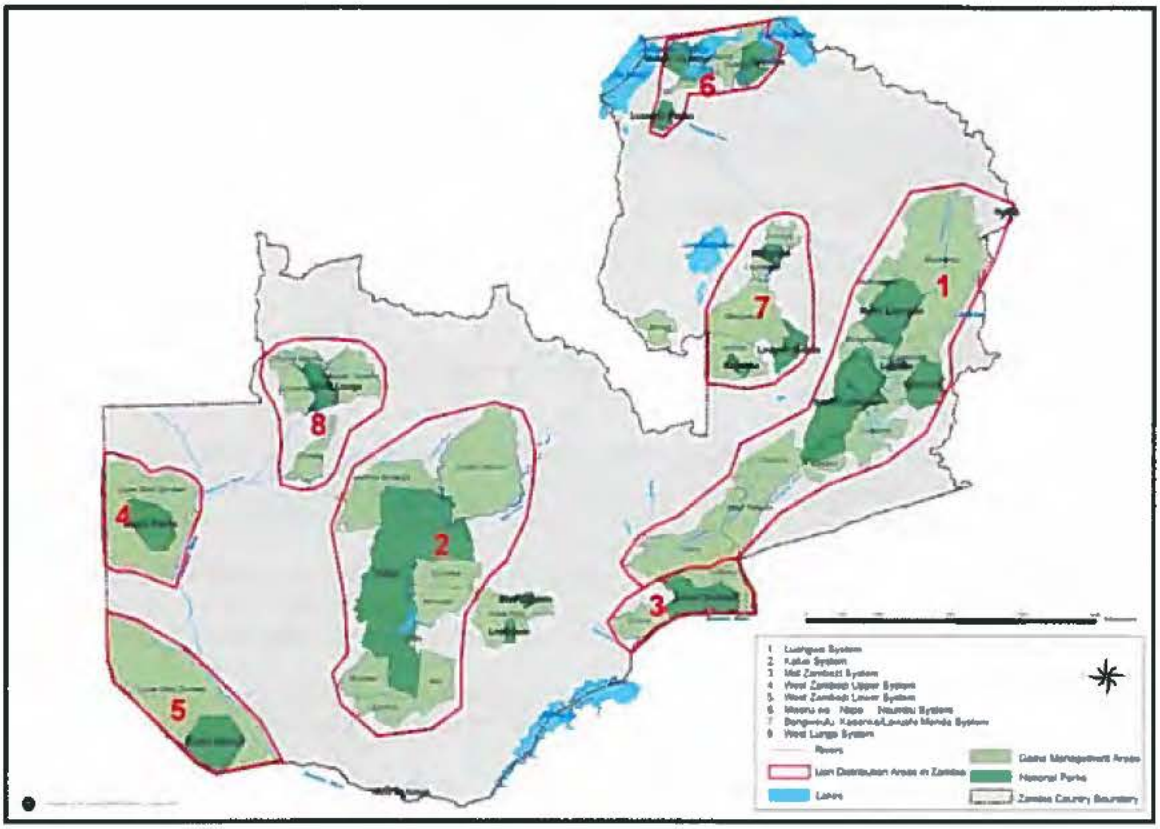


Figure 1 Lion conservation clusters/units in Zambia (Source: ZAWA, 2005)

Table 1: Lion population estimates for the main lion conservation areas

Area	Density (lion per 100 km^2)	Minimum	Estimate	Maximum
North and South Luangwa National Park and adjoining GMAs[a]	4.0	1,143	1,633	2,123
Chisomo, Luano& West Petauke GMAs	1.0	115	165	215
Subtotal	NA	1,259	1,798	2,237
Kafue National Park and surrounding GMAs[b]	1.5	718	1,026	1,334
Lower Zambezi National Park and surrounding GMAs[c]	2.0	128	183	238

(Source: Chardonnet, 2002)

NOTES

[a]This is the most important lion cluster in the country. The population is considered to be healthy and stable particularly along the Luangwa River system and its tributaries and open plains with high densities of prey species. Pride sizes of 15 - 18 animals have been observed in the Mwaleshi River System of North Luangwa National Park (White, personal. comm.).

[b]The Kafue ecosystem covers an area approximately 40,000km^2. Prides of up to 14 members with a mean of seven (7) animals per pride were recorded in 2004. Compared with other large ecosystems in sub-Saharan Africa, the Kafue complex is on the lower side probably due to low densities of the most preferred prey species.

[c]The Zambezi complex is linked to the Luangwa complex through Luano-West Petauke and Chisomo Game Management Areas. Estimates for the Zambezi system are low in comparison with the Luangwa and Kafue systems.

2.1 Factors Determining Present Distribution Patterns

2.1.1 Encroachment and Destruction of Habitat

The most important limiting factor in the distribution of the lion is encroachment on the habitat for both lion and its prey species by human populations, resulting in either loss of habitat and/or in direct conflict with lion. Conversion of natural habitat in GMAs for cropping and grazing of livestock has led to habitat destruction. Inherent with encroachment is increased incidence of poaching of buffalo and other antelopes, which form the food base for lion. Movement of cattle into GMAs which is often facilitated by tsetse fly eradication is likely to exacerbate the human – lion conflict as more live stock is introduced in GMAs.

2.1.2 Prey density

Available evidence indicates that poaching of most prey species and bush meat trade therein combined with continued reduction in wildlife habitat are the major factors affecting the growth of wildlife populations in the country. Proliferation of firearms during the liberation struggle exacerbated poaching whilst continued inadequate funding to ZAWA has continued to constrain its anti-poaching capacity. Limitation in prey species has a direct influence on predator (in this case the African lion) population[3] through predator-prey interaction.

3.0 MAJOR PROBLEMS AND ISSUES RELATING TO LION CONSERVATION IN ZAMBIA

3.1 Human – lion conflicts

3.1.1 Conflict with Livestock

In pastoral areas, livestock-lion conflicts have resulted in increased negative attitude and low tolerance levels towards the lion resulting in some cases to its extermination as the case was on the Kafue Flats. Increased livestock populations in Game Management Areas will increase the incidence of both livestock-lion and human – lion conflicts. In most cases local communities have responded to these conflicts by poisoning the lion as part of their own PAC programme.

3.1.2 Snaring

Lion poaching is not common as most local communities poach for meat. However, lions often get caught up in wire snares set to catch antelope species. In most cases lions that have survived snaring become a menace to livestock and humans as they are no longer

[3] In terms of both temporal and spatial composition and structure

able to hunt game. Consequently, ZAWA has opted to kill such lions under its PAC programme as such lions are of little value[4] to the tourism industry.

3.2 Human Encroachment and Destruction of Wildlife Habitat

Unplanned human settlement in GMAs and encroachment on National Parks is one of the major long-term threats to lion survival as these result in the destruction and reduction in the size of available habitat for the lion and its prey species. Increased human populations have resulted in increased demand for more land for agriculture and loss of wildlife habitat in GMAs. Lack of General Management Plans (GMPs) in many GMAs has exacerbated the rate of human encroachment and loss of the wildlife habitat.

3.3 Inter- and Intra-specific Competition

Studies such as those by Purchase (2004) on lion feeding behaviour have shown a high degree of dietary overlap between lion and hyaena. Prides lacking males are particularly prone to kleptoparasitism from hyaena, and high numbers of hyaena can suppress lion population under such circumstances. Unsustainable harvesting of pride males may expose prides to high levels of kleptoparasitism. A quick turn over of males in a pride would also slow down the population growth rate as new males have the tendency of killing cubs sired by the previous males.

3.4 Population isolation

Destruction of wildlife corridors has resulted in most protected areas becoming ecological. Isolated populations in the long term experience loss of genetic variability[5].

3.5 Lack of protocols for problem lion control

Zambia has no protocol or guidelines on the management of problem animals including the lion. Consequently, ZAWA often opts to kill problem animals which is generally destructive and incompatible with overall conservation goals when compared to translocation and treatment of problem and injured lions respectively.

3.6 Negative Value Placed on the African Lion

Continued loss of livestock and human life has compelled local communities to consider the African lion as a vermin that needs to be exterminated despite its tourism value and community income from lion trophy hunting, which benefits communities in areas with CBNRM, programmes. Livestock as a private resource is considered more valuable both at individual and society levels compared to the lion, a public resource. Consequently, more value is placed on livestock compared to the lion.

---

[4] Due to loss of limbs or other body injuries

[5] Loss of heterozygosity, low allele richness and population bottlenecks

3.7 Inadequate Scientific Data on the African Lion

There is inadequate scientific data on the African lion in terms of population size and structure both at spatial and temporal scale in the country. Existing data is based on limited studies done in isolated protected areas, indices obtained from trophy hunting and limited reports from the field staff and tour operators. In the absence of empirical data setting of off-take quotas for the lion has continued to be controversial with Safari Hunting Operators always demanding a higher quota while the non-consumptive tour operators contest that hunting would reduce lion populations and negatively affect the non-consumptive tourism and have always tried to lobby for a moratorium on lion hunting.

Since 2004, Zambia has made notable progress in assessing its lion populations as requested by IUCN. Efforts include collection of empirical data through various field research studies[6] in protected areas, and the analysis of the trophy hunting industry. Furthermore, Government through ZAWA is working at addressing the issue of problem animal control and habitat conversion including human encroachment in GMAs. ZAWA and the hunting industry continue to work closely with independent researchers under the Zambia Lion Project (ZLP) to ensure that the studies are designed to address both the biological and contemporary issues related to the conservation and management of the lion in the country. The studies will contribute to future improvement of the national lion management plan aimed at enhancing science-based conservation of the species in order to secure the long-term survival of the African lion populations in Zambia.

3.8 Inadequate Data from Hunting Statistics

There is inconsistence in the collection of data at temporal scale and in terms of measurable variables making it difficult to assess trophy quality trends in the country.

3. 9 Unknown Impact of Trophy Hunting on Lion Population Structure

In the absence of empirical data it is difficult to ascertain the actual impact of trophy hunting on the lion population structure. It is however, generally accepted that unregulated trophy hunting would on a long-term have negative impact on the species population through removal of pride males resulting in increased rate of infanticide within the pride as each new coalition of males frequently kill available cubs. In areas with significantly higher hyena populations removal of pride males could result, as shown by studies elsewhere, into strong inter-specific competition between the lion and hyena for food. Lionesses are easily dominated by groups of hyena and it is generally the pride males, which defend the prides from the hyaena.

[6] Surveys of lion distribution and abundance throughout Zambia; Identification of potential corridors between lion populations in Zambia and those in neighboring countries; Profiling of genetic diversity of Zambia's lions and Development of age-based trophy selection program

4.0 MANAGEMENT STRATEGY FOR THE CONSERVATION OF THE AFRICAN LION

The Lion Conservation Strategy was formulated and adopted during the multi stakeholder workshop held in December 2008.

4.1 Vision Statement

To have a secure, viable and well managed wild population of the African lion that will support sustainable tourism[7] and conservation of biodiversity including genetic diversity in harmony with human development.

4.2 Mission Statement

To galvanize stakeholder co-operation[8] in the conservation and management of the African lion populations in its natural habitats in the country thereby contributing to biodiversity conservation, socio-economic development and spiritual well being of the local communities, the general public and the country as a whole.

4.3 Goal

To secure, restore and maintain viability and genetic diversity of lion populations.

5.0 OBJECTIVES

The objectives of the conservation strategy are grouped into seven (7) major thematic subjects namely Research and Management; Mitigation of Human – Lion conflicts; Local community benefits from Lion Utilisation; Land Use Planning and Zoning, Management of the Conservation Politics at national and international levels and Trade in the African Lion.

5.1 Research and Management

The specific objectives and set targets are discussed below.

Objective 5.1.1: To Ensure Effective Protection and Management of the Lion Populations and their Habitat

[7] Consumptive and non-consumptive tourism
[8] Government, Local Communities, Private Sector (including land owners) and Cooperating Partners

Target (1): Effective Research and Monitoring Programmes Established in all Lion Conservation Clusters/Units within the next Five Years

Activities:

i. Identify key lion research areas and parameters for research and monitoring.
ii. Create technical (research) and financing partnerships with individuals and organizations
    a) Undertake resource mobilization through submission of project proposals for funding.
iii. Build requisite capacity for Lion Conservation including research and monitoring
    a) Procure necessary research equipment and facilities;
    b) Establish research out posts;
    c) Formulate field data forms; and
    d) Establish and maintain database.
iv. Undertake research and monitoring including lion population surveys.
v. Review extent /size, viability and prioritize lion conservation clusters/units.
vi. Publish results/Disseminate information.

Target (2): Research on Lion Ecology, Population Dynamics Implemented in all Lion Clusters within Ten (10) Years

Activities:

i. Prepare cost estimates and project proposals for funding.
ii. Prepare field manual identifying key ecological parameters and other related research needs.
iii. Standardize methodology for research and monitoring in all lion clusters and the sub region particularly in cases where collaborative research is required.
iv. Conduct research on the identified parameters.
v. Facilitate new and ongoing lion studies.
vi. Publish results/Disseminate information.

Target (3): Facilitate Capacity Building Programs for Lion Conservation Within the Framework of Lion Research and Monitoring

Activities:

i. Identify institutional and national needs.
ii. Prepare cost estimates and project proposal for funding.
iii. Lobby with Local Universities to assign postgraduate students to undertake conservation related research studies.
iv. Identify other regional training centers where staff can acquire relevant skills.
v. Implement capacity building programmes.

Target (4): Establish Science-based Lion Off-take Quota Setting System, and Monitoring of Trophy Quality and Impact of Trophy Hunting on Lion Populations within Three (3) Years

Activities:

i. Review lion quota setting and trophy hunting practices used in the eastern and southern African sub regions.
ii. Based on the review above, formulate and implement a comprehensive quota setting system and trophy hunting practices.
iii. Prohibit canned lion hunting.
iv. Prohibit use of prerecorded sounds in lion hunting as bait.
v. Review lion licensing procedures.
vi. Develop and implement standardized lion data forms.
vii. Conduct regular training workshops for Wildlife Police Officers, escort staff, and Professional Hunters as primary sources of lion data.
viii. Formulate and implement punitive measures against Professional Hunters harvesting under age lions.

Target (5): Lion Action Plans Developed for all Lion Conservation Clusters/Units within Three (3) Years

Activities:

i. Based on the National Lion Conservation Strategy framework, develop cluster specific lion action plans within three years.
ii. Advocate for support from line Ministries, Public and Private Institutions, Non Governmental Organisations (NGOS), cooperating partners and the general public regarding funding for the implementation of lion action plans.
iii. Develop as part of the action plans cluster specific law enforcement strategies to reduce poaching of prey species for the lion with a focus on the most important species of the African buffalo, zebra and antelope species.

5.2 Mitigation of Human – Lion Conflicts

There is an urgent need to develop and implement a comprehensive package of adaptive and mitigation measures against lion-human conflicts in order to secure the goodwill of the public on whom the long-term survival of the lion depends.

Objective 5.2.1 To minimize and where Possible Eliminate Human – Lion Conflicts

Target (1): Comprehensive Database on all Human – Lion Conflicts Established within Three (3) Years

Activities:

i. Compile all the available literature on human – lion conflicts.
ii. Identify and map all human – lion conflict hot spots.
iii. Develop and maintain database.
iv. Prepare field manual on how to mitigate lion attacks and distribute to identified hot spots.

Target (2): Incidents of Human – Lion Conflicts Reduced by 25% and Retaliatory Killing of Lion Reduced by 50% within Five (5) Years

Activities:

i. Develop broad based national education and awareness campaign on lion conservation.
ii. Conduct education and awareness campaigns in tandem with other mitigation measures.
iii. Develop and implement a comprehensive package of mitigation measures;
iv. In collaboration with the livestock sector, develop mechanisms to reduce livestock predation by lions.
v. In collaboration with CRBs, develop incentives for communities to use legal PAC methods.
vi. Build capacity in all CRBs located in lion conservation clusters/units to deal with certain cases of human – lion conflicts.
vii. Collaborate with partners such as civil society, NGO's and the media and artists in disseminating lion conservation information as part of a wider environmental education.

5.3 Local Community Benefits from Lion Utilisation

Under the current co-sharing of hunting revenues the local communities are not fully aware of the individual species contribution to the 50% revenue share allocated to them by ZAWA. Furthermore, local communities do not incur any hunting transaction costs including those related to PAC under the current CBNRM programme in GMA's. There is need to share both costs and benefits in order to sustain the PAC programmes.

Objective 5.3.1: To Equitably Distribute Costs and Benefits arising from the Conservation and Management of the Lion

Target (1): Strategy for Sharing Costs and Benefits with CRBS arising from Lion Conservation Developed and Implemented within Three (3) Years

Activities:

i. Conduct an inventory of all CRBs in hot spots and other lion conservation clusters/units.
ii. Analyze the contribution of lion hunts to the overall trophy fees per CRB.
iii. Identify and analyze impacts of human – lion conflicts on each stakeholder group.
iv. Analyze costs involved in each PAC technique.
v. Devise methodology for sharing costs of implementing PAC.
vi. Delegate some PAC issues to CRBs.

5.4 Land Use Planning and Zoning

Unplanned human settlement and other land use activities in GMAs is one the major threats to the long-term survival of the lion. Elimination of tsetse flies and subsequent increase in pastoralist activities in GMAs places the lion under renewed direct conflict with human interests. It is therefore, important that each GMA has a General Management Plan (GMP) developed through a participatory process prescribing appropriate land use zones. It is anticipated that the GMP's will enhance community responsibility towards wildlife conservation in general and that of the lion in particular.

Objective 5.4.1: To develop and Implement General Management Plans in GMAs and Selected Open Areas with established CRBs

Target (1): General Management Plans for GMAs which are Lion Conservation Clusters/Units Developed within Five (5) Years

Activities:

i. Prepare cost estimates and project proposal for funding.
ii. Develop GMPs through a participatory approach.
iii. Zone areas in GMAs and establish specific land use zones including lion conservation needs.
iv. Monitor and evaluate implementation of such plans.
v. Review such plans within the framework of adaptive management.
vi. Where the lion cluster straddles into another country, synchronize with the relevant SADC wildlife protocols or adopt the basic principles in the concept of Transfrontier Conservation area (TFCA).

5.5 Managing Conservation Politics at Local, National and International Levels

Zambia like many other countries in the southern African sub region supports the concept of sustainable utilisation as way of generating income for conservation and support of local community integrated development programmes. It is therefore, important to ensure that such national interests are not in conflict with MEAs to which Zambia is a signatory.

Objective 5.5.1: To Ensure that the Local Policies, Regional and International Policy Frameworks are in Support of the Sustainable Utilization of the Lion

Target (1): Local Policies, Regional Policies and Protocols and Global MEAs are not Conflicting with the National Sustainable Use Concept

Activities:

i. Identify all local policy frameworks that are relevant to lion conservation.
ii. Collaborate with such institutions mandated to ensure harmony in implementing such policies.

iii. Lobby for the establishment of a national MEA forum/committee for exchange of information and formulating national positions at COPs, which do not conflict with national interests.
iv. Attend all CoPs for MEAs relevant to Zambia such as CITES, CBD, CMS and others and ensure that decisions are not in conflict with the principles of the national lion conservation strategy;
v. Actively participate in all SADC wildlife fora.
vi. Encourage establishment of TFCAs in lion conservation clusters near international borders to avert issues of lion population isolation.

5.6 Trade in the African Lion

Lion trophies are among the most valued trophies from sport hunting and contribute a significant proportion of game trophies exported from Zambia. Export of live specimens for zoos and captive breeding facilities are not common but given the current trends in science and the need to enrich populations experiencing loss of genes, export of live specimens cannot be ruled out. At national level, there are unknown volumes of trade in lion parts and derivatives, mainly for hunting charms, or magic and medicinal purposes. Further investigation is required to identify other uses.

Objective 5.6.1: To Prevent Illegal Trade in Lion and Lion Derivatives at Local and International Levels whilst Promoting and Safe Guarding Sustainable Legal Trade of the Lion and its Derivatives

Target (1): Existing Subsidiary Legislation Reviewed and Amended to Cover Issues Related to Ownership and Trade of the Lion (and its Derivatives) both at Local and International Levels

Activities:

i. Collaborate with various traditional and cultural institutions and other organizations such as the Traditional Healers Association of Zambia (THAPAZ) to prevent illegal local trade in lion specimens.
ii. Collaborate with the Chair of the House of Chiefs regarding lion trophies kept by traditional leaders.
iii. Issue certificate of ownership to Traditional leaders with legally acquired lion trophies.
iv. Train ZAWA officials and other Law Enforcing Officers[9] in the identification of lion specimens.
v. Work with the research and academic institutions in the genomic mapping/profiling of the lions in Zambia;
vi. Support the domestication of CITES in the national legislation.
vii. Prepare guidelines on the identification of lion specimens.

[9] Customs Officials, Immigration officers, Zambia Police officers, and Other relevant law enforcement personnel

viii. Collaborate with the CITES unit to provide awareness information at entry/exit ports.
ix. Coordinate with other parties on non – detriment findings.
x. Develop lion DNA mapping protocol in collaboration with stakeholders to identify lion products and derivatives to enhance forensic investigations.

6.0 IMPLEMENTATION OF THE LION CONSERVATION STRATEGY

The effective and successive implementation of the national lion conservation strategy is based on the following assumptions:

i. That the Zambia Wildlife Authority Board of Directors will approve the strategy and drive the process of securing funds for its implementation.
ii. That the cooperating partners will adopt and fund relevant components of the strategy.
iii. That the Safari Hunters association of Zambia representing the consumption tourism sector and the non-consumptive tourism operators will provide the needed financial and moral support to implement the strategy.
iv. That the traditional leaders cooperate in declaring lion trophies in their possession and obtain Gratis Certificate of Ownerships.
v. That all lion management, research and monitoring programmes in Zambia will be guided by this strategy.
vi. That ZAWA will succeed in attracting financial support to establish and maintain medium to long-term Carnivore Research and Monitoring.
vii. That individuals, NGOs, and academic institutions will take interest in carrying out lion research in Zambia.
viii. That the southern African sub region, and the lion specialist group of IUCN will officially adopt the document as being part of the Conservation strategy for the lion in Eastern and Southern Africa.

It is hoped that the national lion conservation strategy will form a basis for the development of cluster specific lion management plans. The conservation community is hereby urged to provide financial and moral support for the implementation of this strategy.

7.0 REVIEW OF LION CONSERVATION STRATEGY

This lion conservation plan will be reviewed every five (5) years from the date of approval, but will remain in force until the reviewed plan is approved.

REFERENCES

Bauer, H. and van der Merwe, S. 2004. *Inventory of free ranging lions Panthera leo* in Africa. *Oryx 38, 26-31.*

Bauer, H. and S. van der Merwe S. 2002. *The African Lion Database*. The African Lion Working Group, IUCN/SSC.

Chardonnet, P (ed.) 2002. *Conservation of the African lion: contribution to a Status Survey.* Int. Foundation for the Conservation of Wildlife, France & Conservation Force, USA. 169 pp.

McCarthy, T. 2004. *Nowhere to roam.* Time Magazine. 23 August 2004: 44-53pp.

Nowell, K. and P. Jackson. 1996. *Wild Cats. Status.* Survey and Conservation Action Plan. IUCN/SSC Cat Specialist Group. IUCN, Gland, Switzerland. 382pp.

Packer, C., R. Hilborn, A. Mosser, B. Kissui, M. Borner, G. Hopcraft, J. Wilmshurst, S. Mduma, A.R.E. Sinclair. 2005. Ecological change, group territoriality, and population dynamics of Serengeti lions. *Science 307,390-393.*

Purchase, K.G. 2004. *Factors affecting the ratio of lions (Panthera leo) to spotted hyaenas (Crocuta crocuta) in protected areas of Africa:* Competition and/or available prey. Ph. D. Thesis University of Aberdeen.

Whitman, K.L. 2002. *Safari hunting of lions: a review of policies, practices, and industry concerns.* Pp. 111-124 In: Proceedings of the 2nd Meeting of the African Lion Working Group, H.O. De Waal, (ed.), 9-10 May 2002. Willem Pretorius Game Reserve, FS, RSA. African Lion Working Group, Brandhof, RSA.

APPENDIX I

National Workshop Participants

Date of Workshop: Friday 12th December 2008

Venue: Fair View Hotel, Lusaka

List of Participants

	Name	Title	Station	Contact No.
1	Pope, J.	Director	Luangwa Safaris	0955 919530
2	Bell-Cross, B.	Director	Prohunt Safaris	0979 523320
3	Pope, R.	Managing Director	Luangwa	0955 919530
4	Becker, M (Ph.D.)	Manager AWDC	Luangwa	
5	Paula, W. (Ph.D)	Lion Researcher	ZLP	0978 093693
6	Mkanda, F. (Ph.D)	Park Manager	ZAWA Ngoma	0977 771077
7	Nkole, A.	Area Warden	ZAWA KNP (North)	0955 991074
8	Sakala, G.	Chifunda CRB	Chifunda	
9	Mwanamwobeda, W.	Kasempa CRB	Kasempa	097782955332
10	Namukonde, N.	Ecologist	ZAWA KNP (North)	0978 695289
11	Mwenya, A .N.	Former Director	Makeni	0966 669411
12	Chardonnet, P. (Dr.)	IGF Foundation	France	
13	Milanzi, J.	Ag. Regional Manager	ZAWA Mumbwa	0977 106559
14	Stromach, N.	WWF ZCO	Ireland	+3558684128922
15	Mwima, H. (Ph.D.)	Chairman NRCF	Lusaka	0966 766718
16	Nkhoma, R.	Area Warden	ZAWA Chirundu	0977 438477
17	M'soka, J.	Ecologist	ZAWA Chirundu	0955 927367
18	Chansa, W.	Head of Research	ZAWA Chilanga	278365
19	Kayeyi, H.	Area Warden	ZAWA Mpika	0977 104123
20	Mcbride, C. (Ms)	Lion Researcher	KNP	0977 414871
21	Mcbride, C. (Mr.)	Lion Researcher/Tour Operator	KNP	0977 767416
22	Phiri, M.	Journalist (Post)	Lusaka	0978 263324
23	Randera, R.	Director	Lusaka	0955 1771998
24	Asherwood, K.	Chairman SHCAZ	Lusaka	224672
25	Sikazwe, J.	Head of Information	ZAWA Chilanga	0966 736066
26	Changwe, K.	Regional Manager	ZAWA Kasama	0977 445585
27	Sichone, P.	Ecologist	ZAWA Mfuwe	0977 786785
28	Phiri, J.	Country Coordinator	WWF Lusaka	0977 885825
29	Kahimbinga, B.	PR	Lusaka	0977 794265
30	Mooka, C.L.	Professional Hunter	Lusaka	0966/0977 809288
31	Haamunji, L.	Journalist	Zambia Daily Mail	0979 427262
32	Nyirenda V.R.	Executive Assistant	ZAWA Chilanga	0977 352035
33	Matokwani, E.	Director – Conservation & Management	ZAWA Chilanga	0977 214322
34	Saiwana, L. (Ph.D.)	Director General	ZAWA Chilanga	0979 590422
35	Muleya, Z.	Head of Planning	ZAWA Chilanga	0977 718282
36	Musonda, P.	Relief Management Secretary	ZAWA Chilanga	0955 0977 547932
37	Nyambe, F.	Administrative Assistant	ZAWA Chilanga	0977 743209

The Safari Club International provided financial support for the preparation and printing of this lion conservation strategy.

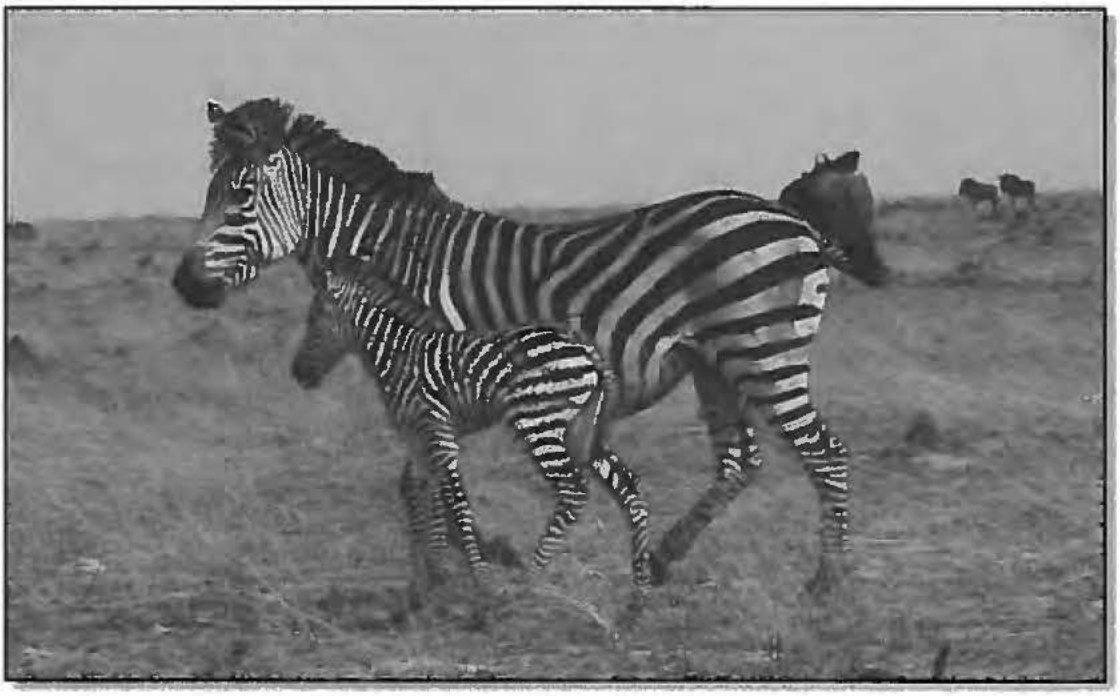
Cartographic and GIS: Zambia Wildlife Authority, Department of Information.

REPUBLIC OF ZAMBIA

MINISTRY OF TOURISM AND ARTS

REPORT ON THE 2015 AERIAL CENSUS OF ELEPHANTS AND OTHER LARGE MAMMALS IN ZAMBIA

Volume II: Population Estimates and Statistics for other large mammals and birds



APRIL 2016

Department of National Parks and Wildlife
Research Unit
Private Bag 1
Chilanga
Email: info@zawa.org.zm

The 2015 aerial survey of elephants and other large mammals in Zambia was commissioned by the Zambia Wildlife Authority (ZAWA) now Department of National Parks and Wildlife (DPNW).

Funding: Funding for the aerial survey was provided by the Paul G. Allen Family Foundation through Vulcan Philanthropy as part of the African Great Elephant Census.

Copyright: 2016 Department of National Parks and Wildlife, Chilanga, Zambia

Reproduction of this publication is prohibited without prior written permission of the copyright holder.

Citation: DPNW (2016), Report on the 2015 aerial census of elephants and other large mammals in Zambia: Volume II Population estimates for other large mammals and birds, Department of National Parks and Wildlife, Chilanga, Zambia

Cover Photo: Plains Zebra (*Equus burchelli*), Liuwa Plain National Park. Photo by Jassiel M'soka

Maps by Chaka Kaumba Senior GIS officer, DNPW

Report Compiled by Jassiel M'soka

REVIEWERS

Jones K Masonde, Principal Ecologist, DNPW

Griffin Shanungu, Senior Ecologist, DNPW

Rhoda Kachali, Senior Ecologist, DNPW

Twakundine Simpamba, Senior Ecologist, DNPW

VOLUME II

POPULATION ESTIMATES AND STATISTICS FOR OTHER LARGE MAMMALS AND BIRDS IN ZAMBIA

SUMMARY

During September 2015 the Zambia Wildlife Authority carried out an aerial survey of elephants and other large herbivores, wild and domestic, in four Zambian ecosystems. A total area of 84,859 km^2, representing 37% of Zambia's protected area network was sampled at an average intensity of 8%. Fixed-wing aircraft were used to conduct transect surveys over the entire survey area.

The main objective was to estimate numbers and distribution of African elephants and the associated elephant carcasses, but other large wild mammals and birds within the survey area were recorded. This report presents the estimates of the other large mammals and birds counted during the survey. Population estimates of elephants are presented in volume I.

Some large herbivores are not easily seen from the air and their numbers were undoubtedly underestimated. Nevertheless, population estimates are given for these species, because the estimates provide useful indices of abundance (with measures of precision) that can be used to determine spatial distribution, as well as temporal trends in population number. No corrections have been applied to any of the estimates to compensate for any undercounting or missed animals.

The areas covered during the surveys are:-

- Luangwa ecosystem (32,819 km^2), comprising the North and South Luangwa, Luambe and Lukusuzi National Parks, Mukungule, Musalangu, Munyamadzi, Lumimba, Lupande and Sandwe Game Management Areas (GMAs);
- Kafue ecosystem (45,030 km^2) comprising the Kafue National Park and the 9 surrounding GMAs except Bbilili.
- Sioma Ngwezi National Park (4,482 km^2)
- Lower Zambezi Valley (2,528 km^2) comprising the valley sections of the Lower Zambezi National Park, Chiawa and Rufunsa GMAs.

Mosi-au-tunya, Liuwa Plains, West Lunga, Kafue flats, Blue Lagoon, Nsumbu, Mweru Wa Ntipa, Lusenga Plains, Isangano, Lavushi Manda, Kasanka and Nyika National Parks with their surrounding Game Management Areas were not covered. Therefore, the total estimates of wild large herbivores presented in this report do not necessarily represent the total for the whole country.

The estimated population numbers of the primary large herbivores in the country were; Buffalo 43715 (95% confidence Interval (CI) 26877 – 60554); Eland 2530 (CI 283 - 4777); Hartebeest 6957 (CI 4753 - 9162); Kudu 3383 (CI 2448 - 4318); Roan 6261 (CI 4121 - 8401); Sable 14874 (CI 11061 - 18686); waterbuck 9927 (CI 6287 - 13567); blue wildebeest 2955 (CI 630 - 5280); Cookson's wildebeest 3753 (CI 1558-5948); zebra 10768 (CI 6426 - 15110).

Of the seven national parks surveyed domestic livestock were only recorded in the Kafue and Sioma Ngwezi National Parks.

TABLE OF CONTENTS

SUMMARY 4
1.0 INTRODUCTION 7
2.0 METHODS 7
2.1 Survey Design 7
2.2 Stratification 7
2.3 Data Analysis 7
3.0 RESULTS AND DISCUSSION 8
3.1 General 8
3.2 Countrywide Estimates 9
3.3 Kafue Ecosystem 9
3.3.1 Kafue National Park 11
3.4 Luangwa Ecosystem 16
3.4.1 South Luangwa National Park 18
3.4.2 Luambe National Park 19
3.4.3 North Luangwa National Park 23
3.4.4 Lukusuzi National Park 23
3.5 Lower Zambezi Valley 25
3.5.1 Lower Zambezi National Park 25
3.6 Sioma Ngwezi National Park 28
3.7 Domestic Livestock 31
3.8 Birds 32
3.9 Other Species 33
4.0 CONCLUSION AND RECOMMENDATIONS 34
5.0 REFERENCES 35
APPENDIX I - Methods 36
Survey design 36
Selection of transects 37
Data collection 39
Data analysis 41
Mapping wildlife distribution 43
APPENDIX II - Results by stratum 43
Kafue Ecosystem 44
Luangwa Ecosystem 50
Lower Zambezi 55
Sioma Ngwezi 56

LIST OF TABLES

Table 1. Population estimates and statistics for large herbivores in Surveyed Area 9
Table 2. Overall population estimates and statistics for the Kafue Ecosystem 11
Table 3. Population estimates and statistics of large herbivores in KNP and GMAs 12
Table 4. Overall population estimates for the Luangwa ecosystem 17
Table 5. Population estimates and statistics for large herbivores in Luangwa Ecosystem Parks and GMAs 18
Table 6. Population estimates for South and North Luangwa National Parks 19
Table 7. Population estimates for Luambe and Lukusuzi National Parks 21
Table 8. Overall population estimates and statistics for the Lower Zambezi Valley 25
Table 9. Population estimates for LZNP and GMAs 26
Table 10. Population estimates and statistics for Sioma Ngwezi National Park 28
Table 11. Population estimates and statistics for domestic livestock 31
Table 12. Population estimates and statistics for large birds 32
Table 13. Other species seen in sample transects 33

LIST OF FIGURES

Figure 1. Survey Areas 8
Figure 2. Kafue ecosystem survey strata 10
Figure 3. Comparison of species abundance between Kafue National Park and the GMAs in the Kafue ecosystem 12
Figure 4. Population trends for selected species in the Kafue National Park for the period 2006 - 2015 13
Figure 5. Sable distribution in the Kafue ecosystem 14
Figure 6. Hartebeest distribution in the Kafue ecosystem 14
Figure 7. Luangwa Ecosystem survey strata 16
Figure 8. Species abundance in the Luangwa ecosystem. National Parks vs GMAs 18
Figure 9. Impala, puku and zebra populations trends in Luambe National Park for the period 2009 - 2015 20
Figure 10. Buffalo distribution in the Luangwa valley 20
Figure 11. Population trends for selected species in the South Luangwa National Park 2002 - 2015 22
Figure 12. Human activities in Lukusuzi National Park 23
Figure 13. Population trends for selected species in NLNP 24
Figure 15. Lower Zambezi Valley Survey Strata 25
Figure 16. Buffalo and Impala distribution in the Lower Zambezi Valley. Note the difference in the distribution of the two species 26
Figure 17. Population trends for selected species in the Lower Zambezi National Park 2003 - 2015 27
Figure 18. Sioma Ngwezi National Park Survey Strata 28
Figure 19. Eland distribution in Sioma Ngwezi National Park 29
Figure 20. Common duiker distribution in Sioma Ngwezi National Park 29
Figure 21: Population trends for selected species in Sioma Ngwezi National Park 30

1.0 INTRODUCTION

This report presents the results of the 2015 dry season aerial survey of large herbivores and selected large birds in Zambia's protected area network. The survey was conducted between 4th and 26th September 2015 and covered 36.6 % (84, 859.3 km^2) of Zambia's protected area network. The areas covered in the survey included: (1) the Luangwa ecosystem – comprising the South Luangwa, North Luangwa, Luambe and Lukusuzi National Parks and adjoining Game Management Areas; (2) Kafue ecosystem comprising the Kafue National Park and its surrounding Game Management Areas (GMAs); (3) the Lower Zambezi valley and (4) Sioma Ngwezi National Parks (Figure 1). The survey was part of the Great Elephant Census covering the main elephant range in East, Central and Southern Africa funded by the Paul G. Allen Family Foundation through the Vulcan Incorporated.

2.0 METHODS

2.1 Survey Design

The survey procedure was based on a well-established standardized wildlife aerial survey approach as described by Norton-Griffiths 1978. This survey was optimised for counting elephants in their known range in Zambia. Thus, counting and estimation of other large mammals and large birds were limited to areas of high elephant densities. However, the range of other large mammals far exceeds the elephant range and thus estimates of large mammals are underrepresented in this current design. Other elephant range areas such as Nsumbu and West Lunga NPs and surrounding GMAs were not included in the survey due to budgetary limitations. The Liuwa Plain National Park, Bangweulu wetlands and Kafue flats which hold significant numbers of blue wildebeest, black lechwe, Kafue lechwe, and plains zebra were not included in the surveys. Therefore, the estimates of large mammals do not necessarily represent the total for the whole country.

Flights were in Cessna 182 and 206 aircraft at a nominal height of 300 feet above the ground, with a total nominal transect strip-width of 300m. Details of methods are provided in Appendix I.

2.2 Stratification

Strata were selected to cover known elephant densities illustrated in previous survey reports (Dunham & Simwanza, 2002; Dunham, 2004; Masonde & Simpamba, 2006; Viljoen, 2007; Chase & Griffin, 2008; Simukonda, 2008; WCS, 2009; Frederick, 2011; Simukonda, 2011; Chase, Nyirenda & Sitali, 2013; Viljoen, 2013; Frederick, 2013). The strata comprised the core elephant range, and the marginal wildlife areas which were expected to contain other wildlife species and few elephants (Figure 1). It was considered important to include the marginal areas to confirm that most of the elephant range was covered by the survey. It is for this reason that protected area boundaries were not used as a basis for stratification.

2.3 Data Analysis

Population estimates and confidence intervals for each stratum were calculated based on Jolly's (II) 1969 method for unequal-sized sampling units (Norton-Griffiths 1978). Population estimates for each ecosystem was further calculated as the sum of the estimates for the individual strata within the ecosystem.

Although protected area boundaries were not the basis for stratification, GIS analysis was used to present population estimates for the national parks within the areas surveyed. This was done

by determining in which national park that each sighting occurred and separating data sets for each area, then re-analysing with the same strata and transects as mentioned in the above paragraph. By re-analysing the data in this way the total for the ecosystems did not change because the sampling intensities remained the same.

To evaluate population trends for large herbivores in each of the ecosystems, a literature search was done to collect data on population estimates from the 2002 to date. The data was analyzed by linear regression where the population estimates taken as the dependent variable and the time as the independent variable. The analysis was done in program R (R Development Core Team, 2013).

A detailed description of the design, implementation and technical details of this aerial survey are extensively elaborated in Part 1 of the report on the 2015 Aerial survey in Zambia (DNPW, 2016).

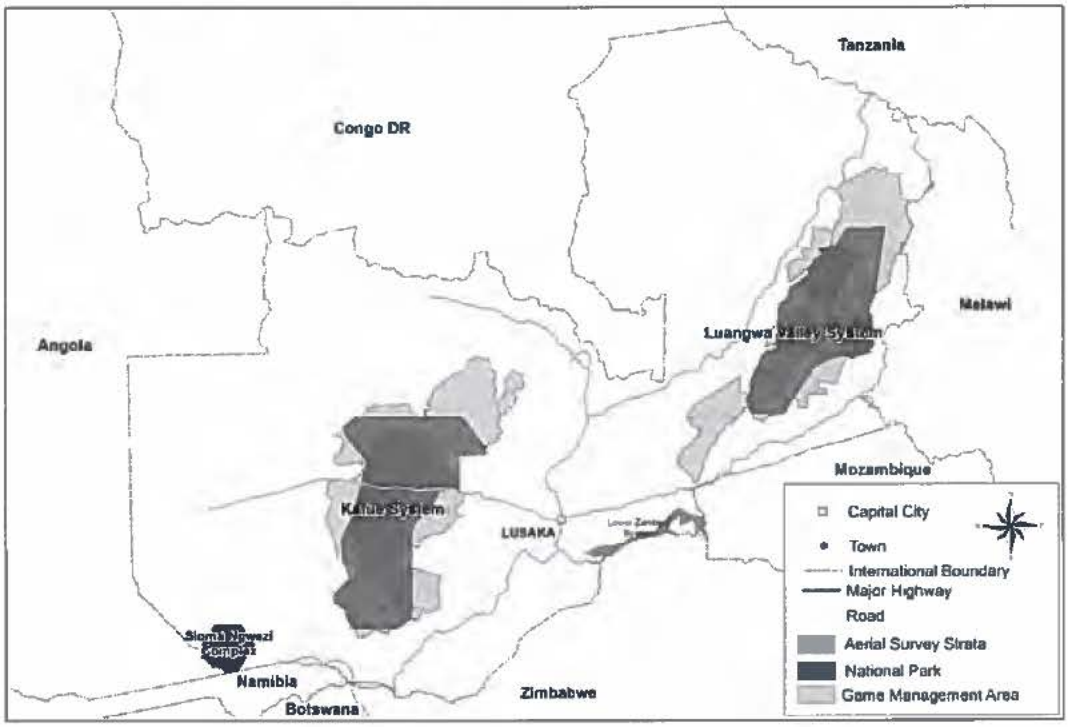


Figure 1. Survey Areas

3.0 RESULTS AND DISCUSSION

3.1 General

The results are presented by ecosystem, with the overall ecosystem estimates presented first (Tables 2, 5 & 12), followed by a breakdown according to the parks and a combined estimate for the Game Management Areas. The results tables provide the estimated number per stratum with the 95% confidence interval indicating the lower limit and the upper limit. The numbers actually seen within the sampling strips by observers are labelled as "No. seen". In deriving the population estimate only the number of animals seen within the sampling strips were used, for species seen outside the sampling strip, the information is used to show species occurrence and distribution.

The presentation of results by park enabled us to make trend comparisons with previous aerial surveys where park only results have been reported. Given the wide and often overlapping confidence

intervals associated with aerial survey population estimates, we did not expect significant differences between estimates considering the short time frame (10 - 12 years) and number of estimates (4 - 6). Thus the assumption that the relationship between population size and time is linear over the short term. For the purpose of comparison we wanted to know how areas we consider core areas i.e., National Parks compare to areas we consider marginal areas i.e., Game Management Areas. Tables 3, 5 and 10 compare the estimates between the NPs and GMAs in the Kafue and Luangwa Ecosystems. For each of the Kafue, Luangwa and Lower Zambezi ecosystems combined estimates are also given the Game Management Areas. Complete population estimates and statistics by strata as flown during the surveys are presented in Appendix I.

3.2 Total Estimates

The estimated population numbers of the primary herbivores in the four ecosystems surveyed were: Buffalo 43715, duiker 4025, eland 2530, giraffe 618, hartebeest 6957, impala 52369, kudu 3383, puku 23538, roan 6261, sable 14874, warthog 12626, waterbuck 9927, blue wildebeest 2955, Cookson's wildebeest 3753 and zebra 10768. Liuwa plain National Park Zambia's stronghold for blue wildebeest was not part of the surveys and as such the estimate presented here is an underestimate of the species in Zambia. Table 1, below gives population estimates and statistics for the primary herbivores counted.

Table 1. Population estimates and statistics for large herbivores in Surveyed Area

Species	Pop. est.	95% Range	No. seen	No./ 100km²
Buffalo	43715	26877 - 60554	4724	51.52
Bushbuck	335	170 - 500	27	0.39
Bushpig	775	291 - 1260	61	0.91
Duiker	4025	3439 - 4612	330	4.74
Eland	2530	283 - 4777	225	2.98
Giraffe	618	331 - 906	73	0.73
Grysbok	28	2 - 67	2	0.03
Hartebeest	6957	4753 - 9162	596	8.2
Impala	52369	42982 - 61756	5257	61.71
Kudu	3383	2448 - 4318	283	3.99
Red Lechwe	12290	1934 - 22646	1372	14.48
Oribi	166	74 - 257	19	0.2
Puku	23538	15294 - 31782	2478	27.74
Reedbuck	981	272 - 1690	73	1.16
Roan	6261	4121 - 8401	474	7.38
Sable	14874	11061 - 18686	1241	17.53
Sitatunga	101	6 - 262	6	0.12
Warthog	12626	10762 - 14490	1182	14.88
Waterbuck	9927	6287 - 13567	581	11.7
Blue wildebeest	2955	630 - 5280	233	3.48
Cookson's wildebeest	3753	1558 - 5948	368	11.44
Zebra	10768	6426 - 15110	927	12.69

3.3 Kafue Ecosystem

At 45030 km², the Kafue ecosystem accounted for 53% of the total surveyed area. The surveys covered approximately 68% of the protected area network in the Kafue ecosystem. This was made up of the entire park and 52% of the Game Management Areas.

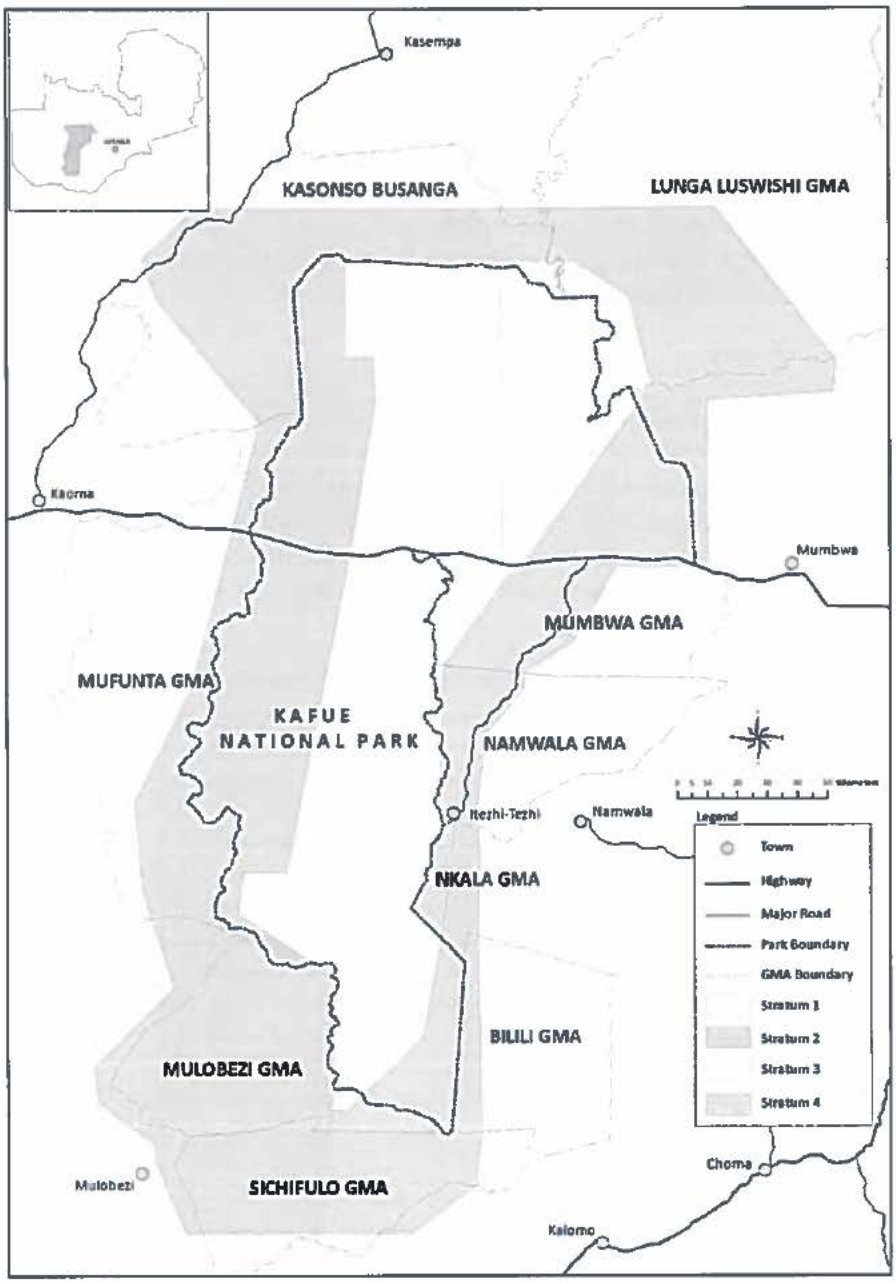


Figure 2. Kafue ecosystem survey strata

The Kafue ecosystem accounted for all the grysbok, red lechwe and sitatunga estimated countrywide, while 90 % or more of hartebeest, oribi, reedbuck and sable was counted from the ecosystem. The population estimates of the primary large herbivore species in the ecosystem were: Buffalo 8534, eland 1156, hartebeest 6265, impala 25847, kudu 1251, red lechwe 12290, puku 16470, roan 2978 and sable 14314. Complete population estimates and associated statistics for the ecosystem are given in table 2 below.

Table 2. Overall population estimates and statistics for the Kafue Ecosystem

Species	Pop. est.	95% Range	No. seen	No./ 100km²
Buffalo	8534	864 - 16993	864	18.95
Bushbuck	211	77 - 345	17	0.47
Bushpig	385	112 - 658	33	0.86
Duiker	1877	1425 - 2330	128	4.17
Eland	1156	68 - 2764	68	2.57
Grysbok	28	2 - 67	2	0.06
Hartebeest	6265	4090 - 8440	542	13.91
Impala	25847	18776 - 32918	2381	57.4
Kudu	1251	695 - 1806	102	2.78
Red Lechwe	12290	1923 - 22657	1372	27.29
Oribi	149	60 - 237	17	0.33
Puku	16470	8489 - 24450	1694	36.57
Reedbuck	973	263 - 1682	72	2.16
Roan	2978	1272 - 4685	220	6.61
Sable	14314	10520 - 18109	1176	31.79
Sitatunga	101	6 - 262	6	0.22
Warthog	9143	7463 - 10823	841	20.3
Waterbuck	7261	3702 - 10820	605	16.13
Wildebeest	2896	562 - 5231	226	6.43
Zebra	5211	1109 - 9313	371	11.57

3.3.1 Kafue National Park

The estimated population numbers of the primary herbivores in the Kafue National Park were: Impala 14859, red lechwe 12206, sable 9695, buffalo 8219, waterbuck 5000, hartebeest 4640, zebra 1269 and eland 771.

In comparison to the surrounding Game Management Areas, the Kafue National Park had a higher density of all the species apart from zebra, common duiker and reedbuck (Figure 1). Nkala Game Management Area had the highest concentration of zebra among the GMAs in the ecosystem (Figure 8). Sable was uniformly distributed in the ecosystem with a higher concentration in the southern parts, the distribution of hartebeest in the KNP was concentrated in the central parts of the park, and almost absent on the western boundary. Of the twelve species considered for population trends (Fig. 4), only zebra showed a decreasing trend for the period 2006 – 2015 in the Kafue National Park. The park also accounted for more than 95 per cent of the buffalo and lechwe population in this ecosystem (Figure 7).Table 3 and 4, below gives the population estimates and statistics for the primary herbivore species in the Kafue National Park and Community areas respectively.

Table 3. Population estimates and statistics of large herbivores in KNP and GMAs

	Kafue National Park				Kafue Ecosystem Game Management Areas			
Species	Pop. est.	95% Range	No. seen	No./ 100km²	Pop. est.	95% Range	No. seen	No./ 100km²
Buffalo	8219	830 - 16658	830	36.97	315	34 - 900	34	1.38
Bushbuck	105	17 - 192	10	0.47	106	7 - 209	7	0.47
Bushpig	200	24 - 377	20	0.9	185	13 - 393	13	0.81
Duiker	631	432 - 830	54	2.84	1246	832 - 1661	74	5.48
Eland	771	47 - 2216	47	3.47	385	21 - 1090	21	1.69
Grysbok	9	1 - 27	1	0.04	18	1 - 54	1	0.08
Hartebeest	4640	2948 - 6333	443	20.87	1625	325 - 2924	99	7.14
Impala	14859	10623 - 19095	1565	66.84	10988	5530 - 16446	816	48.29
Kudu	698	382 - 1015	68	3.14	552	89 - 1015	34	2.43
Red Lechwe	12206	1840 - 22573	1367	54.91	84	5 - 240	5	0.37
Oribi	98	24 - 171	12	0.44	51	5 - 105	5	0.22
Puku	12224	6140 - 18308	1359	54.99	4246	335 - 8915	335	18.66
Reedbuck	419	163 - 676	40	1.88	553	32 - 1217	32	2.43
Roan	2454	1021 - 3887	189	11.04	524	31 - 1434	31	2.3
Sable	9695	6534 - 12856	898	43.61	4619	2294 - 6944	278	20.3
Sitatunga	84	5 - 244	5	0.38	17	1 - 48	1	0.07
Warthog	6240	4905 - 7574	628	28.07	2903	1842 - 3964	213	12.76
Waterbuck	5000	2351 - 7649	479	22.49	2507	353 - 4661	151	11.02
Wildebeest	1631	332 - 2930	157	7.34	1265	69 - 3167	69	5.56
Zebra	1269	435 - 2104	145	5.71	3942	226 - 7964	226	17.32

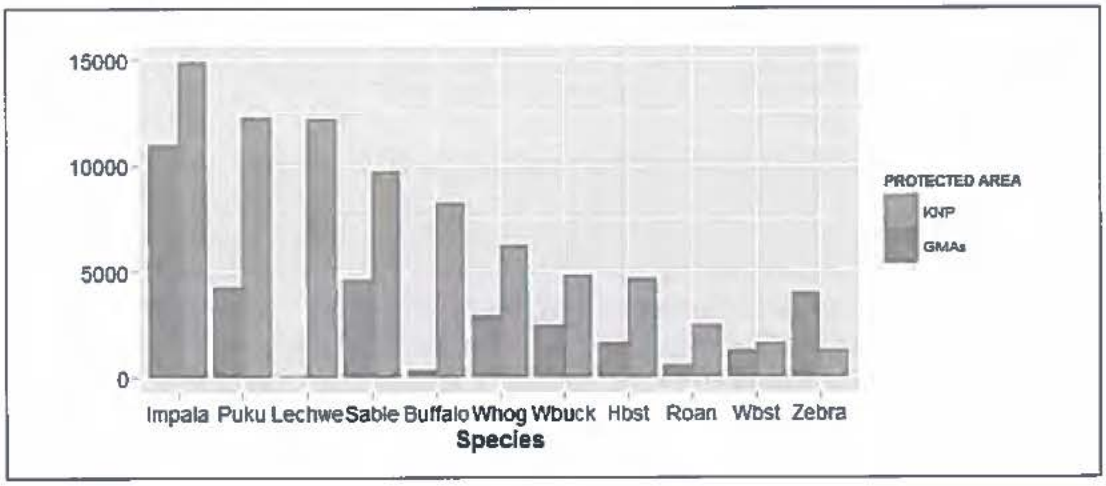


Figure 3. Comparison of species abundance between Kafue National Park and the GMAs in the Kafue ecosystem

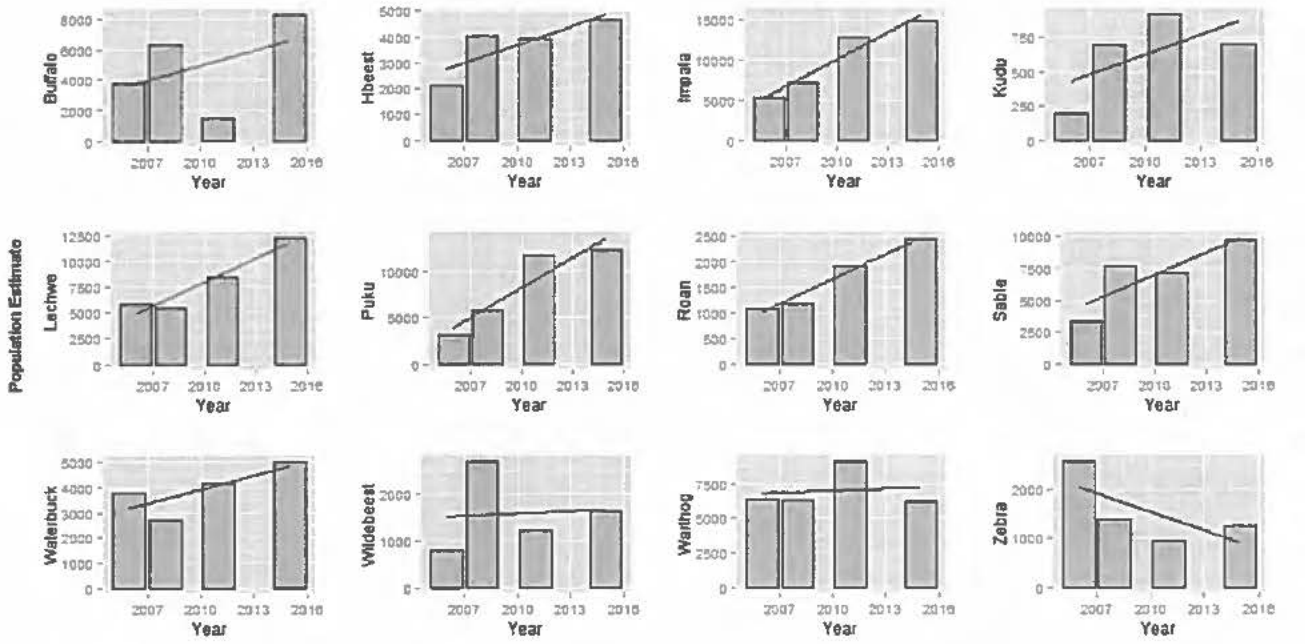


Figure 4. Population trends for selected species in the Kafue National Park for the period 2006 - 2015

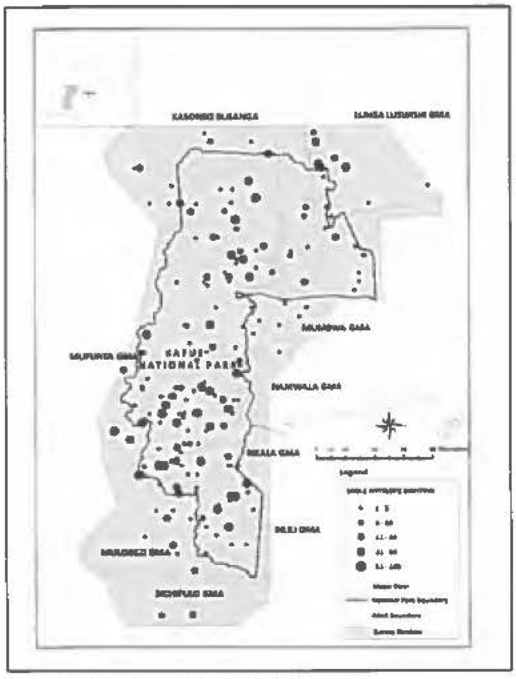


Figure 5. Sable distribution in the Kafue ecosystem



Figure 6. Hartebeest distribution in the Kafue ecosystem

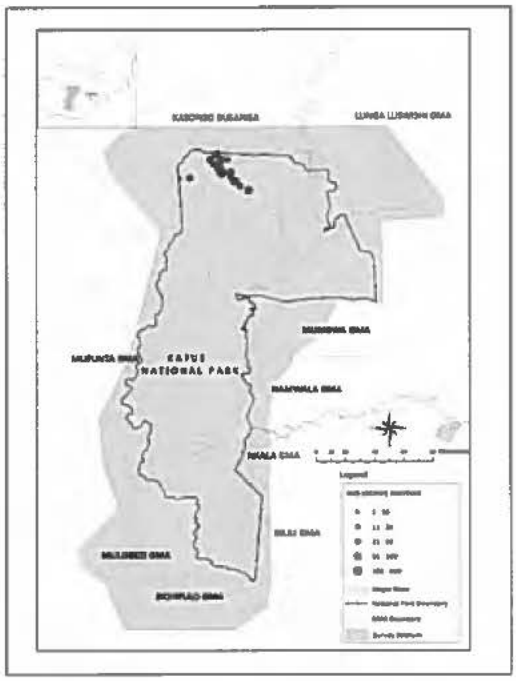


Figure 7: Red lechwe distribution in the Kafue ecosystem



Figure 8: Zebra distribution in the Kafue ecosystem

15

3.4 Luangwa Ecosystem

The estimated population of the primary herbivores in the Luangwa ecosystem were: Buffalo 30082, duiker 962, eland 237, giraffe 99, hartebeest 692, impala 22502, kudu 1655, puku 7068, roan 2457, sable 56, warthog 3208, waterbuck 1773, wildebeest 3753, and zebra 4883. Complete population estimates and statistics for the ecosystem are given in table 5 below.

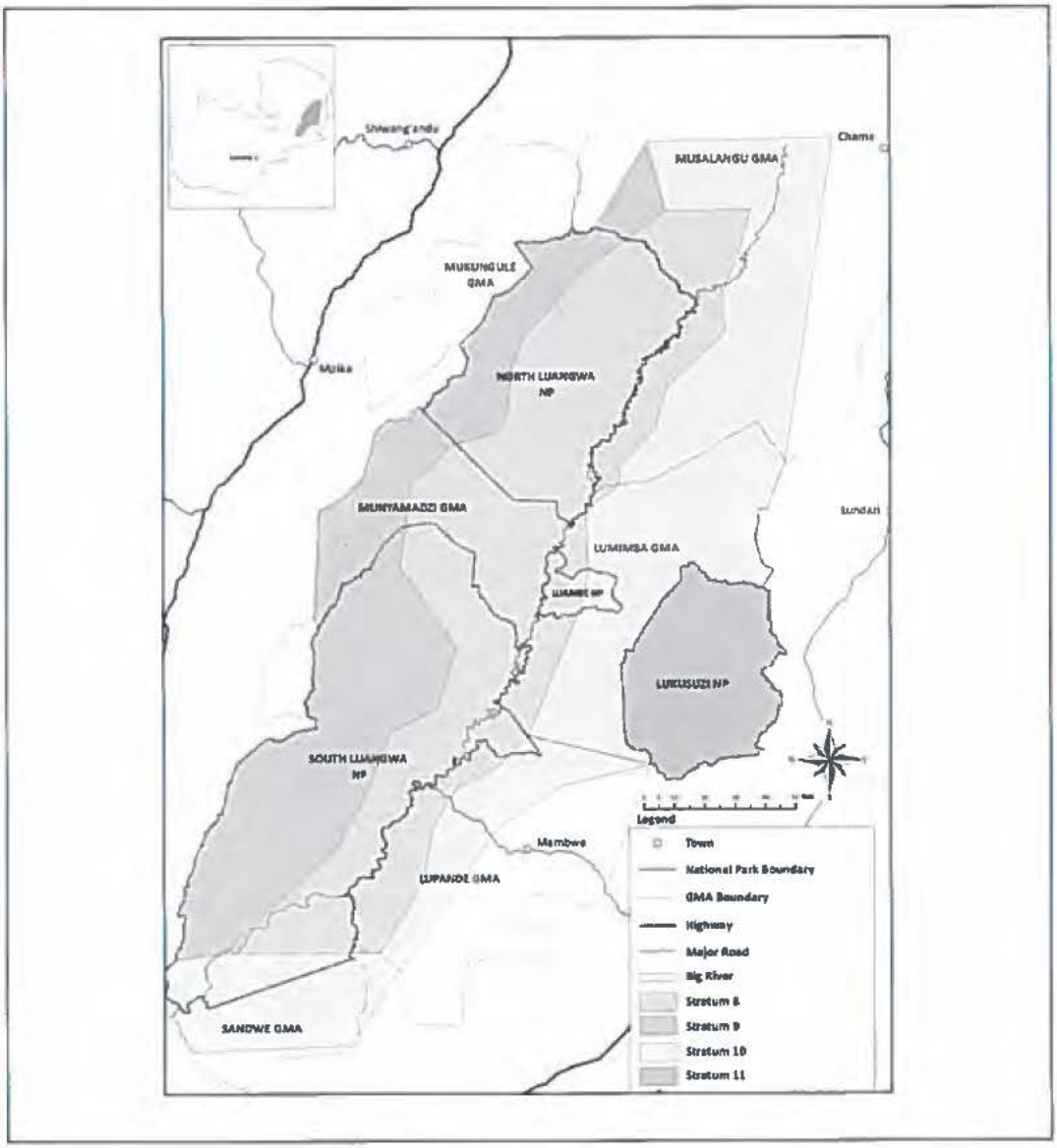


Figure 7. Luangwa Ecosystem survey strata

The Luangwa ecosystem accounted for 70% of the national total of buffalo. Approximately to 60% of the estimated buffalo population in the ecosystem was counted from GMAs (Table 6 & 7). The GMAs also had higher estimates of roan (73%), Cookson's wildebeest (65%), kudu (64%), common duiker (54%), and hartebeest (52%) (Figure 10 and table 7). Sable was only sighted in the Lukusuzi National Park.

Table 4. Overall population estimates for the Luangwa ecosystem

Species	Pop. est.	95% Range	No. seen	No./ 100km^2
Buffalo	30082	16392 - 43772	3321	91.66
Bushbuck	124	27 - 222	10	0.38
Bushpig	390	28 - 792	28	1.19
Duiker	962	652 - 1273	58	2.93
Eland	237	21 - 454	21	0.72
Giraffe	99	30 - 169	11	0.3
Hartebeest	692	318 - 1066	54	2.11
Impala	22502	16664 - 28340	2453	68.56
Kudu	1655	932 - 2378	124	5.04
Puku	7068	4963 - 9173	784	21.54
Reedbuck	8	1 - 24	1	0.03
Roan	2457	1323 - 3591	155	7.49
Sable	56	3 - 130	3	0.17
Warthog	3208	2412 - 4003	310	9.77
Waterbuck	1773	729 - 2817	169	5.4
Wildebeest	3753	1558 - 5948	368	11.44
Zebra	4883	3540 - 6227	481	14.88

Table 5. Population estimates and statistics for large herbivores in Luangwa Ecosystem Parks and GMAs

	Luangwa Ecosystem Parks				Luangwa Ecosystem GMAs			
Species	Pop. est.	95% Range	No. seen	No./ 100km²	Pop. est.	95% Range	No. seen	No./ 100km²
Buffalo	12750	3518 - 21981	1420	78.34	17332	7145 - 27520	1901	124.4
Bushbuck	72	5 - 157	5	0.44	53	6 - 99	5	0.38
Bushpig	339	22 - 735	22	2.08	51	6 - 120	6	0.37
Duiker	442	241 - 643	26	2.72	520	279 - 761	32	3.73
Eland	220	19 - 434	19	1.35	17	2 - 49	2	0.12
Giraffe	81	15 - 146	9	0.5	19	2 - 44	2	0.14
Hartebeest	330	82 - 578	27	2.03	363	94 - 631	27	2.61
Impala	13662	8980 - 18345	1560	83.94	8840	5631 - 12049	893	63.45
Kudu	589	191 - 988	49	3.62	1066	445 - 1687	75	7.65
Puku	5145	3137 - 7153	577	31.61	1923	1033 - 2813	207	13.8
Reedbuck	8	1 - 24	1	0.05	0	0 - 0	0	0
Roan	663	84 - 1243	42	4.07	1794	823 - 2765	113	12.88
Sable	56	3 - 130	3	0.34	0	0 - 0	0	0
Warthog	1671	1229 - 2113	158	10.27	1536	829 - 2243	152	11.02
Waterbuck	1142	280 - 2005	116	7.02	631	113 - 1150	53	4.53
Wildebeest	1304	307 - 2302	143	8.01	2449	689 - 4209	225	17.58
Zebra	3742	2615 - 4869	383	22.99	1142	532 - 1752	98	8.2

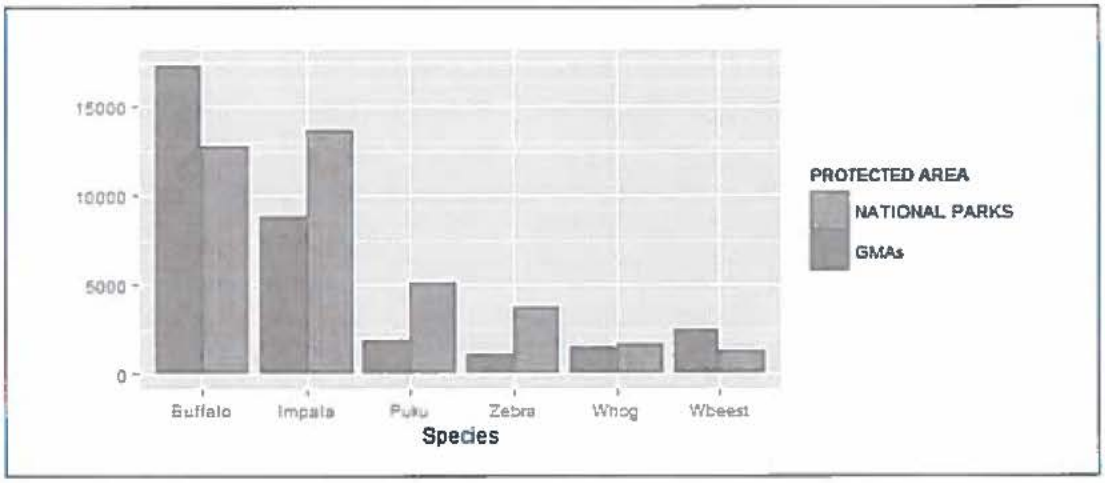


Figure 8. Species abundance in the Luangwa ecosystem. National Parks vs GMAs

3.4.1 South Luangwa National Park

The most abundant species in the South Luangwa National Park was impala 10873, followed by puku 4146, buffalo 3808, zebra 2767, waterbuck 1106 and warthog 1029. Complete population

estimates and statistics for South Luangwa National Park are given in table 6 below. Apart from roan, waterbuck and Cookson's wildebeest, the population trends in the South Luangwa National Park have been decreasing over the period 2002 to 2015 (figure 11). Of concern is the population of Thornicroft's giraffe which has reduced from an estimated 187 in 2002 (Dunham & Simwanza 2002) to 72 in 2015. A reduction of 61%. In contrast Berry and Bercovitch (2016), using an index method estimate between 500 & 600 Thornicroft giraffe along the Luangwa River. The huge differences in estimates call for more robust methods for estimating the population of this endemic sub species of giraffe.

Table 6. Population estimates for South and North Luangwa National Parks

	SLNP				NLNP			
Species	Pop. est.	95% Range	No. seen	No./ 100km²	Pop. est.	95% Range	No. seen	No./ 100km²
Buffalo	3808	404 - 7496	404	44.04	7030	812 - 14799	812	150.34
Bushbuck	35	3 - 75	3	0.4	0	0 - 0	0	0
Bushpig	178	10 - 520	10	2.06	51	6 - 145	6	1.09
Duiker	240	77 - 403	14	2.78	35	3 - 75	3	0.75
Eland	118	13 - 240	13	1.36	9	1 - 27	1	0.19
Giraffe	72	8 - 136	8	0.83	0	0 - 0	0	0
Hartebeest	73	6 - 171	6	0.84	127	14 - 266	14	2.72
Impala	10873	6398 - 15348	1242	125.76	1853	635 - 3071	214	39.63
Kudu	362	92 - 632	32	4.19	60	7 - 119	7	1.28
Puku	4146	2265 - 6028	468	47.95	543	129 - 957	60	11.61
Reedbuck	8	1 - 24	1	0.09	0	0 - 0	0	0
Roan	445	28 - 971	28	5.15	17	2 - 39	2	0.36
Warthog	1029	685 - 1373	94	11.9	563	304 - 822	59	12.04
Waterbuck	1106	242 - 1969	112	12.79	37	4 - 91	4	0.79
Wildebeest	903	100 - 1742	100	10.44	401	43 - 949	43	8.58
Zebra	2767	1767 - 3766	285	32	732	282 - 1182	72	15.65

3.4.2 Luambe National Park

Buffalo 1,911 and impala 936 were the most abundant species in Luambe National Park (Table 9). The density of buffalo (555.52/100km²) was the highest recorded in the country during the 2015 surveys (Figure 8). The density of impala (272.09/100km²) was only second to that of the Lower Zambezi National Park. Population trends for impala, puku and zebra, the three species for which there has been consistent sightings in previous surveys (Simukonda, 2009; Simukonda 2011; WCS, 2012) have largely been stable for the park (Figure 11). The lack of consistent buffalo estimates in the area from previous surveys may indicate that the buffalo population in Luambe is transient between the park and the surrounding Game Management Areas.

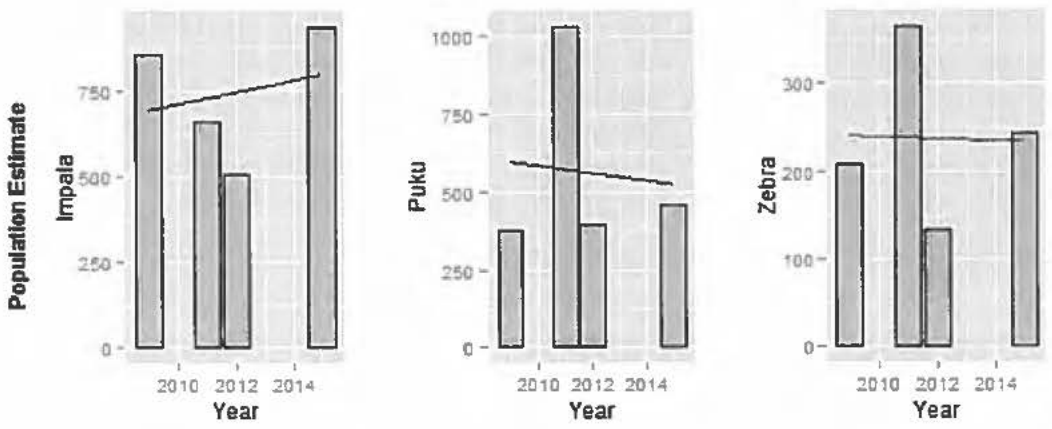


Figure 9. Impala, puku and zebra populations trends in Luambe National Park for the period 2009 - 2015

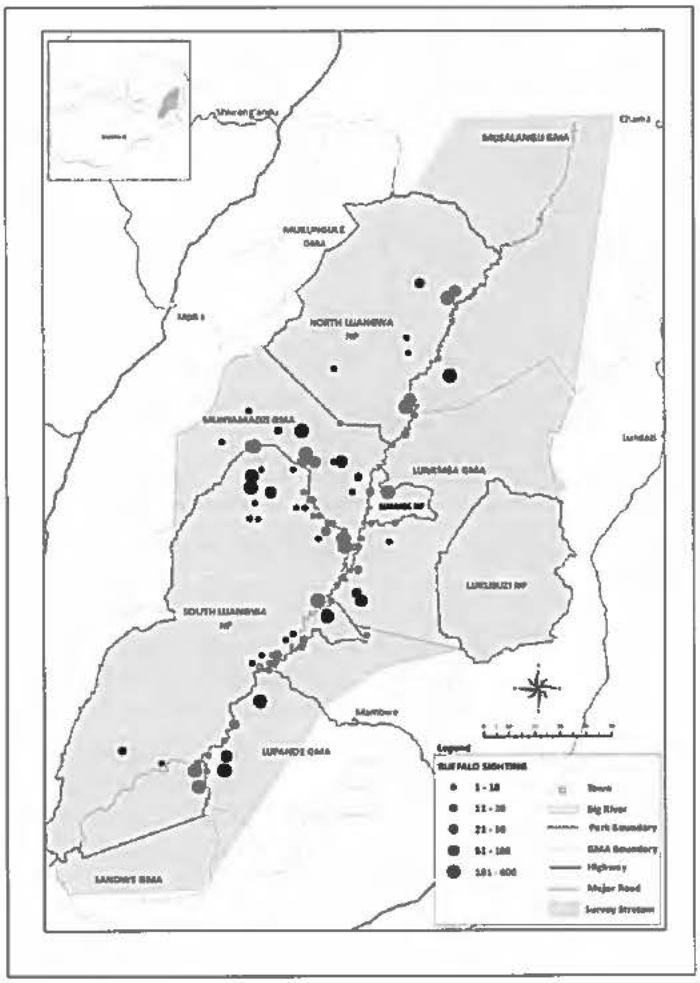


Figure 10. Buffalo distribution in the Luangwa valley

Table 7. Population estimates for Luambe and Lukusuzi National Parks

	LUAMBE				LUKUSUZI			
Species	Pop. est.	95% Range	No. seen	No./ 100km²	Pop. est.	95% Range	No. seen	No./ 100km²
Buffalo	1911	204 - 5398	204	555.52	0	0 - 0	0	0
Bushbuck	0	0 - 0	0	0	37	2 - 122	2	1.42
Bushpig	17	1 - 51	1	4.94	93	5 - 289	5	3.56
Duiker	0	0 - 0	0	0	167	42 - 292	9	6.4
Eland	0	0 - 0	0	0	93	5 - 289	5	3.56
Giraffe	8	1 - 24	1	2.33	0	0 - 0	0	0
Hartebeest	0	0 - 0	0	0	130	7 - 332	7	4.98
Impala	936	187 - 1685	104	272.09	0	0 - 0	0	0
Kudu	19	2 - 54	2	5.52	149	8 - 469	8	5.69
Puku	455	49 - 1045	49	132.27	0	0 - 0	0	0
Reedbuck	0	0 - 0	0	0	0	0 - 0	0	0
Roan	34	3 - 80	3	9.88	167	9 - 436	9	6.4
Sable	0	0 - 0	0	0	56	3 - 139	3	2.13
Warthog	60	4 - 162	4	17.44	19	1 - 57	1	0.71
Waterbuck	0	0 - 0	0	0	0	0 - 0	0	0
Wildebeest	0	0 - 0	0	0	0	0 - 0	0	0
Zebra	243	26 - 522	26	70.64	0	0 - 0	0	0

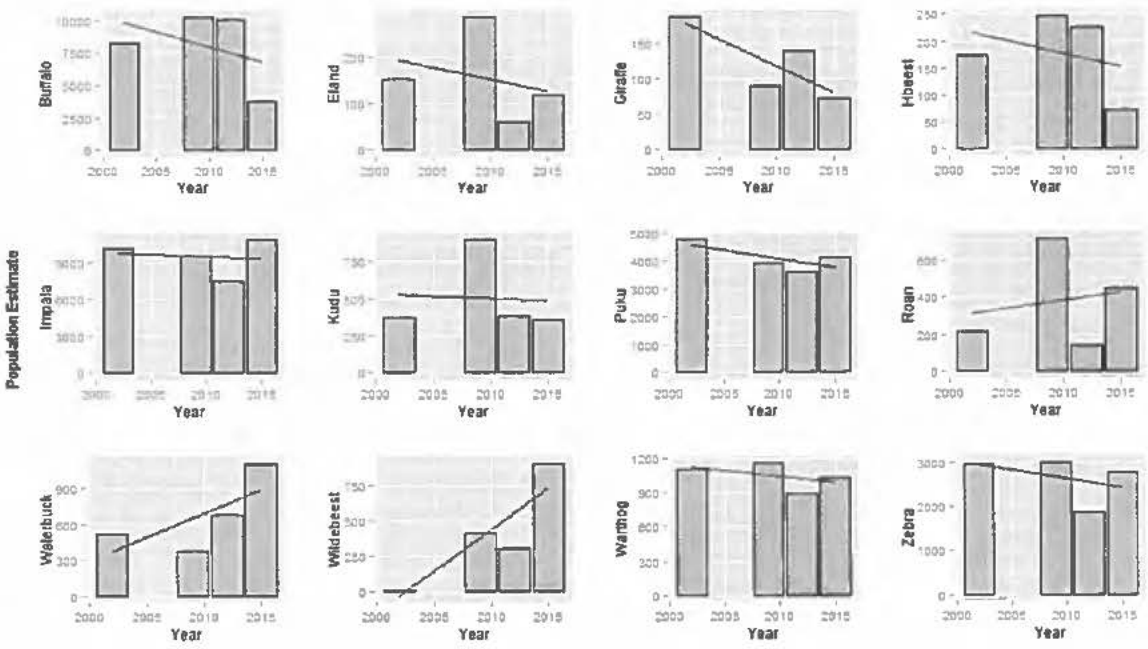


Figure 11. Population trends for selected species in the South Luangwa National Park 2002 - 2015

3.4.3 North Luangwa National Park

The most abundant herbivores in North Luangwa National Park were buffalo 7030, impala 1853, zebra 732, warthog 563 and puku 543 (Table 10). Other species counted were bushpig, duiker, hartebeest, kudu, roan and wildebeest. Population trends for North Luangwa are given in figure 15 below. Apart from buffalo, hartebeest and warthog, most other species in the North Luangwa National Park showed a declining trend.

3.4.4 Lukusuzi National Park

Nine herbivore species were observed in the Lukusuzi National Park and of these only duiker 167, hartebeest 130, kudu 149 and roan 167 were estimated above a hundred individuals (Table 5). Lukusuzi National Park is the only park that recorded Sable Antelope in the Luangwa ecosystem. Previous surveys have considered the number of sightings in Lukusuzi National Park to be too low to warrant statistical analysis, and have only provided absolute numbers (e.g., WCS, 2009, 2012). It is evident from the associated confidence intervals (table 7), which are too wide that the estimates from Lukusuzi are unreliable due to the few sightings recorded. As such caution should be taken when interpreting the estimates. Lukusuzi National Park recorded human activities (mining) right in the interior of the park (Figure 14). The abundance of these activities could be having an effect on the abundance, diversity and distribution of the animal species in the park.

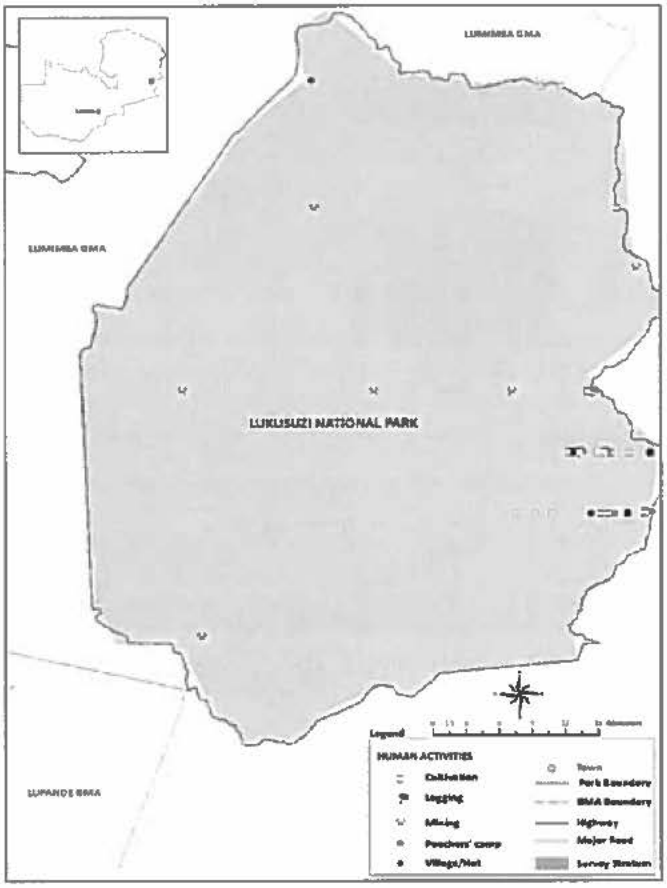


Figure 12. Human activities in Lukusuzi National Park

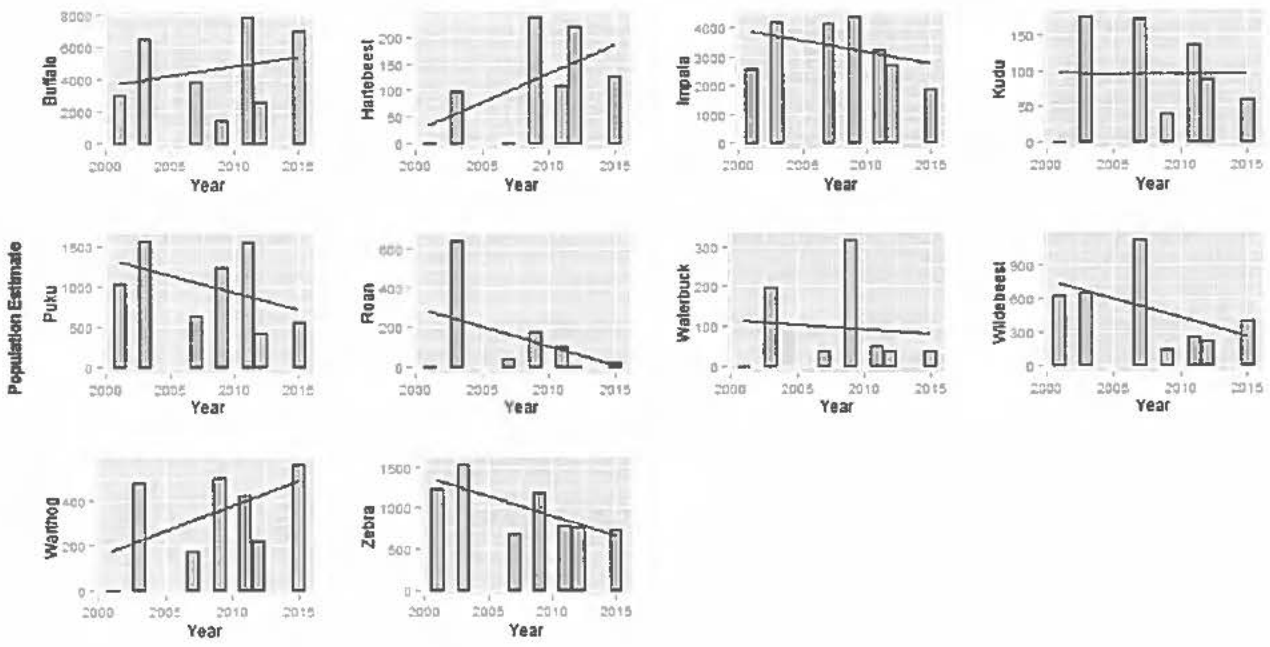


Figure 13. Population trends for selected species in NLNP

3.5 Lower Zambezi Valley

The estimated population of the primary herbivores in the Zambezi valley were: Buffalo 4806, impala 3947, waterbuck 658, zebra 400, warthog 162, kudu 67, and duiker 19 (Table 12).



Figure 14. Lower Zambezi Valley Survey Strata

Buffalo was the most abundant herbivore in the Zambezi valley, however, about 81% of this population was found in the Game Management Areas, which accounted for 55% of the surveyed area.

Table 8. Overall population estimates and statistics for the Lower Zambezi Valley

Species	Pop. est.	95% Range	No. seen	No./ 100km²
Buffalo	4806	504 - 9912	504	190.1
Duiker	19	2 - 44	2	0.75
Impala	3947	1845 - 6050	414	156.15
Kudu	67	7 - 129	7	2.64
Warthog	162	17 - 307	17	6.41
Waterbuck	658	69 - 1347	69	26.03
Zebra	400	42 - 833	42	15.84

3.5.1 Lower Zambezi National Park

The Lower Zambezi National Park recorded the highest density (282.27/100km²) of impala in the country (Table 13).The distribution of impala in the Zambezi Valley is in direct contrast to the distribution of buffalo (Figure 6). Eighty-two per cent of the impala population in the Lower Zambezi Valley was found in the LZNP. Previous studies using ground counts have found similar high densities of impala in the Lower Zambezi National Park (Leigh, 2005). The LZNP recorded the lowest species

diversity in primary large herbivores of the 7 parks surveyed. Apart from waterbuck, the populations of buffalo, Impala, and warthog have seen a downward trend in the period 2003 – 2015 (Figure 6).

Table 9. Population estimates for LZNP and GMAs

	LZNP				Lower Zambezi GMAs			
Species	Pop. Est	95% Range	No. seen	No./ 100km²	Pop. Est	95% Range	No. seen	No./ 100km²
Buffalo	887	93 - 2276	93	77.47	3919	411 - 8835	411	283.37
Duiker	10	1 - 28	1	0.87	10	1 - 28	1	0.72
Impala	3232	1244 - 5220	339	282.27	715	146 - 1284	75	51.7
Kudu	48	5 - 101	5	4.19	19	2 - 55	2	1.37
Warthog	114	12 - 247	12	9.96	48	5 - 111	5	3.47
Waterbuck	200	21 - 417	21	17.47	458	48 - 1072	48	33.12
Zebra	362	38 - 792	38	31.62	38	4 - 109	4	2.75

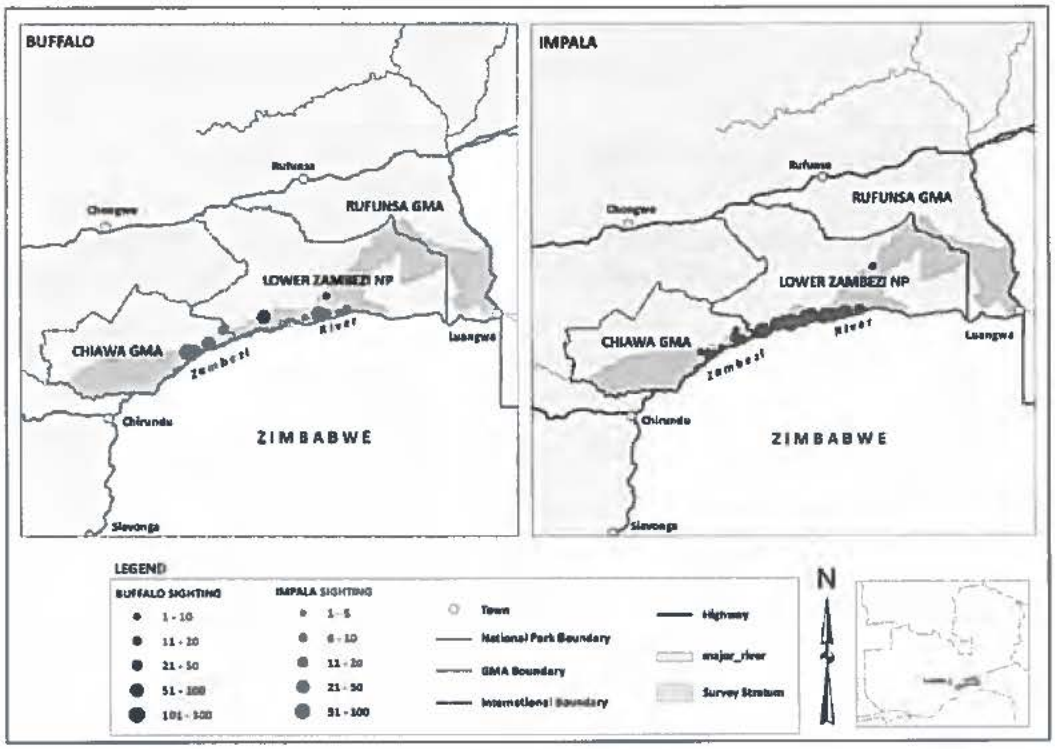


Figure 15. Buffalo and Impala distribution in the Lower Zambezi Valley. Note the difference in the distribution of the two species.

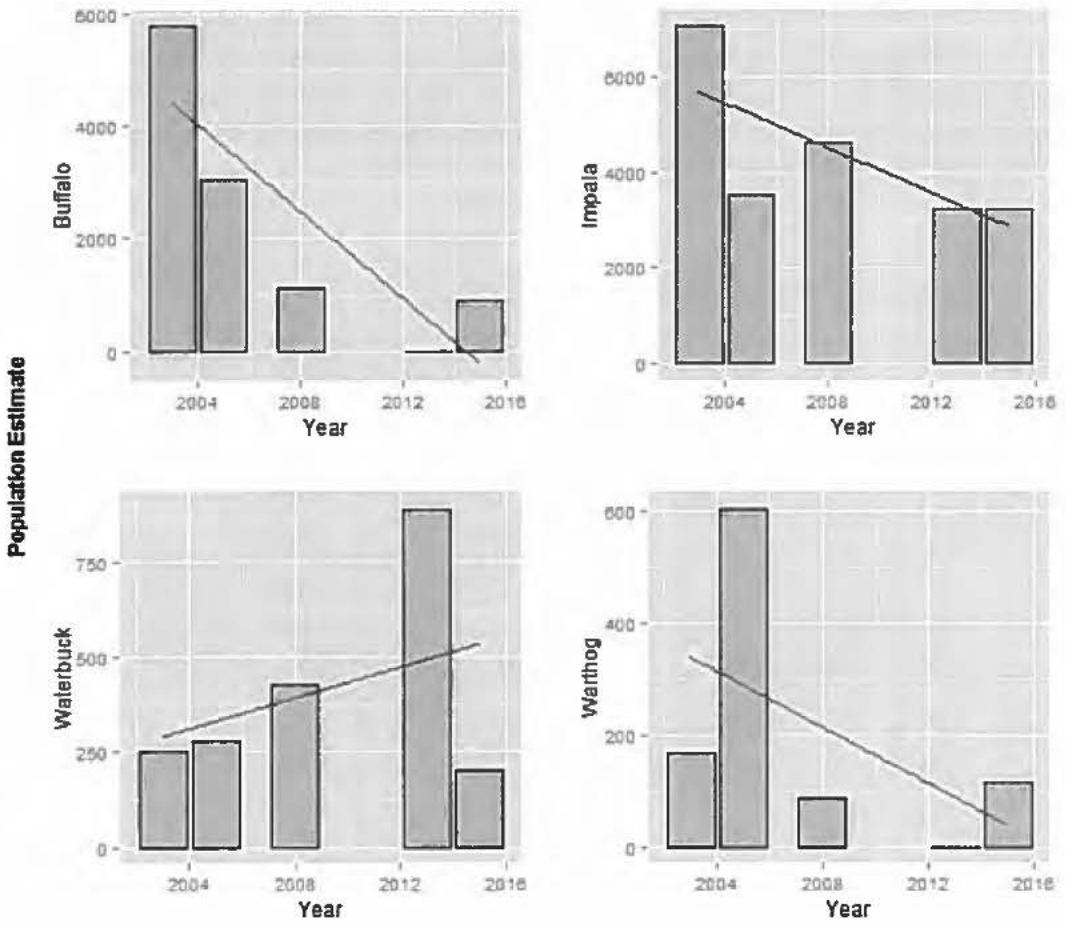


Figure 16. Population trends for selected species in the Lower Zambezi National Park 2003 - 2015

3.6 Sioma Ngwezi National Park

Sioma Ngwezi National Park recorded the highest density of eland (25.37/100km2), duiker (26.02/100km2) and roan (18.41/100km2) in the country. The population estimate (1137) for eland in Sioma Ngwezi National Park was the highest in the country during the 2015 surveys, whilst the estimate for duiker (1166) was only second to Kafue National Park.

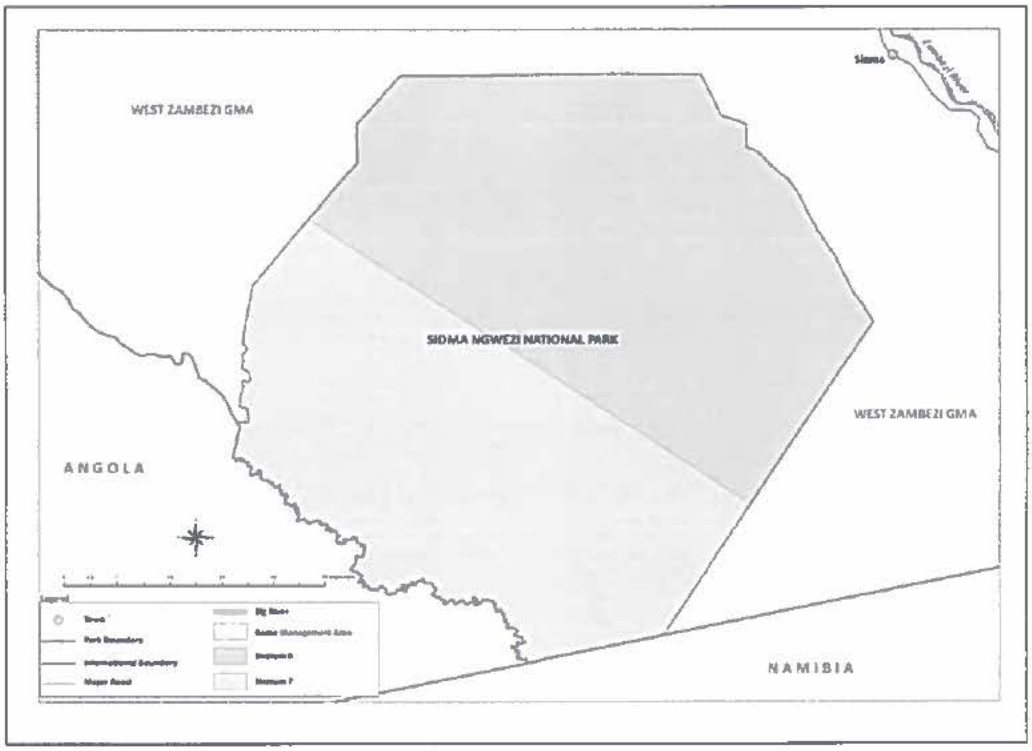


Figure 17. Sioma Ngwezi National Park Survey Strata

Table 10. Population estimates and statistics for Sioma Ngwezi National Park

Species	Pop. est.	95% Range	No. seen	No./ 100km²
Buffalo	293	35 - 851	35	6.54
Duiker	1166	954 - 1379	142	26.02
Eland	1137	136 - 2731	136	25.37
Giraffe	519	233 - 804	62	11.57
Impala	72	9 - 182	9	1.61
Kudu	411	201 - 621	50	9.17
Oribi	17	2 - 39	2	0.37
Roan	825	182 - 1469	99	18.41
Sable	504	92 - 916	62	11.24
Warthog	114	24 - 203	14	2.54
Wildebeest	59	7 - 156	7	1.31
Zebra	273	33 - 573	33	6.09

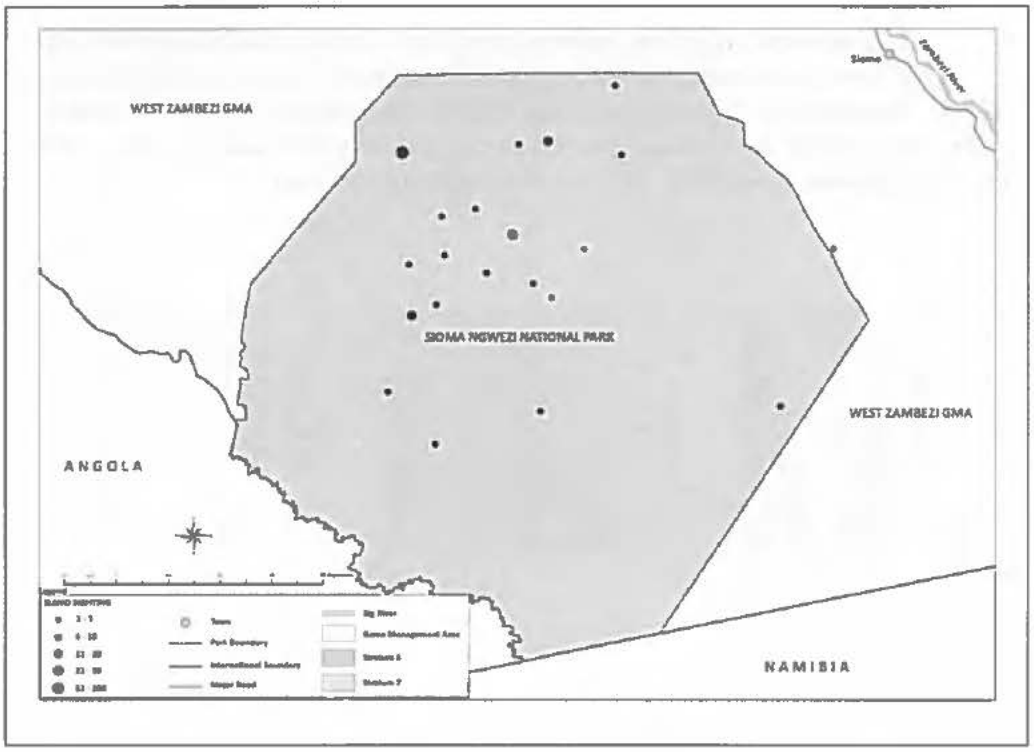


Figure 18. Eland distribution in Sioma Ngwezi National Park

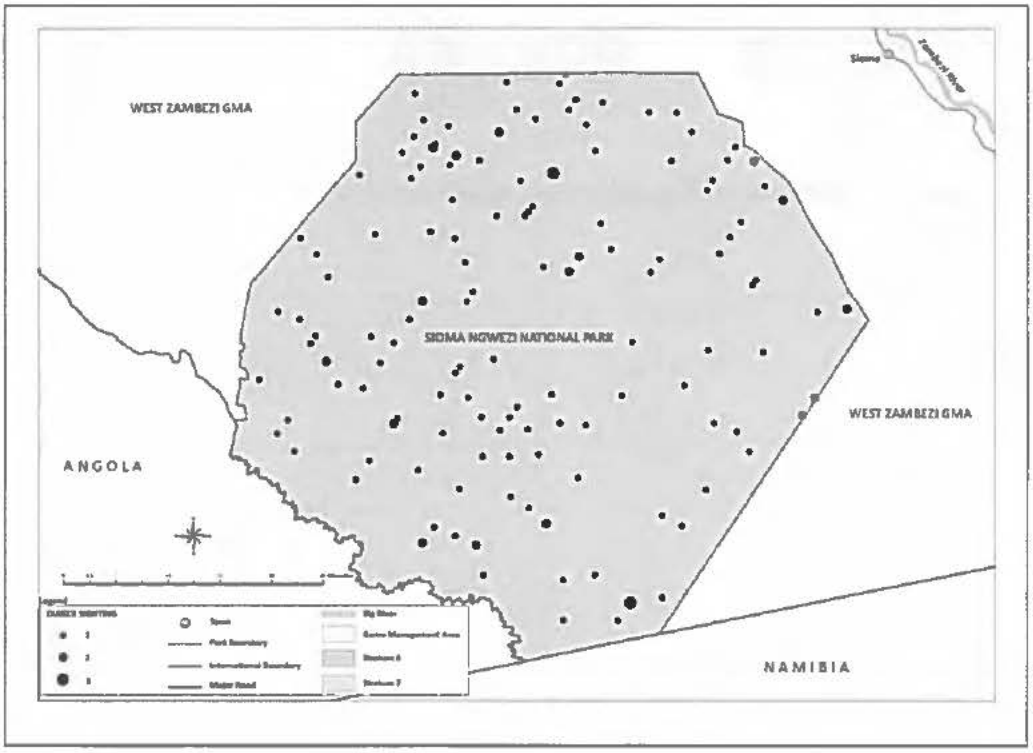


Figure 19. Common duiker distribution in Sioma Ngwezi National Park

Previous studies in the Sioma Ngwezi National Park have indicated higher estimates for all species in the wet season compared to the dry season (Chase and Griffin, 2009). Sioma Ngwezi National Park is seasonally inundated and has little topographic relief, so that surface pans remain widely distributed. These pans are the main water source for animals in the National Park, however in the dry season, these pans dry up and this was worse in 2015 (Henry Luwaya, pers. Communication). Thus animals were forced to migrate to permanent water sources such as the Kwando and the Zambezi rivers in the west and east respectively. These were outside the survey area.

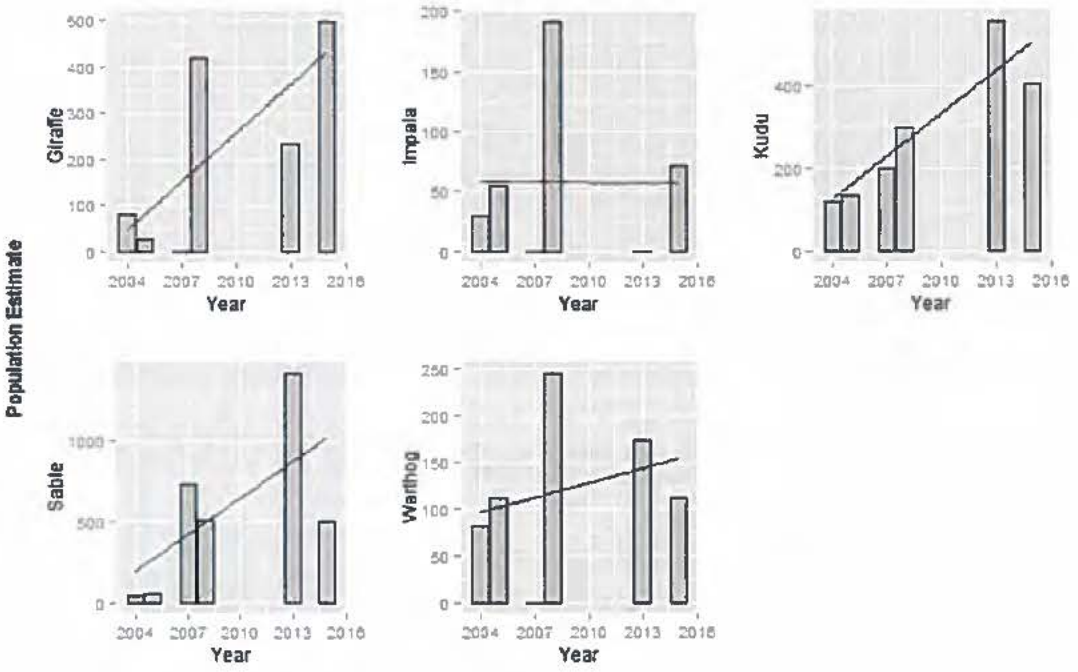


Figure 20: Population trends for selected species in Sioma Ngwezi National Park

3.7 Domestic Livestock

The Kafue ecosystem recorded the highest estimate of cattle at 45549, of which 159 were estimated within the boundaries of the National Park. The density of cattle in the Kafue GMAs was as high as 199.32/100km^2. Of the seven national parks surveyed domestic livestock were only recorded in the Kafue and Sioma Ngwezi National Parks. The estimates for domestic livestock encountered during the surveys are given in the table 12 below.

Table 11. Population estimates and statistics for domestic livestock

Species	Protected Area	Pop. est.	95% Range	No. seen	No./ 100km^2
Donkey	Kafue GMAs	176	10 - 412	10	0.77
Cattle	Kafue National Park	194	17 - 460	17	0.87
	Kafue GMAs	45355	28207 - 62503	2530	199.32
	Luangwa GMAs	588	34 - 1201	34	4.22
	Lower Zambezi GMAs	601	63 - 1252	63	43.46
	Sioma Ngwezi National Park	1057	174 - 1941	130	23.59
Shoats	Kafue GMAs	12318	6470 - 18165	682	54.13
	Luangwa GMAs	129	9 - 278	9	0.93
	Lower Zambezi GMAs	1077	113 - 2213	113	77.87
	Sioma Ngwezi National Park	72	9 - 166	9	1.61

3.8 Birds

Apart from large wild herbivores and domestic livestock, large birds were counted during the surveys. These included crowned cranes, ground hornbill, saddle-billed stocks, and wattled cranes. The estimated population sizes for these species and the associated statistics are given in table 13 below. Ground hornbill were the most widely distributed of the bird species, recorded in all the National Parks and the Game Management areas surveyed. Wattled cranes, of which 10 were sighted in the Luangwa ecosystem, are considered vagrant in this system.

Table 12. Population estimates and statistics for large birds

Species	Protected Area	Pop. est.	95% Range	No. seen	No./ 100km²
Ground hornbill	Kafue National Park	1558	947 - 2169	137	7.01
	Kafue GMAs	1731	971 - 2491	103	7.61
	South Luangwa National Park	364	110 - 618	35	4.21
	North Luangwa National Park	162	18 - 307	15	3.46
	Luambe National Park	34	4 - 97	4	9.88
	Lukusuzi National Park	167	9 - 349	9	6.4
	Luangwa GMAs	744	413 - 1075	71	5.34
	Lower Zambezi National Park	48	5 - 112	5	4.19
	Zambezi Valley GMAs	29	3 - 68	3	2.1
	Sioma Ngwezi National Park	17	2 - 39	2	0.37
Wattled Crane	Kafue National Park	418	95 - 742	48	1.88
	Kafue GMAs	123	8 - 253	8	0.54
	North Luangwa National Park	28	3 - 80	3	0.6
	Luangwa GMAs	66	7 - 187	7	0.47
Crowned Crane	Kafue National Park	26	3 - 60	3	0.12
	South Luangwa National Park	144	17 - 347	17	1.67
	Luangwa GMAs	68	8 - 158	8	0.49
Saddlebilled stock	Kafue National Park	8	1 - 23	1	0.04
	South Luangwa National Park	28	3 - 67	3	0.32
	Luangwa GMAs	18	2 - 41	2	0.13
Marabou stock	Kafue GMAs	165	9 - 483	9	0.73
	Luangwa GMAs	9	1 - 27	1	0.06

3.9 Other Species

Other species recorded during the surveys include baboon, crocodile, hippo, hyaena, honey badger, lion, and wild dogs. Aerial surveys are not the best methods for estimating abundance of these species, the numbers seen in the sample transects are however given in table 17 below as a record of their presence in the surveyed areas.

Table 13. Other species seen in sample transects

Species	Protected Area	No.seen
Baboon	Kafue National Park	9
	Kafue GMAs	30
	Luangwa South National Park	45
	North Luangwa National Park	40
	Luambe National Park	1
	Luangwa Parks	86
	Luangwa GMAs	188
	Lower Zambezi National Park	3
	Kafue National Park	52
	Kafue GMAs	82
	Sioma Ngwezi National Park	2
Hippopotamus	Kafue National Park	57
	Kafue GMAs	26
	Luangwa South National Park	125
	North Luangwa National Park	72
	Luangwa Parks	197
	Luangwa GMAs	159
	Lower Zambezi National Park	54
	Lower Zambezi GMAs	23
Monkey	Luangwa GMAs	10
Honey Badger	Luangwa South National Park	1
Hyaena	Luangwa GMAs	4
Lion	Luangwa South National Park	11
Wild Dog	Kafue National Park	7
	Luangwa GMAs	4
Crocodile	Luangwa South National Park	1
	Luangwa GMAs	44
	Lower Zambezi National Park	2

4.0 CONCLUSION AND RECOMMENDATIONS

Most species are increasing or stable compared to previous surveys. Given that a low sampling intensity was used during 2015, the actual estimated numbers are likely to be higher than what was counted.

The low numbers of sable in the Luangwa valley is of great concern. It is therefore recommended that the Department continues with the policy of excluding sable on any hunting quota. It is further proposed that studies are undertaken to investigate the limiting factors to the distribution of sable in the Luangwa ecosystem.

The decreasing numbers in Thornicroft giraffe is worrisome and it is suggested that an intensive study is instituted to determine precise estimates (e.g., mark-resight or other robust methods), and the likely reasons for this downward trend of this endemic sub-species of giraffe.

Habitat encroachment is a serious problem in the country's protected areas. There is a need to develop and implement General Management Plans for the country's protected areas to stem the loss of wildlife habitat. The extensive distribution of human settlements close to water sources is affecting the distribution of wildlife and further constricting their movement and habitat.

The survey has revealed that Game Management Areas, which are often considered as marginal areas are actually important areas for the conservation of some important species such as buffalo in the Luangwa ecosystem, Zebra in the Kafue ecosystem, and impala in the Lower Zambezi Valley. Thus it is important that an ecosystem approach is taken in the management of our protected area network.

The basic design of future aerial surveys should follow designs similar to the 2015 design as it takes an ecosystem approach rather than administrative boundaries in making population level estimates. Monitoring the wider ecosystem will allow management to detect changes in populations that might otherwise have been obscured by movements out of smaller survey areas.

Due to the wide confidence intervals associated with aerial surveys, we recommend regular countrywide surveys at 2 – 3 years intervals. We also recommend alternate wet season and dry season surveys.

5.0 REFERENCES

Chase, M., and Griffin, C. (2008). Seasonal abundance and distribution of elephants in Sioma Ngwezi National Park, southwest Zambia. Pachyderm, (45), 88-97.

Berry, P.S.M., and Bercovitch, F.B. (2016). Population census of Thornicroft's giraffe Giraffa camelopardalis thornicrofti in Zambia, 1973–2003: conservation reassessment required. Oryx, available on CJO2016. doi:10.1017/S003060531500126X.

Chase M., Nyirenda, V., and Sitali, L. (2013). Dry season fixed-wing aerial survey of elephants and other wildlife in Sioma Ngwezi National Park. Internal Report to ZAWA

Dunham, K.M. (2004). Aerial survey of elephants and other large herbivores in the Zambezi heartland (Zimbabwe, Mozambique and Zambia): 2003. African Wildlife Foundation, Kariba, Zimbabwe.

Dunham, K., and Simwanza, H.I. (2002). Aerial census of elephants and other large herbivores in South Luangwa National Park and Lupande Game Management Areas. Zambia: WWF-SARPO and ZAWA Occasional Paper.

Frederick, H. (2009). Aerial Survey of Kafue Ecosystem 2008. ZAWA, Chilanga, Zambia

Frederick, H. (2011). Aerial Survey: Kafue Ecosystem 2011. ZAWA, Chilanga, Zambia

Frederick, H. (2013). Aerial Survey Report: Luangwa Valley 2012. COMACO, Lusaka

Masonde, J.K., and Simpamba T. (2006). Aerial Survey of Large Mammals in Kafue National Park and Surrounding GMAs. ZAWA, Chilanga, Zambia

Norton Griffiths, M. (1978). Counting Animals. Second edition. African Wildlife Leadership Foundation, Nairobi.

Leigh, K. A. (2005). The ecology and conservation biology of the endangered African wild dog (Lycaon pictus) in the Lower Zambezi, Zambia.

R Core Team (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

Simukonda, C. (2009). The Elephant Survey 2008 – A Country Report. ZAWA, Chilanga, Zambia

Simukonda C. (2011). Wet season survey of the African elephant and other large herbivores in selected areas of Luangwa Valley. Zambia Wildlife Authority.

Simukonda. C. (2008). Aerial Survey Report: Kafue Ecosystem 2008. Zambia Wildlife Authority, Lusaka

Viljoen, P. (2007). Sioma Ngwezi National Park, Zambia: Aerial Wildlife Survey October 2007. Peace Parks Foundation.

Viljoen, P. (2013). Lower Zambezi National Park Rufunsa & Chiawa GMAs Zambia: Aerial Wildlife Survey October 2013. Zambia Wildlife Authority, Lusaka

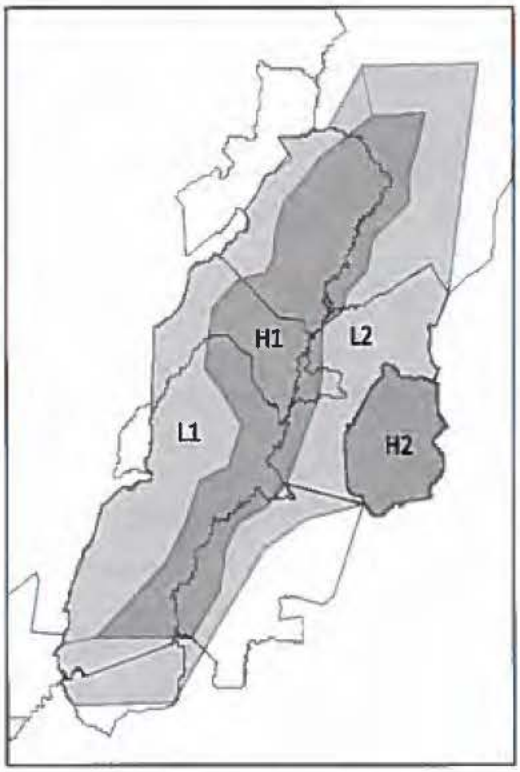
WCS Flight Programme (2009). Aerial Survey Report: Luangwa Valley 2009. WCS, New York

APPENDIX I - Methods

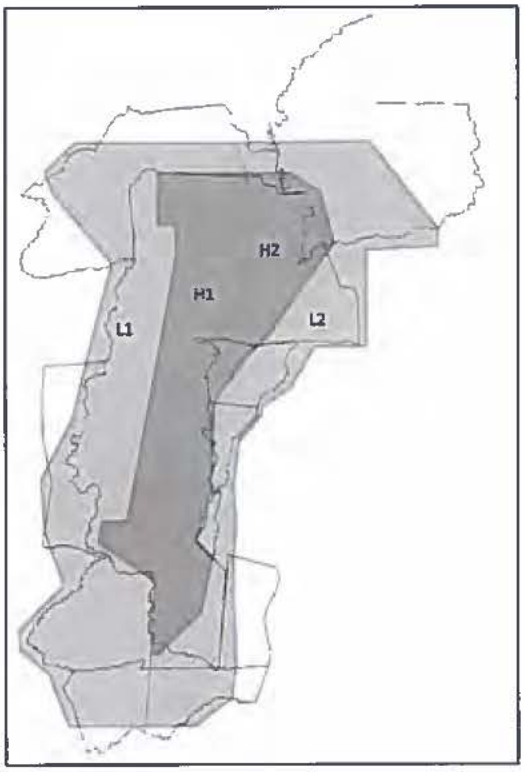
Methods followed CITES MIKE aerial survey standards using stratified systematic transect sampling (Norton Griffiths, 1978) with analysis by Jolly's method for unequal size sampling units (Jolly, 1969).

Survey design

The survey area was stratified on the basis of previously reported elephant densities. The Lower Zambezi Valley was not stratified.



Luangwa Survey Zones: Light shading: 7.5% sampling; Dark shading: 15% sampling; Unshaded: excluded from survey.

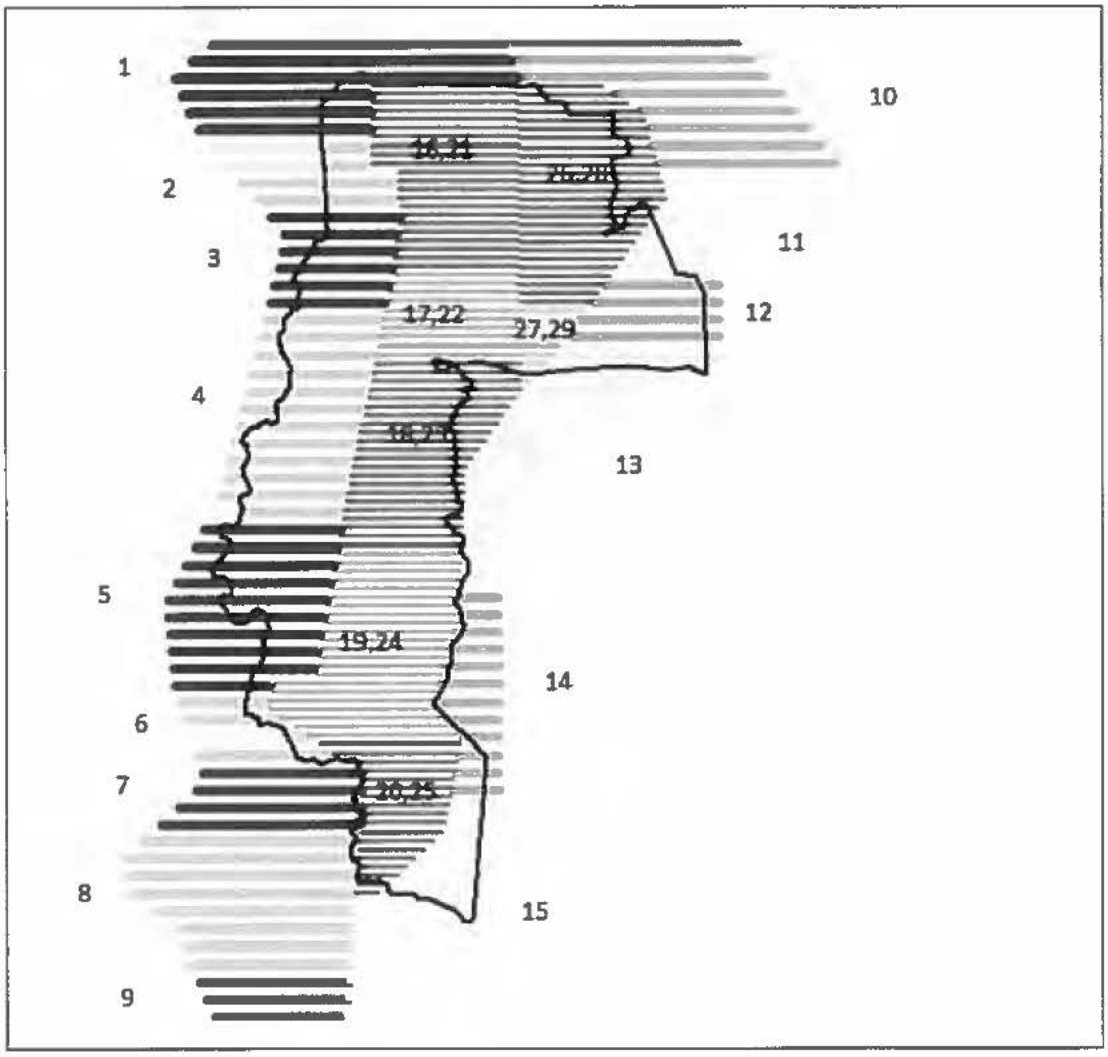


Kafue Survey Zones: Light shading: 7.5% sampling; Dark shading: 15% sampling; Unshaded: excluded from survey

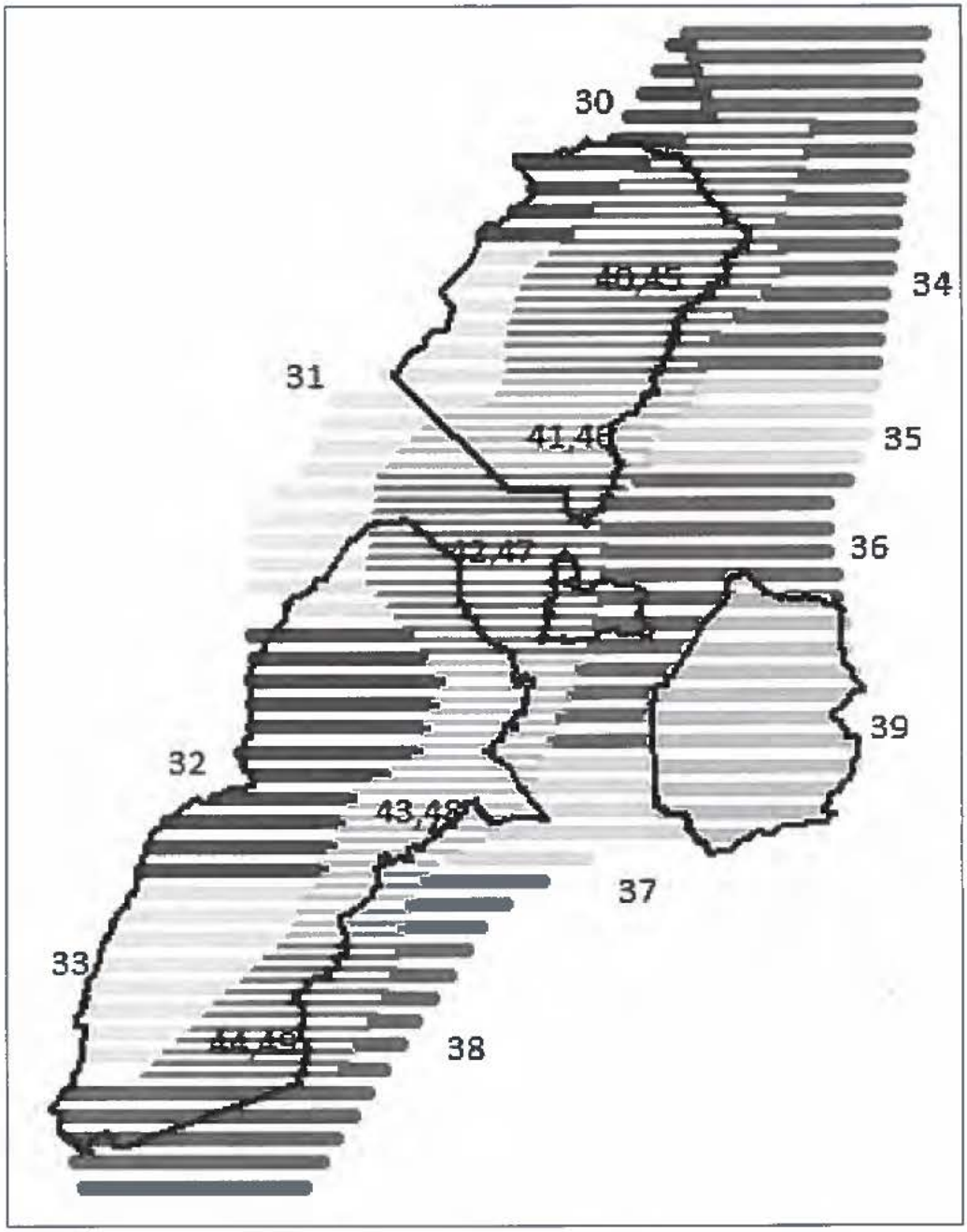
Selection of transects

Transects were evenly spaced according to the required sampling intensity (3 km for 10% coverage,) from a randomly chosen start point and oriented at right angles to major features (e.g. rivers) in each stratum, as far as possible (Fig. 18).

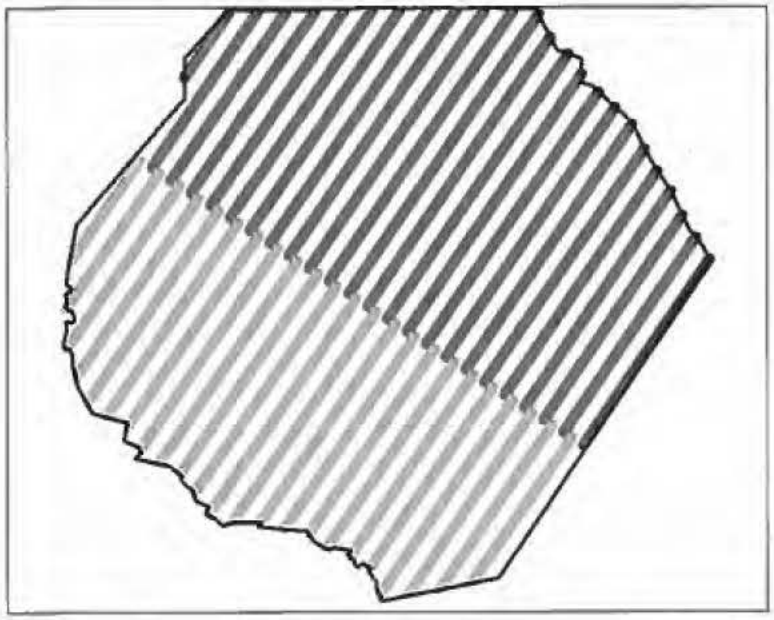
Sampling intensities were designed to maximise the precision of elephant estimates so were selected for each stratum on the basis of previously reported elephant densities and modified to fit budgetary constraints.



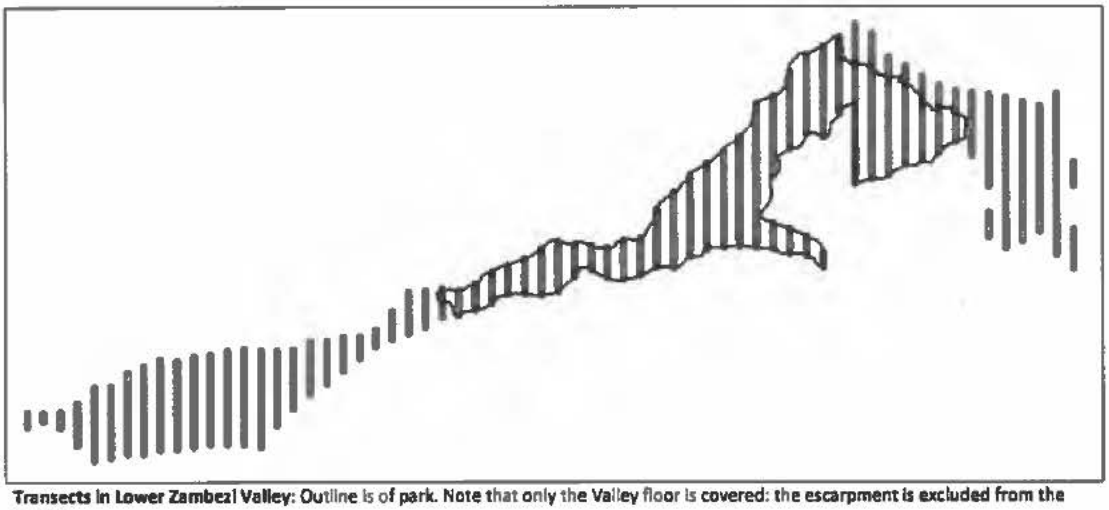
Strata and substrata in Kafue ecosystem: Eastern Stratum is KA, Western is KB and the two central strata are named KC (red) and KD (green), respectively. As each central stratum consists of two interleaved sets of transects, these sets are named KCA, KCB, KDA and KDB. Flight substrata are distinguished by colour here, and numbered 1-25.



Strata and substrata in the Luangwa Ecosystem. Strata: 5% sampling blocks are named LA (blue), LB(green) and LD(yellow). Central block (red) consists of two interleaved 5% coverages: LCA and LCB. Flight substrata are numbered. LD is Lukusuzi National Park - other parks do not coincide with



Transects in Sioma Ngwezi. Northernmost stratum is SIA, the other is SIB



Transects in Lower Zambezi Valley: Outline is of park. Note that only the Valley floor is covered: the escarpment is excluded from the survey.

Data collection

The aircraft were flown at a nominal height of 300 feet above ground level along the transects. Height above ground level was maintained by the pilots using the radar altimeters fitted in each aircraft. The height was recorded every 30 seconds along the transect and the mean height was used to correct the strip width for the transect from the calibrated width at 300ft to the actual width.

Calibration was carried out prior to the survey by flying over numbers painted on the airstrip at 10m intervals. The further and nearer numbers within the strip markers were called out by each observer

on each of about 20 passes over the airstrip. Height readings on both pressure and radar altimeters were taken on each pass. Results and calculations to give calibrated height are reported in Appendix II. Strip markers were fishing rods clamped to the aircraft struts.

Accurate navigation along each transect was achieved using Garmin GPS sets uploaded with transect coordinates. The position of each sighting was recorded on the GPS, which was also

used to record tracklogs of all flights. This data was downloaded as GPX files after each flight. Digital data of uploads and downloads are provided separately with this report.

Species and number seen for each sighting were recorded on data sheets. Data was captured to digital form during and after the survey.

Data analysis

Jolly's (1969) method for blocks of unequal size was used to calculated estimates of density and variance for each species in each stratum as follows:

$$R = \frac{\sum_{i=1}^{n} y_i}{\sum_{i=1}^{n} z_i}$$

$$\hat{Y} = Z.R$$

$$V_{\hat{Y}} = \frac{N(N-n)}{n}.(s_y^2 - 2.R.s_{zy} + R^2.s_z^2)$$

where:

R = density of animals

Y = total number estimated

Z = total area of stratum

y_i = number of animals counted in transect i

z_i = area of transect i

n = number of transects

N = number of transects possible in stratum where N = n.Z/Σz

s_y^2 = variance of number seen per transect

s_z^2 = variance of transect areas

s_{zy} = covariance between number seen per transect and transect area

V_y = variance of estimated number in stratum (i.e. variance of Y)

Overall estimates and variances were obtained from the sums of the stratum estimates and their variances.

Where strata were flown twice by different aircraft (strata KC A&B,KD A&B and LC A&B) the mean estimate of the two results was taken as the overall estimate. The variance of the mean result was the sum of the variances divided by four.

The standard error (SE) of the estimate is the square root of the variance and the 95% confidence limits of the estimate is $Y \pm t \, . \, SE$, where t is Student's t for a two-tailed probability of 0.05 and n-1 degrees of freedom.

Estimates for areas other than original strata (e.g. Parks) were obtained by classifying sightings according to area and reanalysing the strata with the reduced sets of sightings.

Mapping wildlife distribution

The positions of the sightings were simply plotted on a map of the area without accounting for the relative numbers of animals per sighting or the sampling intensity at which the sighting was made. All sightings (in the sample strips and out) were plotted.

APPENDIX II - Results by stratum

The following tables give the results for each stratum based on the numbers seen in the sample. SI refers to the Sampling Intensity for the stratum. Results for all species and associated statistical attributes are given. Column 6, % CI (Percent Confidence Interval), is the 95% confidence interval expressed as a percentage of the estimate.

These are the individual stratum results which have been combined to give higher level results reported above. "No. in" is the number of animals seen between the sampling strips. "No. out" is the number seen outside of them. Where the calculated lower limit of the confidence range is less than the number actually seen in the stratum (including all sightings, both in and out), the number seen is given as the lower confidence limit.

For species or attributes where no meaningful estimate can be given, only number seen is reported.

Kafue Ecosystem

	Stratum:	Kafue A		Area:	17638	Km²	SI:	6
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Baboon	669	40	40 -	1650	239625	146.5	3.79
2	Buffalo	2012	120	120 -	5935	3836403	195	11.41
3	Bushbuck	34	2	2 -	97	1014.5	190.3	0.19
4	Bushpig	84	5	5 -	200	3389.3	139.1	0.48
5	Duiker	1140	68	720 -	1560	43940.1	36.8	6.46
6	Eland	754	45	45 -	2224	538234.1	194.8	4.28
7	Hartebeest	1710	102	231 -	3189	545117.5	86.5	9.7
8	Hippopotamus	17	1	1 -	49	252.8	190	0.1
9	Impala	3739	223	1439 -	6038	1318013	61.5	21.2
10	Kudu	570	34	103 -	1037	54437.6	82	3.23
11	Lechwe	872	52	52 -	2401	582382.9	175.4	4.94
12	Monkey	671	40	40 -	1975	424284.6	194.6	3.8
13	Oribi	17	1	1 -	49	252.8	190	0.1
14	Puku	989	59	59 -	2249	395548.4	127.4	5.61
15	Reedbuck	201	12	12 -	419	11831.9	108.3	1.14
16	Roan	1509	90	197 -	2821	428779.8	86.9	8.55
17	Sable	5767	344	2959 -	8576	1965594	48.7	32.7
18	Sitatunga	101	6	6 -	265	6725.4	163.3	0.57
19	Warthog	1844	110	1144 -	2544	122114.3	38	10.46
20	Waterbuck	234	14	14 -	477	14625.6	103.4	1.33
21	Zebra	117	7	7 -	346	13008.6	194.7	0.67
22	Jackal SS	0	0	0 -	0	0	0	0
23	Ground Hornbill	1073	64	600 -	1546	55802.9	44.1	6.08
24	Wattled crane	34	2	2 -	97	1014.5	190.3	0.19
25	Donkey	84	5	5 -	246	6553.6	193.5	0.48
26	Cattle	6052	361	361 -	11998	8809719	98.2	34.31
27	Sheep/goats	2029	121	121 -	4443	1453256	119	11.5

	Stratum:	Kafue B				Area:	12141	Km²	SI:	5.5
	Species	Pop. est.	No. seen	95% Range			Variance	% CL	No./ 100km²	
1	Baboon	1174	64	64	-	2313	323301.3	97	9.67	
2	Bushbuck	92	5	5	-	197	2781.9	115.2	0.76	
3	Bushpig	92	5	5	-	271	7997.7	195.4	0.76	
4	Duiker	403	22	258	-	549	5277.4	36.1	3.32	
5	Eland	385	21	21	-	1102	127960.6	186.1	3.17	
6	Grysbok	18	1	1	-	54	322.6	196.2	0.15	
7	Hartebeest	1376	75	153	-	2598	372367.9	88.9	11.33	
8	Hippopotamus	183	10	10	-	538	31314.3	193.3	1.51	
9	Impala	5337	291	520	-	10154	5782437	90.3	43.96	
10	Kudu	165	9	9	-	332	6965.9	101.3	1.36	
11	Monkey	18	1	1	-	54	318	194.8	0.15	
12	Puku	2366	129	129	-	6855	5021544	189.7	19.49	
13	Reedbuck	459	25	25	-	1120	109168.8	144.4	3.78	
14	Roan	569	31	31	-	1494	213271.6	162.7	4.68	
15	Sable	2403	131	933	-	3872	538182.8	61.2	19.79	
16	Warthog	1541	84	524	-	2557	257657.1	66	12.69	
17	Waterbuck	3375	184	184	-	6720	2788253	99.1	27.8	
18	Wildebeest	1669	91	91	-	3783	1113868	126.7	13.75	
19	Zebra	3631	198	198	-	7705	4136205	112.2	29.91	
20	Ground Hornbill	1302	71	562	-	2042	136394.1	56.8	10.73	
21	Wattled crane	92	5	5	-	209	3454.7	128.4	0.76	
22	Crowned crane	0	0	0	-	0	0	0	0	
23	Marabou stork	165	9	9	-	488	26028.4	195.8	1.36	
24	Donkey	92	5	5	-	270	7889	194	0.76	
25	Cattle	38973	2125	22573	-	55374	6.70E+07	42.1	321.01	
26	Sheep/goats	10289	561	4856	-	15722	7356537	52.8	84.75	

	Stratum:	Kafue CA		Area:	11821	Km²	SI:	6.2
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Buffalo	4825	297	297 -	11395	1.07E+07	136.2	40.82
2	Bushbuck	49	3	3 -	119	1209.7	143.6	0.41
3	Bushpig	49	3	3 -	144	2221.6	194.7	0.41
4	Duiker	146	9	23 -	270	3776.4	84.6	1.24
5	Eland	32	2	2 -	77	484.9	136.4	0.27
6	Hartebeest	1690	104	711 -	2668	236497.7	57.9	14.29
7	Hippopotamus	536	33	33 -	1089	75439.6	103.1	4.54
8	Impala	3444	212	1226 -	5662	1214510	64.4	29.14
9	Kudu	422	26	26 -	829	40825.1	96.3	3.57
10	Lechwe	11583	713	713 -	23919	3.76E+07	106.5	97.99
11	Oribi	65	4	4 -	164	2435	152.9	0.55
12	Puku	9098	560	560 -	19153	2.50E+07	110.5	76.96
13	Reedbuck	81	5	5 -	194	3130	138.6	0.69
14	Roan	195	12	12 -	499	22742.4	155.7	1.65
15	Sable	4776	294	2399 -	7153	1394732	49.8	40.4
16	Warthog	2583	159	1728 -	3438	180360.9	33.1	21.85
17	Waterbuck	1381	85	733 -	2079	111775.3	47.8	11.68
18	Wildebeest	341	21	21 -	704	32538.2	106.4	2.89
19	Zebra	926	57	57 -	2042	307523.1	120.5	7.83
20	Wild Dog	114	7	7 -	336	12201.9	195.5	0.96
21	Ground Hornbill	650	40	319 -	980	26939.3	50.8	5.5
22	Wattled crane	504	31	31 -	1117	92733.9	121.7	4.26
23	Crowned crane	32	2	2 -	96	986.5	194.6	0.27
24	Saddlebill	16	1	1 -	48	246	194.3	0.14
25	Cattle	601	37	37 -	1441	174039.5	139.7	5.08

	Stratum:	Kafue CB		Area:	11821	Km²	SI:	5.4
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Baboon	556	30	30 -	1177	98289.3	115.5	4.7
2	Buffalo	705	38	38 -	1936	374254.2	174.8	5.96
3	Bushbuck	56	3	3 -	117	931.3	110.4	0.47
4	Bushpig	334	18	18 -	679	29487.7	103.6	2.82
5	Duiker	297	16	142 -	451	5890.5	52.1	2.51
6	Grysbok	19	1	1 -	55	325.7	195.9	0.16
7	Hartebeest	3337	180	1636 -	5039	714455.8	51	28.23
8	Hippopotamus	148	8	8 -	438	20775.5	195.6	1.25
9	Impala	18762	1012	9980 -	27544	1.90E+07	46.8	158.72
10	Kudu	519	28	147 -	891	34132	71.6	4.39
11	Lechwe	11254	607	607 -	29006	7.78E+07	157.7	95.2
12	Oribi	19	1	1 -	55	324.3	195.5	0.16
13	Puku	11254	607	2421 -	20086	1.93E+07	78.5	95.2
14	Reedbuck	334	18	18 -	661	26447.2	98.1	2.82
15	Roan	946	51	51 -	1955	251670.6	106.8	8
16	Sable	6507	351	2729 -	10286	3524130	58.1	55.05
17	Warthog	5599	302	3759 -	7439	835210.2	32.9	47.36
18	Waterbuck	5766	311	3100 -	8431	1753355	46.2	48.78
19	Wildebeest	2114	114	114 -	4319	1200736	104.4	17.88
20	Zebra	593	32	32 -	1298	122471.9	118.7	5.02
21	Ground Hornbill	890	48	354 -	1425	70794.1	60.2	7.53
22	Wattled crane	297	16	16 -	588	20953.9	98.2	2.51
23	Crowned crane	19	1	1 -	55	323.3	195.2	0.16
24	Cattle	445	24	24 -	1059	92916.5	137.9	3.76

	Stratum:	Kafue C Mean Estimates		Area:	11821	Km²	SI:	5.8
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Baboon	278	30	-				2.35
2	Buffalo	2765	335	335	5953	2576726	115.3	23.39
3	Bushbuck	52	6	8	97	502.1	85.3	0.44
4	Bushpig	191	21	21	363	7470.6	89.8	1.62
5	Duiker	221	25	127	316	2270.8	42.7	1.87
6	Eland	16	2	2	37	113.3	130.1	0.14
7	Grysbok	9	1	1	27	76.8	187.7	0.08
8	Hartebeest	2513	284	1574	3453	223676.8	37.4	21.26
9	Hippopotamus	342	41	44	640	22520.6	87.1	2.89
10	Impala	11103	1224	6765	15441	4770617	39.1	93.93
11	Kudu	471	54	207	734	17583.3	55.9	3.98
12	Lechwe	11418	1320	1320	21759	2.71E+07	90.6	96.59
13	Oribi	42	5	5	92	645.3	120.8	0.35
14	Puku	10176	1167	3780	16571	1.04E+07	62.9	86.08
15	Reedbuck	207	23	42	373	6966	79.9	1.76
16	Roan	570	63	65	1075	64643.1	88.6	4.82
17	Sable	5642	645	3506	7778	1156613	37.9	47.73
18	Warthog	4091	461	3120	5062	239030.6	23.7	34.61
19	Waterbuck	3573	396	-				30.23
20	Wildebeest	1227	135	157	2298	290670.3	87.2	10.38
21	Zebra	760	89	129	1390	100710.3	83	6.43
22	Wild Dog	57	7	7	163	2850.4	186.5	0.48
23	Ground Hornbill	770	88	469	1071	22982.5	39.1	6.51
24	Wattled crane	400	47	76	724	26602.6	81	3.38
25	Crowned crane	26	3	3	60	306.7	136.3	0.22
26	Saddlebill	8	1	1	23	57.5	185.3	0.07
27	Cattle	523	61	61	1020	62560.7	95	4.42

	Stratum:	Kafue DA			Area:	3430	Km²	SI:	5.4
	Species	Pop. est.	No. seen	95% Range			Variance	% CL	No./ 100km²
1	Baboon	717	39	39		1558	159030.8	117.4	20.89
2	Buffalo	7516	409	409		22587	5.10E+07	200.5	219.12
3	Bushbuck	18	1	1		56	315.3	203.9	0.54
4	Bushpig	37	2	2		112	1266.8	204.3	1.07
5	Duiker	129	7	7		256	3626.6	98.8	3.75
6	Hartebeest	294	16	16		848	69071.2	188.6	8.57
7	Hippopotamus	294	16	16		856	70988.2	191.2	8.57
8	Impala	8159	444	4257		12061	3420973	47.8	237.87
9	Kudu	74	4	4		172	2194.9	134.5	2.14
10	Oribi	37	2	2		112	1266.8	204.3	1.07
11	Puku	3547	193	961		6132	1501575	72.9	103.4
12	Reedbuck	147	8	11		283	4173.7	92.7	4.29
13	Roan	662	36	36		1566	183982.1	136.8	19.29
14	Sable	845	46	46		1768	191099.5	109.1	24.64
15	Warthog	2775	151	1409		4140	418768.4	49.2	80.9
16	Waterbuck	570	31	31		1324	127903.2	132.5	16.61
17	Zebra	1341	73	78		2605	358781.5	94.2	39.11
18	Ground Hornbill	129	7	7		294	6151.3	128.6	3.75

	Stratum:	Kafue DB			Area:	3430	Km²	SI:	6.3
	Species	Pop. est.	No. seen	95% Range			Variance	% CL	No./ 100km²
1	Bushbuck	48	3	3	-	118	1082.6	145.6	1.4
2	Duiker	96	6	7	-	185	1762.1	92.9	2.79
3	Eland	0	0	0	-	0	0	0	0
4	Hartebeest	1038	65	65	-	2127	264037.9	104.9	30.26
5	Hippopotamus	240	15	15	-	581	25967.9	142.6	6.98
6	Impala	3178	199	1186	-	5170	883118.4	62.7	92.65
7	Kudu	16	1	1	-	50	257.9	213.2	0.47
8	Oribi	144	9	17	-	270	3548.4	87.9	4.19
9	Puku	2332	146	146	-	4617	1162224	98	67.97
10	Reedbuck	64	4	4	-	193	3699.7	201.9	1.86
11	Sable	160	10	10	-	457	19640	186	4.66
12	Warthog	559	35	125	-	993	41986.8	77.7	16.3
13	Waterbuck	80	5	5	-	211	3823.8	164.2	2.33
14	Zebra	64	4	4	-	192	3674	201.2	1.86
15	Ground Hornbill	160	10	10	-	348	7876.3	117.8	4.66
16	Wattled crane	32	2	2	-	97	938.6	203.4	0.93

	Stratum:	Kafue D Mean Estimates		Area:	3430	Km²	SI:	5.9
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Baboon	358	39	39	752	37469.6	109.9	10.45
2	Buffalo	3758	409	409	10812	1.20E+07	187.7	109.56
3	Bushbuck	33	4	4	70	326.8	111	0.97
4	Bushpig	18	2	2	54	298.5	191.3	0.54
5	Duiker	112	13	40	185	1265.6	64.5	3.27
6	Eland	0	0	0	0	0	0	0
7	Hartebeest	666	81	98	1234	77873.8	85.2	19.42
8	Hippopotamus	267	31	31	574	22784	115.1	7.78
9	Impala	5668	643	3622	7715	1012054	36.1	165.26
10	Kudu	45	5	5	94	577.3	109.3	1.3
11	Oribi	90	11	22	159	1126.3	75.7	2.63
12	Puku	2939	339	1331	4547	624935.3	54.7	85.69
13	Reedbuck	105	12	18	193	1846.5	82.9	3.07
14	Roan	331	36	36	754	43348.4	128.1	9.64
15	Sable	502	56	56	956	49607.4	90.2	14.65
16	Warthog	1667	186	997	2337	108462.4	40.2	48.6
17	Waterbuck	325	36	36	683	31027.6	110.4	9.47
18	Zebra	703	77	108	1297	85390.4	84.6	20.49
19	Ground Hornbill	144	17	28	261	3286.8	80.9	4.2
20	Wattled crane	16	2	2	46	219	188.5	0.47

Luangwa Ecosystem

	Stratum:	Luangwa A		Area:	7767	Km²	SI:	5.6
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Buffalo	375	21	21	858	57619	129.2	4.82
2	Bushbuck	36	2	2	84	575.6	135.5	0.46
3	Bushpig	178	10	10	527	29902.4	195.4	2.3
4	Duiker	268	15	101	434	6847.9	62.3	3.44
5	Hartebeest	36	2	2	105	1170.8	193.3	0.46
6	Impala	71	4	4	153	1649.7	114.7	0.92
7	Kudu	36	2	2	83	561.8	133.9	0.46
8	Roan	428	24	24	970	72269.8	126.6	5.51
9	Warthog	499	28	248	750	15507.9	50.3	6.43
10	Waterbuck	196	11	11	482	20060.7	145.5	2.53
11	Zebra	749	42	285	1213	53084.9	62	9.64
12	Ground Hornbill	161	9	9	362	10042.5	125.8	2.07

	Stratum:	Luangwa B		Area:	11108 Km²	SI:	5.8
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Baboon	1608	93	93	3321	728138.9	106.6	14.47
2	Buffalo	380	22	22	1048	110512.9	175.6	3.42
3	Bushpig	17	1	1	51	284.1	195.9	0.16
4	Duiker	467	27	226	707	14305.4	51.5	4.2
5	Hartebeest	259	15	15	516	16371.2	99.1	2.33
6	Impala	1729	100	407	3050	433157.1	76.5	15.56
7	Kudu	951	55	325	1577	97161.7	65.9	8.56
8	Monkey	173	10	10	512	28513.8	196.2	1.56
9	Puku	225	13	13	634	41485.9	182.1	2.02
10	Roan	1608	93	631	2584	236150.6	60.7	14.47
11	Warthog	432	25	160	704	18352.9	63	3.89
12	Waterbuck	277	16	16	612	27846.2	121.2	2.49
13	Wildebeest	899	52	52	2138	380515.7	137.8	8.09
14	Zebra	380	22	22	751	34145.5	97.6	3.42
15	Hyaena	17	1	1	51	275.2	192.8	0.16
16	Crocodile	17	1	1	51	276.3	193.2	0.16
17	Ground Hornbill	311	18	51	571	16790.9	83.7	2.8
18	Cattle	588	34	34	1212	96701.1	106.3	5.29
19	Sheep/goats	104	6	6	251	5369.3	141.9	0.93

	Stratum:	Luangwa CA		Area:	11334	Km²	SI:	5.3
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Baboon	412	22	22	1181	144846.8	186.6	3.64
2	Buffalo	32905	1756	11781	54028	1.09E+08	64.2	290.32
3	Bushbuck	19	1	1	55	328.2	195.4	0.17
4	Duiker	37	2	2	88	625.5	134.9	0.33
5	Eland	187	10	10	423	13604.8	125.8	1.65
6	Giraffe	131	7	7	263	4240.8	100.3	1.16
7	Hartebeest	281	15	15	563	19486	100.4	2.48
8	Hippopotamus	3841	205	629	7053	2525670	83.6	33.89
9	Impala	17127	914	9382	24872	1.47E+07	45.2	151.11
10	Kudu	431	23	147	715	19747.4	65.9	3.8
11	Puku	6615	353	3632	9598	2178627	45.1	58.36
12	Roan	187	10	10	446	16323.2	137.8	1.65
13	Sable	0	0	0	0	0	0	0
14	Warthog	1893	101	1258	2527	98442.8	33.5	16.7
15	Waterbuck	2043	109	109	4004	941581.9	96	18.02
16	Wildebeest	3729	199	316	7142	2851869	91.5	32.9
17	Zebra	4666	249	2404	6928	1252160	48.5	41.17
18	Lion	112	6	6	300	8610.8	166.8	0.99
19	Wild Dog	75	4	4	222	5260.8	195.6	0.66
20	Crocodile	431	23	23	1237	159173	187.1	3.8
21	Ground Hornbill	618	33	261	975	31180.2	57.7	5.46
22	Wattled crane	187	10	10	554	32960.7	195.8	1.65
23	Saddlebill	75	4	4	164	1933	118.6	0.66
24	Marabou stork	19	1	1	55	329.6	195.8	0.17

	Stratum:	Luangwa CB		Area:	11334	Km²	SI:	5.9
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Baboon	2690	159	297	5083	1401462	88.9	23.73
2	Buffalo	25749	1522	6071	45428	9.48E+07	76.4	227.19
3	Bushbuck	85	5	13	156	1261.4	84.9	0.75
4	Bushpig	203	12	12	444	14237.4	118.8	1.79
5	Duiker	85	5	14	155	1208.5	83.1	0.75
6	Eland	102	6	6	224	3647.7	120.3	0.9
7	Giraffe	68	4	4	132	1023	95.5	0.6
8	Hartebeest	254	15	15	558	22696.7	120	2.24
9	Hippopotamus	2555	151	323	4786	1219198	87.4	22.54
10	Impala	24278	1435	15076	33480	2.07E+07	37.9	214.2
11	Kudu	609	36	175	1043	46028.8	71.2	5.37
12	Monkey	17	1	1	50	266.1	194.9	0.15
13	Puku	7072	418	3884	10260	2487669	45.1	62.39
14	Reedbuck	17	1	1	50	271.9	197	0.15
15	Roan	321	19	81	562	14208.4	74.9	2.84
16	Warthog	2622	155	1268	3976	448768.3	51.6	23.14
17	Waterbuck	558	33	142	975	42453.5	74.6	4.93
18	Wildebeest	1979	117	186	3773	787183.8	90.6	17.46
19	Zebra	2842	168	1655	4030	345335.8	41.8	25.08
20	Honey Badger	17	1	1	50	273.1	197.4	0.15
21	Hyaena	51	3	3	151	2460.2	197.5	0.45
22	Lion	85	5	5	221	4536	160.9	0.75
23	Crocodile	355	21	21	1048	117457.4	195	3.13
24	Ground Hornbill	1150	68	549	1752	88571.8	52.3	10.15
25	Crowned crane	423	25	25	888	53026.9	110	3.73
26	Saddlebill	17	1	1	50	271.8	197	0.15
27	Sheep/goats	51	3	3	124	1296.7	143.4	0.45

Stratum:	Luangwa C Mean Estimates	Area:	11334	Km²	SI:

	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Baboon	1551	181	353	2749	362525.3	77.3	13.69
2	Buffalo	29327	3278	15542	43112	4.80E+07	47	258.75
3	Bushbuck	52	6	13	90	373	74.4	0.46
4	Bushpig	102	12	12	216	3335.7	113.2	0.9
5	Duiker	61	7	20	102	430.7	67.7	0.54
6	Eland	144	16	18	271	4064.1	87.8	1.27
7	Giraffe	99	11	29	170	1240.1	70.5	0.88
8	Hartebeest	267	30	69	466	9914.6	74.1	2.36
9	Hippopotamus	3198	356	1330	5066	881473.4	58.4	28.22
10	Impala	20702	2349	14962	26443	8321284	27.7	182.66
11	Kudu	520	59	273	767	15442.8	47.6	4.59
12	Monkey	8	1	1	24	62.3	185.7	0.07
13	Puku	6843	771	4759	8927	1096800	30.5	60.38
14	Reedbuck	8	1	1	24	63.7	187.8	0.07
15	Roan	254	29	86	423	7179.7	66.3	2.24
16	Sable	0	0	0	0	0	0	0
17	Warthog	2257	256	1544	2970	128367.3	31.6	19.92
18	Waterbuck	1300	142	342	2259	232071.8	73.7	11.47
19	Wildebeest	2854	316	1012	4697	857207.3	64.6	25.18
20	Zebra	3754	417	2533	4975	376303	32.5	33.12
21	Honey Badger	8	1	1	24	64	188.2	0.07
22	Hyaena	25	3	3	73	576.4	188.3	0.22
23	Lion	99	11	11	209	3094.1	112.4	0.87
24	Wild Dog	37	4	4	108	1241.1	187.1	0.33
25	Crocodile	393	44	44	901	65069.6	129.1	3.47
26	Ground Hornbill	884	101	551	1218	28107.5	37.7	7.8
27	Wattled crane	94	10	10	269	7775.6	187.3	0.83
28	Crowned crane	211	25	25	433	12423.9	104.9	1.87
29	Saddlebill	46	5	5	91	519.7	98.8	0.41
30	Marabou stork	9	1	1	27	77.8	187.3	0.08
31	Sheep/goats	25	3	3	60	303.8	136.7	0.22

	Stratum:	Luangwa D		Area: 2610 Km²		SI: 5.4	
	Species	Pop. est.	No. seen	95% Range	Variance	% CL	No./ 100km²
1	Bushbuck	37	2	2 122	1470.2	227.2	1.42
2	Bushpig	93	5	5 289	7951.6	211.4	3.56
3	Duiker	167	9	42 292	3206.7	74.6	6.4
4	Eland	93	5	5 289	7951.6	211.4	3.56
5	Hartebeest	130	7	7 332	8460.2	155.7	4.98
6	Kudu	149	8	8 469	21175.2	215.6	5.69
7	Roan	167	9	9 436	14926.1	160.9	6.4
8	Sable	56	3	3 139	1420.1	148.9	2.13
9	Warthog	19	1	1 57	309.5	208.5	0.71
10	Ground Hornbill	167	9	9 349	6805.2	108.6	6.4

Lower Zambezi

	Stratum:	Zambezi Valley		Area: 2528 Km²		SI: 0.5	
	Species	Pop. est.	No. seen	95% Range	Variance	% CL	No./ 100km²
1	Baboon	29	3	3 82	721.2	187.3	1.13
2	Buffalo	4806	504	504 9912	6553079	106.3	190.1
3	Duiker	19	2	2 44	159.9	132.3	0.75
4	Hippopotamus	734	77	159 1310	83223.1	78.4	29.04
5	Impala	3947	414	1845 6050	1110993	53.3	156.15
6	Kudu	67	7	7 129	973.6	93.3	2.64
7	Warthog	162	17	17 307	5309.8	89.7	6.41
8	Waterbuck	658	69	69 1347	119389.3	104.8	26.03
9	Zebra	400	42	42 833	47057.3	108.1	15.84
10	Crocodile	19	2	2 45	165.7	134.7	0.75
11	Ground Hornbill	76	8	8 150	1353.8	96.2	3.02
12	Cattle	601	63	63 1252	106662.3	108.5	23.76
13	Sheep/goats	1077	113	113 2213	323754.9	105.3	42.62

Sioma Ngwezi

	Stratum:	Sioma A			Area: 2772.1 Km²		SI: 11.9
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Buffalo	293	35	35	867	76516.9	195.6	11.86
2	Duiker	620	74	470	769	5195.7	24.1	25.08
3	Eland	1081	129	129	2720	624553.9	151.7	43.72
4	Giraffe	503	60	210	796	19971.8	58.3	20.33
5	Kudu	226	27	52	400	7024.5	76.8	9.15
6	Oribi	17	2	2	40	124.2	137.9	0.68
7	Roan	729	87	89	1369	95155.6	87.8	29.48
8	Sable	134	16	16	273	4521.1	104	5.42
9	Warthog	34	4	4	85	615.1	153.5	1.36
10	Wildebeest	59	7	7	158	2316.1	170.2	2.37
11	Zebra	193	23	23	459	16508	138.3	7.79
12	Ground Hornbill	17	2	2	39	117.5	134.2	0.68
13	Cattle	310	37	37	652	27246.2	110.4	12.54

	Stratum:	Sioma B			Area: 2010.2 Km²		SI: 12.4
	Species	Pop. est.	No. seen	95% Range		Variance	% CL	No./ 100km²
1	Baboon	16	2	2	47	225.8	193.9	0.8
2	Duiker	546	68	386	707	5954.2	29.3	27.19
3	Eland	56	7	7	121	975.3	115.1	2.8
4	Giraffe	16	2	2	37	106.5	133.2	0.8
5	Impala	72	9	9	185	2948	155.7	3.6
6	Kudu	185	23	57	313	3802.8	69.2	9.2
7	Roan	96	12	12	266	6695.8	176	4.8
8	Sable	370	46	46	770	37277.4	108.3	18.39
9	Warthog	80	10	10	157	1357.9	95.1	4
10	Zebra	80	10	10	236	5637	193.7	4
11	Cattle	747	93	93	1590	164944.9	112.7	37.18
12	Sheep/goats	72	9	9	169	2164.3	133.4	3.6

GOVERNMENT OF ZAMBIA

STATUTORY INSTRUMENT NO. 60 OF 2007

The Zambia Wildlife Act
(Act No. 12 of 1998)

The Zambia Wildlife (Licences and Fees)
Regulations, 2007

IN EXERCISE of the powers contained in sections thirty-four and one hundred and forty-four of the Zambia Wildlife Act 1998, the following Regulations are hereby made:

Title

S I No. of 2007

1. These Regulations may be cited as the Zambia Wildlife (Licences and Fees) Regulations, 2007

Non-Resident Hunting licence

2 (1) An application for a non-resident hunting licence, shall be made in LF ZAWA FORM 1 as set out in the First Schedule.

(2) The non-resident hunting licence shall be in LFZAWA FORM 2 as set out in the First Schedule.

(3). A non-resident hunting licence shall –

(a) be issued to a client of a licenced hunting outfitter; and

(b) authorise the licensee to hunt the animals specified in the licence and in the numbers stated in the licence and shall be subject to the conditions specified in the licence.

(4) An applicant of a non-resident hunting licence shall at the beginning of the hunting season submit to the Director-General a non-resident hunting order form in LFZAWA FORM 3 set out in the First Schedule.

Resident hunting licence

3. (1) An application for a resident hunting licence shall be made in LF ZAWA FORM 4 as set out in the First Schedule.

(2) For purposes of this regulation a resident hunting licence may be issued by a designated Licensing office in LFZAWA FORM 5 set out in the First Schedule;

(3) The licensee shall pay the fee in respect of a resident hunting licence as specified in the Second Schedule.

(4) A resident hunting licence shall authorise the licensee to hunt the game and/or protected animals specified in the licence and shall be subject to the terms and conditions set out in the licence.

(5) A holder of a resident hunting license shall, in accordance with section sixty-one of the Act, endorse all animals killed, captured or wounded during the validity of the licence, on the space provided at the back of the licence.

Game Management Area Permit

4. (1) The Game Management Area Permit shall be in LFZAWA FORM 7 as set out in the First Schedule.

(2) The Permit Holder shall, in respect of a Game Management Area Permit, pay the prescribed fee specified in the Second Schedule and shall be valid for the period specified in the permit and shall be subject to the conditions specified in the permit.

Bird Licence

5. (1) An application for a bird licence shall be made in LFZAWA FORM 8 as set out in the First Schedule.

(2) The licensee shall, in respect of a bird licence, pay the prescribed fee specified in the Second Schedule.

(3) A bird licence shall be in LFZAWA FORM 9 as set out in the First Schedule.

(4) A bird licence shall be subject to the conditions stated in the licence and shall authorise the licensee to hunt the birds specified in the licence, in any area in Zambia, other than a National Park, Wildlife/Bird Sanctuary, and in the number specified in that licence.

Special Licence

6. (1) An application for a special licence shall be in LFZAWA FORM 10 as set out in the First Schedule.

(2) The licensee shall, in respect of a special licence, pay the prescribed fee specified in the Second Schedule.

(3) The special licence shall be in LFZAWA FORM 11 as set out in the First Schedule.

(4) A special licence shall authorise the licensee –

(a) for purposes of scientific research or for the collection of specimens for zoos, museums or education centres to hunt such game and/or protected animal(s) as may be specified in the licence;

(b) to hunt in any stated National Park, Wildlife/Bird Sanctuary or Game Management Area such game and/or protected animals as may be specified in the licence; or

(b) to rear any wild animal and for such purposes to capture for rearing or hunt in any stated area or part of the republic such game and/or protected animal as may be specified.

(5) The licensee shall endorse all animals captured, killed or wounded during the validity of the licence, on the space provided at the back of the licence.

Professional Hunters Licence

7. (1) An application for a professional hunter's licence shall be made in LFZAWA FORM 12 as set out in the First Schedule.

(2) A professional hunter's licence shall be in LFZAWA FORM 13 as set out in the First Schedule.

(3) The licensee under this Regulation shall be subject to the terms and conditions specified in the licence and be required to pay the fee specified in the Second Schedule.

(4) A professional hunter's licence shall authorise the licensee to carry on business as a professional hunter, and while accompanied by a bona fide client, to hunt, such animals as are specified in the licence issued to such bona fide client and in the numbers so prescribed in accordance with the terms and conditions set out in the licence.

(5) Every licensee under a professional hunter's licence shall, in accordance with paragraph (c) of section sixty-two, of the Zambia Wildlife Act keep in LFZAWA FORM 14 set out in the First Schedule, on a daily basis, a record of –

(a) each licence issued to each client in respect of which the licensee accepted engagement by such client as a professional hunter; and

(b) the game and/or protected animals, other than birds, hunted by, or on behalf of, such client under the licence.

(6) Every licensee holding an Elephant Licence shall keep a record of the elephant killed in LFZAWA FORM 14 A set out in the First Schedule,

Apprentice Professional Hunter's

8. (1) An application for an apprentice professional hunter's licence shall be made in LFZAWA FORM 15 as set out in the First Schedule.

(2) An apprentice professional hunter's licence shall be in LFZAWA 16 as set out in the First Schedule and shall be subject to the conditions stated in the licence.

(3) The licensee shall in respect of the licence pay the fee specified in the Second Schedule.

(4) An apprentice professional hunter's licence shall –

(a) be subject to the terms and conditions set out in the licence; and

(b) shall authorise the licensee to hunt the game and/or protected animals specified in the licence, under the supervision and subject to the instructions of a licence under a Professional Hunter's licence, in the areas of a province, other than a National Park, bird/wildlife sanctuary, specified in the licence.

Professional Guides Licence

9 (1) An application for a professional guide's licence shall be made in LFZAWA FORM 17 set out in the First Schedule.

(2) A professional guides licence shall be in LFZAWA FORM 18 set out in the First Schedule.

(3) The licensee shall, in respect of the licence, be subject to the terms and conditions specified in the licence and shall pay the fee specified in the Second Schedule.

(4) A professional Guide's Licence shall authorise a licensee to conduct, or to offer to conduct for reward, a photographic or viewing safari in accordance with such terms and conditions as may be specified in the licence.

Apprentice Professional Guides Licence

10.(1) Any person who ordinarily resides in Zambia may apply for an apprentice professional guide's licence and an application shall be made in LFZAWA FORM 19 as set out in the first Schedule.

(2) The applicant shall, in respect of the apprentice professional guide's licence, pay the fees specified in the Second Schedule.

(3) An apprentice professional guide's licence shall be in LFZAWA FORM 20, as set out in the First Schedule and shall be subject to the conditions specified in the licence.

(4) The licence shall authorise the licensee to carry on business as an apprentice professional guide under the supervision, and subject to the instructions, of a licensee issued with a valid professional guide's licence while accompanied by the client in respect of whom the licensee is engaged, the conduct for reward, subject to the terms and conditions of the licence, photographic or viewing safari.

(5) A licensee shall not take any client out for game drives and walks unless accompanied by a licensee issued with a valid professional guide's licence.

Photographic Tour operator's licence

11 (1) A person holding a valid tourism enterprise licence issued under the

Tourism Act may apply for a photographic tour operator's licence which application shall be made in LFZAWA FORM 21 as set out in the First Schedule.

(2) The applicant shall pay the fee specified in the Second Schedule.

(3) A photographic tour operator's licence shall be in LFZAWA FORM 22, set out in the First Schedule and shall be subject to the conditions specified in the licence.

(4) The licence shall authorise the licensee to conduct the business of a photographic tour operator subject to the terms and conditions specified in the licence.

Hunting Outfitters Licence

12. (1) Any person may apply for a hunting outfitter's licence in LFZAWA FORM 23, set out in the First Schedule if the person –

(a) holds a valid tourism enterprise licence issued under the Tourism Act;

(b) ordinarily resides in Zambia; and

(c) holds a hunting concession over a Game Management Area or part thereof.

(d) has a Registered game ranch in Zambia.

(2) The applicant shall pay the fee specified in the Second Schedule.

(3) A hunting outfitter's licence shall authorise the licensee to conduct hunting operations in a Game Management Area or a hunting block, subject to the terms and conditions of the licence.

(4) The hunting outfitter's licence shall be in LFZAWA FORM 24 set out in the First Schedule.

Restricted Professional Hunter's Licence

13 (1) Any person may apply for a restricted professional hunter's licence in LFZAWA FORM 25, as set out in the First Schedule.

(2) The applicant shall pay the fee specified in the Second Schedule.

(3) A restricted professional hunter's licence shall be in LFZAWA FORM 26, as set out in the First Schedule.

(4) The licence shall authorise the licensee to carry on business as a professional hunter in respect of non-dangerous animals subject to the terms and conditions as specified in the licence.

Commercial Photographic Licence

14. (1) Any person may apply for a commercial photographic licence in LFZAWA FORM 27, as set out in the First Schedule.

(2) The applicant shall pay the appropriate fee prescribed in the Second Schedule.

(3) A commercial photographic licence shall be in LFZAWA FORM 28, as set out in the First Schedule.

(4)The licensee shall, subject to the other provisions of the Act and

to the terms and conditions stated in the licence, authorise the licensee to –

(a) make paintings; or

(b) take films or video in a National Park, for commercial purposes.

Licence not Transferable

15. A licence issued under the Act shall not be transferable.

Grant of licence refusal to grant licence. etc.

16. (1) The Director General may at any time –

(a) grant;

(b) refuse to grant;

(c) suspend;

(d) revoke; or

(e) cancel;

any licence under these regulations, and shall upon so doing notify the applicant, in the appropriate form, as the case may be.

(2) A notice of refusal to grant a licence shall be in LFZAWA FORM 29, as set out in the First Schedule.

(3). A notice to revoke a licence shall be in LFZAWA FORM 30, as set out in the First Schedule.

(4) A notice to suspend a licence shall be in LFZAWA FORM 31, as set out in the First Schedule.

(5) Where a licence is suspended –

(a) the period of suspension shall be endorsed on the licence by the Director-General;

(b) the licence shall be surrendered to the Director-General.

(6) A notice to Cancel a licence shall be in LFZAWA FORM 31A, as set out in the First Schedule.

Certificate of Ownership of trophies

17. (1) Any person who is in lawful possession of any trophy may apply to the Director General, for a certificate of ownership of trophy to that person(applicant). The application form shall be in LFZAWA FORM 32A set out in the First Schedule.

(2) The Inspection Form for Wildlife trophies shall be in LFZAWA FORM 32B set out in the First Schedule.

(3) The Director-General may upon being satisfied that a person is in lawful custody of any trophy, issue a certificate of ownership of that trophy to that person. A certificate of ownership shall be in LFZAWA FORM 32, as

set out in the First Schedule.

(4). The applicant shall pay the appropriate fee prescribed in the Second Schedule.

(5) The Director-General may, upon satisfaction that a certificate of ownership was issued through error, fraud or misrepresentation of any person, revoke the certificate.

(6) The person to whom a certificate of ownership is issued shall, when the certificate of ownership is revoked, return the certificate to the Director General for cancellation.

(7) A notice of revocation shall be in LFZAWA FORM 33, as set out in the First Schedule.

Certificate of ownership of Game animal or Protected animals

18 (1) Any person who is in lawful possession of any game and/or protected animal may apply to the Director-General for a certificate of ownership of such game and/or protected animal.

(2) The applicant shall pay the appropriate fee as set out in the Second Schedule

(3) The Director-General may upon being satisfied that a person is a lawful owner of any game and/or protected animal issue a certificate of ownership of that game and/or protected animal to that person.

(4) A certificate of ownership of game and/or protected animal shall be in LFZAWA FORM 34, as set out in the First Schedule.

(5) The Director-General may, upon satisfaction that a certificate was issued through error, fraud or misrepresentation of any person, revoke the certificate.

(6) The person to whom a certificate is issued shall, when the certificate is revoked, return the certificate to the Director-General, for cancellation.

(7). A notice of revocation shall be in LFZAWA FORM 35, as set out in the First Schedule.

Permit to import wild animals or meat of any wild animal

19. (1) Any person who wishes to import any wild animal or the meat or any trophy, other than ivory and/or rhinoceros horn, may apply to the Director General for a permit to import such wild animal, meat or trophy.

(2) The applicant shall pay the appropriate fee set out in the Second Schedule.

(3) The permit shall be in LFZAWA FORM 36 as set out in the First Schedule, and shall be valid for the period specified in the permit and shall be subject to the conditions specified in the permit.

(4) The permit issued under this regulation shall not be a substitute to any permit or authority to export any wild animal or meat or any trophy required by or under any written law nor shall the permit be deemed to relieve any person from any restriction on or prohibition of the import of any wild animal, meat or trophy imposed by or under the Act or any other written law.

Permit to import ivory or rhinoceros horn

20. (1) Any person who wishes to import any ivory, rhinoceros horn or any game and/or protected animal may apply to the Director-General for a permit to import such ivory, rhinoceros horn or game and/or protected animal.

(2) The applicant shall pay the appropriate fee set out in the Second Schedule.

(3) The Authority may, with the approval of the Minister, issue to the applicant, a permit to import ivory or rhinoceros horn in LFZAWA FORM 37 set out in the First Schedule.

(4) The permit shall –

(a) specify the period of validity; and

(b) state the terms and conditions imposed on the permit holder by the Authority.

(5) The permit issued under this regulation shall not be a substitute to any permit or authority to export any ivory or rhinoceros horn required by or under any written law nor shall any restriction on or prohibition of the export of any ivory or rhinoceros horn imposed by or under the Act or any other written law.

Trophy dealers permit

21 (1) Any person may apply to the Director-General for a trophy dealer's permit in LFZAWA FORM 38, as set out in the First Schedule.

(2) The applicant shall pay the appropriate fee, as set out in the Second Schedule.

(3) A trophy dealer's permit shall be in LFZAWA FORM 39, as set out in the First Schedule.

(4) The permit shall –

(a) state the period of validity;

(b) state the terms and conditions applicable to the holder of the permit; and

(c) authorise the holder of the permit to buy, sell, deal in, process or manufacture articles from trophies by way of trade or business.

(5) The Director-General may –

(a) impose any conditions he/she considers appropriate; or

(b) limit the permit to, or exclude from the permit, any specific trophy or class of trophies.

(6) The Director General may at any time –

(a) grant;

(b) refuse to grant;

(c) suspend;

(d) revoke; or

(e) cancel;

any trophy dealer's permit and shall upon so doing notify the applicant in writing by; post, e-mail, fax, hand or electronic the reason thereof, as the case may be, in the appropriate Form.

(7) A notice of refusal to grant a trophy dealer's permit shall be in LFZAWA FORM 40, as set out in the First Schedule.

(8) A notice to suspend, revoke or cancel a trophy dealer's permit shall be in LFZAWA FORM 41, as set out in the First Schedule.

Permit to export ivory or rhinoceros horn

22. (1) Any person who wishes to export any ivory, rhinoceros horn or any game and/or protected animal may apply to the Director-General for a permit to export such ivory, rhinoceros horn, game and/or protected animal.

(2) The applicant shall pay the appropriate fee set out in the Second Schedule.

(3) The Authority may, with the approval of the Minister, issue to the applicant, a permit to export ivory or rhinoceros horn, in LFZAWA FORM 42 set out in the First Schedule.

(4) The permit shall –

(a) specify the period of validity; and

(b) state the terms and conditions of issuance of the permit by the Authority.

(5) The permit issued under this regulation shall not be a substitute to any permit or authority to export any ivory or rhinoceros horn required by or under any written law nor shall any restriction on or prohibition of the export of any ivory or rhinoceros horn imposed by or under the Act or any other written law.

Permit to export wild animals, meat or trophies

23. (1) Any person who wishes to export any wild animal or the meat of any wild animal, other than a protected animal, or any trophy, other than ivory or Rhinoceros horn, may apply to the Director for a permit to export such wild animal, meat or trophy.

(2) The application shall be in LFZAWA FORM 43A set out in the First Schedule and the applicant shall pay the appropriate fee set out in the Second Schedule.

(3). The permit shall be in LFZAWA FORM 43 as set out in the First Schedule,

and shall be valid for the period specified in the permit and shall be subject to the conditions specified in the permit.

(4) The permit issued under this regulation shall not be a substitute to any permit or authority to export any wild animal or meat or any trophy required by or under any written law nor shall the permit be deemed to relieve any person from any restriction on or prohibition of the import of any wild animal, meat or trophy imposed by or under the Act or any other written law.

Permit to enter a National Park

24 (1) A permit to enter a national park shall be in LFZAWA FORM 44 set out in the first Schedule.

(2) The Permit holder shall pay the fees set out in the Second Schedule

Permit to fish in National Park

25. (1) An application for a permit to fish in a national park shall be made in writing to the Director-General.

(2) The Director-General or any wildlife police officer authorised in writing by the Director-General may issue a fishing permit where an application is made under sub regulation (1) and upon payment of the fee specified in the Second Schedule.

(3) The permit shall be in LFZAWA FORM 45 as set out in the First Schedule.

Permit to sell game or protected animal meat

26. (1) An application for a permit to sell the meat of a game and/or protected animal shall be in LFZAWA FORM 46 set out in the First Schedule.

(2) A permit to sell meat of a game and/or protected animal shall be in LFZAWA FORM 47 set out in the First Schedule..

(3) The fee payable for a permit to sell the meat of a game and/or protected animal shall be as set out in the Second Schedule.

Certificate of Valuation of trophies

27. Any person in lawful possession of a trophy may present such trophy to the Authority for valuation and shall, upon paying the prescribed fee set out in the second schedule, be issued with a Certificate of valuation of trophy in LFZAWA FORM 48 set out in the First Schedule.

Trophy Dealer's Register

28. (1) Any holder of a trophy dealer's permit shall in accordance with section eighty-eight of the Zambia Wildlife Act No. 12 of 1998, keep in LFZAWA FORM 49 set out in the First Schedule a register of the trophy traded, bought, sold or processed by the trophy dealer during the validity of the permit.

(2) The register shall be sold by the authority at the fee prescribed in the Second Schedule.

Permit to capture game and protected animal and collect wild animal eggs

29. (1) A permit to capture wild animals/birds and collect nile crocodile eggs shall be in LFZAWA FORM 50 set out in the First Schedule.

(2) The fee for a permit to capture wild animals/birds and nile crocodile eggs collection shall be as prescribed in the Second Schedule.

Permit to reside in a National Park, Bird or wildlife Sanctuary

30. (1) An application for a permit to reside in a national park, bird or wildlife sanctuary shall be in LFZAWA FORM 51 as set out in the First Schedule.

(2) The permit shall be in LFZAWA FORM 52 as set out in the First Schedule.

Permit to keep domestic animals/ birds in National Park, Bird or Wildlife Sanctuary

31. (1) An application to keep domestic animals/birds in a national park, bird or wildlife sanctuary shall be in LFZAWA FORM 53 as set out in the First Schedule.

(2) The permit holder shall pay the fees specified in the Second schedule

(3) The permit shall be in LFZAWA FORM 54 as set out in the First Schedule.

Permit to moor/beach in National Park, Bird or Wildlife Sanctuary

32. (1) An application to moor/beach a vessel in a national park, bird or wildlife sanctuary shall be in LFZAWA FORM 55 as set out in the First Schedule..

(2) The permit holder shall pay the fees specified in the Second schedule

(3) The permit shall be in LFZAWA FORM 56 as set out in the First Schedule.

Permit to keep Rhinoceros on private property

33. (1) The permit to keep rhinoceros on a private property shall be in LFZAWA FORM 57 as Set out in the First Schedule.

(2) The permit shall be applicable to person(s) holding the rhinoceros on behalf of the Director General

Fees

34. Fees shall be paid as specified in the Second Schedule.

Revocation

35. The Zambia Wildlife (Licences and Fees) regulations 2004 are hereby

revoked.

REPUBLIC OF ZAMBIA

FIRST SCHEDULE

(Regulations 2,3,4,5,6,7,8,9,10,11,12,13,14, 16, 17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32 and 33)

Zambia Wildlife Act
(No.12 of 1998)

LFZAWA FORM 1

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

APPLICATION FOR A NON RESIDENT HUNTING LICENCE

(Regulation 2)

To: The Director General

Full Name:……..……NRC No/Passport No:……

Postal Address:……..

Residential Address:……..

Occupation:…….. Tel/Fax/E-mail……..……

Firearm Licence No(s):……Tourist Firearm Licence No……..……

Calibre of Firearms:1…… 2……

3…… 4……

I HEREBY apply for a Non Resident Hunting Licence for the period:

…… to ……

1. This application is made on behalf of the above named applicant who is a bona fide client of ……..
(Name of Safari Company)

2. I, ……., declare that I am a bona fide client of
(Name of applicant)
……..being a Safari Company registered in Zambia.
(Name of Safari Company)

3. Name of company representative……..

Date:…….. ……
Signature of applicant

APPROVED/NOT APPROVED

…….. ……..
Date Director General

REPUBLIC OF ZAMBIA

THE ZAMBIA WILDLIFE ACT
(ACT NO. 12 OF 1998)

LFZAWA FORM 2

THE ZAMBIA WILDLIFE
(LICENCES AND FEES) REGULATIONS, 2007

NON RESIDENT HUNTING LICENCE

Regulation 2(2)

Station of Issue..... Date of Issue.....

DETAILS OF LICENSEE

Full Name..... Nationality.....

Tel/Fax..... E-mail address.....

Full Name of Safari Company:.....

Postal Address.....

Residential Address.....

Firearm Licence/Tourist Firearm Import No..... Calibre of Weapons.....

Type of Hunt.....

The above named Safari Company and its bonafide Clients are authorized by this licence under the guidance of the Professional Hunter to hunt the following Game and/or protected animals within the Game Management Area or hunting block specified hereunder and for the specified period and upon payment of the fees specified below:

Species of Animal	Number	Sex	Hunting Area	Hunting Period	Fees – US$

Total Animals fees paid US$.....

Concession Fees paid US$.....

Grand Total **US$.....**

.....

.....

Date Director General

Copies of this licence shall be distributed as follows:

White copy to the licensee

Yellow copy to be forwarded to the Director-General or to an agent duly appointed in writing by the Authority

Blue copy to be retained in the book

14

Conditions of issue

1. This licence expires on 31st December in the year of issue
2. Not more than three persons may accompany the licensee into the Game Management Area
3. The Licence is not transferable
4. The licence shall be valid only for the Game Management Area indicated.
5. No firearm other than those specified in this Licence may be brought and used in the Game Management Area.
6. Holders of this licence shall not be permitted to use Shotgun(s) to hunt all species of Lechwe found in the Wetland Areas

REPUBLIC OF ZAMBIA

THE ZAMBIA WILDLIFE ACT
(ACT NO. 12 OF 1998)

LFZAWA FORM 3

THE ZAMBIA WILDLIFE
(LICENCES AND FEES) REGULATIONS, 2007

NON RESIDENT HUNTING ORDER FORM

Regulation 2(4)

Name of Safari Company .....

Date.....

Name of Client.....

NRC/Passport No.....

Country of Residence.....

Postal Address.....

Residential Address.....

DETAILS OF FIREARM(S)

Tourist Firearm Import No:.....

Firearm Licence No(s).....

Calibre of Firearm(s).....

Hunting Block	Type of Hunt	Species	Sex	No. of animals	Duration of Hunt

Signature of Applicant..... Date.....

APPROVED/NOT APPROVED

....
Date Director General

16

REPUBLIC OF ZAMBIA

THE ZAMBIA WILDLIFE ACT
(ACT NO. 12 OF 1998)

LFZAWA FORM 7

THE ZAMBIA WILDLIFE
(LICENCES AND FEES) REGULATIONS, 2007

PERMIT TO HUNT IN A GAME MANAGEMENT AREA
(Regulation 4(1))

Station of issue..... Date of issue.....

DETAILS OF PERMIT HOLDER

Full name:..... NRC/Passport No:.....

Tel/Fax..... E-mail address.....

Postal Address:.....

Residential Address:.....

DETAILS OF FIREARMS

Firearm Licence No(s).....

Calibre(s).....

DETAILS OF LICENCES, HUNTING AREA & HUNTING TYPE

Non Resident/Resident Hunting Licence No (s).....

Bird Hunting Licence No.....

Hunting Type.....

is hereby authorised to hunt in .....Game

Management Area, ...Hunting block

For .....days from..... .....to.....(dates inclusive)

Fees Paid K..... Receipt No.....

....
Date Director General

Conditions of issue

1. Not more than three(3) persons may accompany the permit holder into the Game Management Area.
2. No firearms, other than those endorsed on this Permit may be brought into the Game Management Area.

Note: White copy to the Permit holder
Yellow copy to Director General
Blue copy to be retained in the book

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No.12 of 1998)

LFZAWA FORM 12

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

APPLICATION FOR A PROFESSIONAL HUNTER'S LICENSE
(Regulation 7(1))

To: The Director General

Full Name:.....NRC No/Passport No:.....

Tel/Fax..... E-mail address.....

Occupation:..... Nationality:.....

Postal Address:.....

Residential Address:.....

Firearm Import Permit/Licence No(s):.....

Calibre of Firearms:1..... 2.....

I HEREBY apply for a Professional Hunters' Licence to carry on the business of a Professional Hunter in Zambia.

1. Are you a Resident/Citizen of Zambia? YES/NO
2. If you are a Non-Zambian please give your employment permit Number, date and place of issue if applicable
   Employment/Resident Permit No.:.....Place of issue.....
   Date of issue:..... Expiry Date:.....
3. Have you ever held a Professional Hunter's Licence? YES/NO
4. If the answer to question 3 is YES, please give details.....
5. Have you been convicted of any offence relating to wildlife in any country? YES/NO
6. If the answer to question 5 is YES, please give details.....
   .....
7. Provide an employment letter with a Safari company registered in Zambia
8. Please give the names and addresses of two referees (one of whom must be a member of the Zambia Professional Hunter's Association)

Name	Address
1.....	.....
2.....	.....

9. Any other relevant information which could be considered in support of the application (e.g. previous hunting experience).....
10. I certify that the information in this application is correct.
11. (a) Give details of your qualifications:.....

    (b) Attach a C.V.

Date:..... .....
Signature of Applicant

APPROVED/NOT APPROVED

....
Date Director General

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No. 12 of 1998)

LFZAWA FORM 13

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

PROFESSIONAL HUNTER'S LICENCE
(Regulation 7(2))

Station of issue:..... Date of issue:.....

DETAILS OF LICENSEE

Full Name:..... NRC/Passport No.:.....

Tel/Fax..... E-mail address.....

Employment Permit No:.....

Postal Address:.....

Residential Address:.....

Tourist Import Permit No:..... Calibre of Firearm(s):.....

DETAILS OF EMPLOYER

Name of Employer:.....

Postal Address:.....

Residential Address:.....

Tel/Fax..... Email.....

The above named Licensee is authorised to carry on business as a Professional Hunter subject to the conditions of issue set out hereunder.

1. The Licence is valid only during the period in which the holder is employed by the above named Safari Company or Game Ranch during the year of issue.
2. The licence does not authorise the holder to hunt any wild animals except for defence or protection of human life or property, or when killing any wild animals previously wounded by a bona fide client accompanying the holder.
3. The licensee is not permitted to hunt for another Safari company without notifying ZAWA of any change in Employers.
4. The holder of the licence shall have this licence in his/her actual possession at all times whilst carrying out the business of a professional hunter and shall produce it for inspection on request to any authorised officer.
5. The licensee shall keep in the prescribed form a record of each Non Resident Hunting licence issued to each client, together with a true Daily record of all game animals or protected animals hunted by such client under Non Resident Hunting Licence or any other licence.
6. The licence is not valid until it is signed by the holder.

FEES PAID K…….. …….. RECEIPT NO……..……...

Date:…… ……..
Signature of Holder

…….. ……..
Date Director General

Note: White copy/Original to be retained by visitor for production at entrance gate
Yellow copy/duplicate to support general revenue cash book
Blue copy/triplicate to be retained in the book.

REPUBLIC OF ZAMBIA

The Zambia Wildlife Act, 1998
(Act No. 12 of 1998)

LFZAWA FORM 14

The Zambia Wildlife
(Licences and Fees) Regulations, 2007

RECORD OF GAME AND/OR PROTECTED ANIMALS KILLED OR WOUNDED EXCEPT ELEPHANT
(Regulation 7(5))

Name of Professional Hunter	
Residential Address	
Safari Company on behalf of which the Professional Hunter is submitting this return	

DETAILS OF CLIENT

Name of client	
NRC/Passport No.	
Postal Address	

GMA permit No.		Non Resident Hunting Licence No.	

DETAILS OF HUNT

Name of Hunting Block where hunting was conducted		Hunting period From	To

Date Killed or wounded	Species	Sex	Number killed	Number Wounded	GPS Location	Trophy for export		Foreign currency value charged to client
						Yes	No	

DETAILS OF TROPHY MEASUREMENTS

Species	Tip to Tip (Overhead)	Tip to Tip (Around Boss)	Right Boss	Left Boss	Skull length	Skull width

Species (curved horned)	Horn length (Right)	Horn length (Left)	Boss circumference (Right)		Boss circumference (Left)	
Species (spiral horned)	Horn length (Right)	Horn length (Left)	Boss circumference (Right)		Boss circumference (Left)	

DETAILS OF PAYMENTS MADE

Type of payment	Currency	Amount
1) Amount of foreign currency paid by the client directly to The safari company for the services rendered by the Company, including overheads and extras.		
2) Amount of foreign currency paid by the safari company on behalf of the client to the Director-General for the Animals, licences and permits.		
3) Amount of foreign currency paid by the safari company on behalf of the client to the Director-General in respect of hunting rights.		
Total amount paid		

Certification by -

(a) Client

I certify that the animals listed on this return were hunted or wounded by me during the period stated and that the total amount of foreign currency stated and paid by me to the safari company is the full amount I was charged.

....

Date Name of Client Signature of Client

(b) Professional Hunter

I certify that the animals listed in this return were actually hunted by the client in accordance with the terms and conditions of a Safari Hunting Licence and that the total foreign currency stated above is the full amount paid by the client for the hunt

.....	.....	.....
Date	Name of Professional Hunter	Signature of Professional Hunter
.....	.....	.....
Date	Name of Wildlife Police officer	Signature of Wildlife Police officer

Notes

1. In the event of insufficient space, the list is to be continued on a separate page.

2) Any currency deposited by the client for the cost of processing or shipping such clients' trophies to their destination must be indicated. Where there is a discrepancy between the total amount of foreign currency paid by the client to the safari hunting company and the actual amount deposited with the Zambian Registered Commercial Bank, the Safari company shall provide a written explanation for such discrepancy and shall attach the explanation to the original copy of the return and to the export permit.
3) The amount of foreign currency paid by the client directly to the safari company shall be supported by a Form.
4) This return must be completed by the Professional Hunter who was in direct control of the hunt in question

5) The register must be presented to any wildlife police officer or honorary wildlife police officer on demand

6) The Professional Hunter is required to ensure that the register is available for inspection within his hunting area during the hunt.
7) The original (white) copy of the return should be submitted to the Director-General within fourteen days after the completion of the hunt.

8) The duplicate (yellow) return, which should be stamped by the appropriate licensing office of ZAWA, is to be attached to the client's Export Permit and both are to be exhibited to the Bank of Zambia when applying for an export licence.

9) The foreign client and the Professional Hunter are required to sign this form immediately upon the completion of the hunt. Non-compliance will render the Professional Hunter liable to prosecution. For this reason, all Professional Hunters should ensure that they are in possession of a register whilst the hunt is being conducted.

10) Professional Hunters are required to take GPS coordinates for all areas where they have hunted or wounded game animals or protected animals.

FOR OFFICIAL USE ONLY

Export Permit No..... Date.....

CITES Permit No..... Stamp.....

FOR OFFICIAL USE ONLY
(Bank of Zambia/Commercial Bank)

1) Endorse number on both original and duplicate (yellow) copies of the Export Permit and CITES Permit.

2) Check animal killed or wounded and values overleaf.

3) Retain this copy and attach EX D Form.

Date Stamp

Form EX D Number .....

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No. 12 of 1998)

LFZAWA FORM 14A

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

RECORD OF ELEPHANT KILLED
(Regulation 7(6))

Station of issue:..... Date of issue:.....

A. DETAILS OF LICENSEE

Full Name:..... NRC/Passport No.:.....

Tel/Fax..... E-mail address.....

Employment Permit No:.....Expiry Date:.....

Postal Address:.....

Residential Address:.....

Tourist Import Permit /Firearm Licence No:..... Calibre of Firearm(s):.....

B. DETAILS OF HUNT

Name of Hunter:..... NRC/Passport No.....

Non Resident Hunting Licence No..... Game Management Area Permit No.....

Hunting Block..... Animal Sex.....

Duration of hunt.....to ..... Date Elephant hunted.....

Description	Tusk 1	Tusk 1	Comments
Weight			
Length			
Special Mark(s)			

C. CONDITIONS

1. This Form shall be completed and submitted together with the ivory to the nearest Area Management Unit within 48 hours of the killing of the Elephant

2. The completed form shall move with the ivory until a Certificate of Ownership is issued to the Licensee

3. Any loss of Form LFZAWA FORM 14 A prior to or after the hunting shall be reported to the authority headquarters within 48 hours.

D. DECLARATION

I ..... hereby declare that the information provided above is a true record
(Licensee)
of the animal(s) hunted in the Republic of Zambia.

Date..... .....
Signature of Licensee

I ..... hereby declare that the information provided above is a true record
(ZAWA Representative)
of the animal(s) hunted in the Republic of Zambia.

Date..... .....
Signature of ZAWA Representative

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No.12 of 1998)

LFZAWA FORM 15

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

APPLICATION FOR AN APPRENTICE PROFESSIONAL HUNTER'S LICENCE

(Regulation 8(1))

To: The Director General

Full Name:.....NRC No/Passport No:.....

Tel/Fax..... E-mail address.....

Occupation:.....Nationality:.....

Postal Address:.....

Residential Address:.....

Firearm Import Permit/Licence No(s):.....

Calibre of Firearms:1..... 2.....

I HEREBY apply for an Apprentice Professional Hunters' Licence under the supervision and subject to the instructions

of .....

Who holds a valid Professional Hunter's Licence and whose particulars are as follows:

Professional Hunter's Licence No.: .....Validity: From.....to .....

Firearm Import Permit/Licence No(s):.....

Calibre of Firearms:1.....

Please answer the following questions in full.

1. Are you a Resident/Citizen of Zambia? YES/NO

2. If you are a Non-Zambian please give your Employment Permit Number, date and place of issue if applicable

   Employment/Resident Permit No.:.....

   Place of issue:..... Date of issue:.....

3. If you do not have a Resident permit, state whether you have made an application for a Work permit, or intends to make an application.....

4. Have you ever held an Apprentice Professional Hunter's Licence or Professional Hunter's Licence? YES/NO

5. If the answer to question is YES, please give full details.....

6. Have you been convicted of any offence relating to wild animals during the previous five years?

   YES/NO

7. If the answer to question 6 is YES, please give full details.....

8. Have you received a firm offer of employment with a Safari company registered in Zambia
   YES/NO

9. If the answer to question 8 is YES, please give full details:.....

10. Please give the names and addresses of two referees (one of whom must be a member of the Zambia Professional Hunter's Association)

Name	Address
1.....	.....
2.....	.....

11. Any other relevant information which could be considered in support of the application (e.g. previous hunting experience).....

12. Attach your C.V. to the application.

13. I certify that the information in this application is correct.

Date:..... .....

Signature of Applicant

APPROVED/NOT APPROVED

....

Date Director General

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(Act No.12 of 1998)

LFZAWA FORM 16

THE ZAMBIA WILDLIFE
(Licences and fees)Regulations, 2007

APPRENTICE PROFESSIONAL HUNTER'S LICENCE

(Regulation 8(2))

Station of issue..... Date of issue.....

DETAILS OF LICENSEE

Full name:..... NRC/Passport No:.....

Tel/Fax..... E-mail address.....

Employment Permit No.:..... Expiry date:.....

Postal Address:.....

Residential Address:.....

DETAILS OF FIREARM(S)

Firearm Licence No(s)..... Calibre of Firearm(s).....

Firearm Import Permit No(s):..... Calibre of Firearm(s):.....

DETAILS OF EMPLOYER

Name:.....

Postal Address:.....

Residential Address:.....

Tel/Fax..... Email.....

DETAILS OF SUPERVISOR, HOLDER OF PROFESSIONAL HUNTER'S LICENCE.

Full Name:..... Position:.....

Professional Hunter's Licence:..... Address:.....

Apprentice Professional Hunter Licence Fee paid: K.....

....

Licensee **Director General**

Date..... Date.....

The above named Licensee is authorised to carry on business as an Apprentice Professional Hunter subject to the conditions of issue set out hereunder:

Note: White (Original) copy to Licensee
Yellow copy to the Director General or agent
Blue copy to be retained in the book.

CONDITIONS OF ISSUE

1. The Licence is valid only during the period the licensee is supervised by the above named holder of a Professional Hunter's Licence
2. The Licensee shall be subject to the instructions of the above named holder of a Professional hunter's licence and the licensee while accompanied by the client in respect of whom the licensee is engaged.
3. The Licensee shall have this licence in his/her possession at all times whilst carrying out the business of an apprentice Professional Hunter and shall produce this licensee for inspection to any authorised officers on request.
4. This licence does not authorise the licensee to kill any wild animals except in the defence or protection of life or property or when killing any wild animal previously wounded by a bona fide client who has accompanied the licensee.
5. The licensee is not permitted to guide a client who holds a licence for a dangerous animal.
6. The licensee shall have a record of the hunt and Non Resident hunting licence number issued to each client together with a true daily record of all game animals or protected animals hunted by each client under a Non Resident Hunting Licence or any other licence.
7. This licence is not valid unless signed by the licensee.

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No. 12 of 1998)

LFZAWA FORM 23

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

APPLICATION FOR HUNTING OUTFITTER'S LICENCE
(Regulation 12(1))

TO: The Director General - ZAWA

Name of Company:..... .....

Certificate of Incorporation No.....Date of Issue.....

Postal Address.....

Physical Address:.....

I HEREBY apply for a Hunting Outfitter's Licence to conduct hunting operations in the following Game Management Area(s):
1..... 2.....

Please answer the following questions in full.

1. Are you a resident /citizen of Zambia? YES/NO

3. Do you own a game Ranch or hold a hunting concession in any Game Management Area or part thereof? YES/NO

3. If the answer to question 2 is YES please state details:.....
   .....
4. Have you ever been convicted of any offence related to wild animals in the past five years? YES/NO

5. If the answer to question 4 is YES, please give details.....
   .....
7. Please give the names and addresses of two referees

   1. ....

   2 ....
8. State any other relevant information which should be considered in support of this

   application.....
9. I certify that the information provided in this application is correct.

Date:..... Signature of applicant.....

APPROVED/NOT APPROVED

....
Date Director General

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No. 12 of 1998)

LFZAWA FORM 24

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

HUNTING OUTFITTER'S LICENCE
(Regulation 12(4))

Station of issue:..... Date of issue:.....

DETAILS OF LICENSEE

Full Name:..... NRC/Passport No.:.....

Tel/Fax..... E-mail address.....

Tourism Enterprise Licence No.:.....

Postal Address:.....

Residential Address:.....

The above named licensee who holds a hunting concession or owns a Game Ranch in

.....

Game Management Area (GMA)is hereby authorised to conduct the business of a hunting outfitter in the following GMA or Hunting block:

Name of GMA/Hunting Block/Game Ranch	Classification: (Prime/Secondary/Understocked)
1.....	.....
2.....	.....

CONDITION OF LICENCE

1. This licence is valid for a single hunting season.
2. This licence is valid for the above named GMA(s) or Hunting block/Game Ranch.
3. The Holder shall display this licence at all times at their business premises.
4. The holder shall produce this licence for inspection and give his/her name and address to any authorised officer upon request.
5. This licence is not valid until it is signed by the holder.

Hunting Outfitter's Licence Fee Paid $..... Receipt No:.....

.....	.....
Licensee	Director General
Date.....	Date.....

Note: White copy/Original to be retained by visitor for production at entrance gate
Yellow copy/duplicate to support general revenue cash book
Blue copy/triplicate to be retained in the book.

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No. 12 of 1998)

LFZAWA FORM 25

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

APPLICATION FOR RESTRICTED PROFESSIONAL HUNTER'S LICENCE

(Regulation 13(1))

TO: The Director General - ZAWA

Details of applicant

Full Name:..... NRC/Passport No.:.....

Tel/Fax..... E-mail address.....

Nationality:.....

Postal Address.....

Residential Address:.....

Firearm Licence No.:..... Calibre of Firearm(s):.....

Please answer the following questions in full.

1. Are you a resident /citizen of Zambia? YES/NO
2. If you are a Non-Zambian please give your Employment/Resident Permit number, date and place of issue if applicable. Employment/Resident Permit No:.....
3. Place of issue:..... Date of issue .....
4. If you do not have a Permit, state whether you have made an application for such a permit or intend to make such an application.....
5. Have you ever held a Restricted Professional Hunter's Licence? YES/NO
6. If the answer to question 4 is YES please state details.....
7. Have you ever been convicted of any offence related to wild animals in the past? YES/NO
8. If the answer to question 6 is YES, please state the details.....
9. Please give details if employed by a Safari company registered in Zambia. YES/NO
10. Please give the names and addresses of two referees (one of whom must be a current member of the Professional Hunter's Association of Zambia).
    1. ....
    2 ....
11. Any other relevant information which should be considered in support of this application.....

Certification by applicant:

12. I certify that the information provided in this applications is correct.

Date:.....

.....
Signature of applicant

APPROVED/NOT APPROVED

....
Date Director General

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(Act No. 12 of 1998)

LFZAWA FORM 26

THE ZAMBIA WILDLIFE
(Licences and fees)Regulations, 2007

RESTRICTED PROFESSIONAL HUNTER'S LICENCE

(Regulation 13(3))

Station of issue..... Date of issue.....

DETAILS OF LICENSEE

Full name:..... NRC/Passport No:.....

Nationality:..... Age.....

Tel/Fax..... E-mail address.....

Employment Permit No.:..... Email Address:.....

Postal Address:.....

Residential Address:.....

DETAILS OF FIREARM(S)

Firearm Licence No(s)..... Calibre of Firearm(s).....

Firearm Import Permit No(s):..... Calibre of Firearm(s):.....

DETAILS OF EMPLOYER

Name of Company.....

Postal Address:.....

Residential Address:.....

Tel/Fax..... Email.....

The above named licensee is authorised to carry on business as a Restricted professional hunter in respect of non dangerous animals subject to the conditions set out below:

Restricted Professional Hunters Licence fee paid: K.....

....
Licensee *Director General*

Date..... Date.....

NOTE White (Original) copy to Licensee
Yellow copy to the Director General or agent
Blue copy to be retained in the book.

CONDITIONS OF ISSUE

1. The licence is valid only during the period in which the holder is employed by the above named Safari Company during the year of issue.
2. This licence does not authorise the licensee to hunt any wild animals except for the defence or protection of human life or property or when killing any wild animal previously wounded by a bona fide client accompanying the licensee
3. The Licensee shall have his/her licence in his/her possession at all times whilst carrying out the business of a Restricted professional hunter and shall produce it for inspection to any authorised officers.
4. The licensee shall keep in a form prescribed a record of the Non Resident hunting licence issued to each client together with a true daily record of all game animals or protected animals hunted by such client under a Non Resident Hunting Licence or any other Licence.
5. This licence is not valid unless signed by the licensee.

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No.12 of 1998)

LFZAWA FORM 29

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

NOTICE OF REFUSAL TO ISSUE LICENCE

(Regulation 16(2))

Station of issue:..... Date of issue:.....

From: The Director General - ZAWA

To: ..... NRC/Passport No.:.....

Certificate of incorporation No.:..... Date of incorporation:.....

Tel/Fax..... E-mail address.....

Postal Address:.....

Residential Address:.....

YOU ARE HEREBY NOTIFIED that your application for a .....

Licence has been rejected on the following ground(s);

.....

.....

.....

.....

TAKE NOTICE that you may appeal against this decision of refusal to issue a Licence to the Authority within thirty (30) days from the date of this notice, and if you are not satisfied with the decision of the Authority, you may appeal therefrom to the High Court.

....
Date Director General

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No.12 of 1998)

LFZAWA FORM 30

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

NOTICE OF REVOCATION OF LICENCE

(Regulation 16(3))

Station of issue:..... Date of issue:.....

From: The Director General - ZAWA

To: ..... NRC/Passport No.:.....

Certificate of incorporation No.:..... Date of incorporation:.....

Tel/Fax..... E-mail address.....

Postal Address:.....

Residential Address:.....

YOU ARE HEREBY NOTIFIED that your .....

Licence is hereby revoked on the following ground(s);

.....

.....

.....

.....

TAKE NOTICE that you may appeal against this decision of revocation of your .....
..... licence to the Authority within thirty (30) days from the date of this notice, and if not satisfied with the decision of the Authority, you may appeal to the High Court.

....
Date Director General

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No.12 of 1998)

LFZAWA FORM 31

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

NOTICE TO SUSPEND A LICENCE

(Regulation 16(4))

Station of issue:..... Date of issue:.....

From: The Director General - ZAWA

To: ..... NRC/Passport No.:.....

Certificate of incorporation No.:..... Date of incorporation:.....

Tel/Fax..... E-mail address.....

Postal Address:.....

Residential Address:.....

YOU ARE HEREBY NOTIFIED that your .....

Licence is hereby suspended on the following ground(s);

.....

.....

In the case of suspension, you are further notified that if within.....days you do not

..... the licence will be cancelled

TAKE NOTICE that you may appeal against this decision to cancel the Licence within thirty (30) days from the date of this notice to the Authority, and if not satisfied with the decision of the Authority, you may appeal to the High Court.

....
Date Director General

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No.12 of 1998)

LFZAWA FORM 31A

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

NOTICE TO CANCEL A LICENCE

(Regulation 16(6))

Station of issue:..... Date of issue:.....

From: The Director General - ZAWA

To: ..... NRC/Passport No.:.....

Certificate of incorporation No.:..... Date of incorporation:.....

Tel/Fax..... E-mail address.....

Postal Address:.....

Residential Address:.....

YOU ARE HEREBY NOTIFIED that your .....

Licence is hereby cancelled on the following ground(s);

.....

.....

In the case of suspension, you are further notified that if within.....days you do not

..... the licence will be cancelled

TAKE NOTICE that you may appeal against this decision to cancel the Licence within thirty (30) days from the date of this notice to the Authority, and if not satisfied with the decision of the Authority, you may appeal to the High Court.

....
Date Director General

REPUBLIC OF ZAMBIA

THE ZAMBIA WILDLIFE ACT
(ACT NO. 12 OF 1998)

LFZAWA FORM 32

THE ZAMBIA WILDLIFE
(LICENCES AND FEES) REGULATIONS, 2007

CERTIFICATE OF OWNERSHIP OF TROPHIES
(Regulation 17(3))

Station of Issue..... Date of Issue.....

DETAILS OF CERTIFICATE HOLDER

Full Name..... NRC/Passport No.....
Tel/Fax..... E-mail address.....
Postal Address.....
Residential Address.....

The above named Certificate holder is entitled to possess the following Trophies:

(a) **Ivory**

Number of Tusks			
Identification Mark	Weight	Source	Date of issue

(b) **Prescribed Trophies**

Species	List of Trophies	Source	Date of issue

(c) **Other Trophies**

Species	List of Trophies	Source	Date of issue

Fees paid K..... Receipt No.....

....
Date Director General

NOTE: White (Original) copy to Certificate Holder
Yellow copy to the Director General or agent
Blue copy to be retained in the book.

Endorsement to be completed in respect of the Transfer of trophy/Trophies listed above:

I .....(Name in Block Letters) have today transferred the following trophies

1.....

2.....

3.....

4.....

5.....

as listed on this Certificate of Ownership to.....(name)

of ..... (address)

Tel/Fax..... Email.....

Signature of transferor..... Date:.....

Signature of transferee..... Date:.....

REPUBLIC OF ZAMBIA

THE ZAMBIA WILDLIFE ACT
(ACT NO. 12 OF 1998)

LFZAWA FORM 32A

THE ZAMBIA WILDLIFE
(LICENCES AND FEES) REGULATIONS, 2007

APPLICATION FOR A CERTIFICATE OF OWNERSHIP OF TROPHIES
(Regulation 17(1))

TO: The Director General - ZAWA

Full Name:..... NRC/Passport No.....

Tel/Fax..... E-mail address.....

Postal Address.....

Residential Address:.....

I ..... Hereby apply for a CERTIFICATE OF OWNERSHIP OF TROPHIES for the trophies listed below:

Species	Description of trophy	Source document(s)	Date issued

I certify that the information provided in this application is correct.

Date..... .....
Signature of Applicant

*Approved/disapproved by..... Date:.....

*(Delete what is inapplicable)

APPROVED/NOT APPROVED

.....
.....
Date Director General

63

REPUBLIC OF ZAMBIA

THE ZAMBIA WILDLIFE ACT
(ACT NO. 12 OF 1998)

LFZAWA FORM 32B

THE ZAMBIA WILDLIFE
(LICENCES AND FEES) REGULATIONS, 2007

INSPECTION FORM FOR WILDLIFE TROPHIES/LIVE ANIMALS/BIRDS/INSECT/PLANTS
(Regulation 17(2))

I, ……..,A/AN…… Has today the ……..day
(Name) (Designation)

of ……..20……..inspected the items described below, belonging to

…… of ……
(Name of owner) (Business Address)

……living at……
(Residential address)

Species	Description	Quantity	Source	Condition	Remarks

Full Names of Inspecting Officer……

Signature of Inspecting Officer……

Full Names of Owner/Agent……

Signature of Owner/agent…… ……

Official stamp

Scores of condition
1 - Excellent
2 - good
3 - Fair
4 - Bad
5- Deteriorated

64

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(No. 12 of 1998)

LFZAWA FORM 33

THE ZAMBIA WILDLIFE
(Licences and Fees) Regulations, 2007

REVOCATION OF CERTIFICATE OF OWNERSHIP OF TROPHIES

(Regulation 17(7))

Station of issue:..... Date of issue:.....

From: The Director General - ZAWA

To: ..... NRC/Passport No.:.....

Certificate of Incorporation No.:..... Date of issue:.....

Postal Address:.....

Residential Address:.....

YOU ARE HEREBY NOTIFIED that your Certificate of Ownership of Trophies No.: ..... is HEREBY REVOKED on the following ground(s);

.....

.....

.....

.....

TAKE NOTE that you may appeal against this decision to revoke the Certificate of Ownership of Trophies to the Authority within thirty (30) days from the date of this notice, and if you are not satisfied with the decision of the Authority, you may appeal therefrom to the High Court.

....
Date Director General

REPUBLIC OF ZAMBIA

THE ZAMBIA WILDLIFE ACT
(ACT NO. 12 OF 1998)

LFZAWA FORM 42

THE ZAMBIA WILDLIFE
(LICENCES AND FEES) REGULATIONS, 2007

PERMIT TO EXPORT IVORY OR RHINOCEROS HORN
(Regulation 22(3))

Station of Issue..... Date of Issue.....

DETAILS OF EXPORTER

Full Name..... NRC/Passport No.....

Tel/Fax..... E-mail address.....

Postal Address.....

Residential Address.....

The above named Exporter is hereby authorized subject to any other written law, to export from the Republic of Zambia to ..... the following items:

DETAILS OF SPECIMEN(S) FOR EXPORT

Specimen	Quantity	Identification Marks	Source

Export Fees paid:
K.....

Handling fees paid: K.....

Grand Total: K.....

Receipt No.: K.....

1. This Export Permit is valid until.....
2. The above mentioned items have been approved for export by Veterinary Clearance Certificate No..... Dated.....and Issued at .....
3. The package containing the said items shall be sealed by a Customs Officer in the presence of the Exporter and a Wildlife Police Officer. The Customs Officer shall also endorse his/her signature thereon.

....
Date Director General

....
Date Customs Officer

Note: White (Original) copy to Permit holder

77

Yellow copy to the Director General or agent
Blue copy to be retained in the book.

REPUBLIC OF ZAMBIA

Zambia Wildlife Act
(Act No. 12 of 1998)

LFZAWA FORM 43

THE ZAMBIA WILDLIFE
(Licences and fees)Regulations, 2007

PERMIT TO EXPORT WILD ANIMALS, MEAT OR TROPHIES

(Regulation 23(3))

Station of issue..... Date of issue.....

DETAILS OF PERMIT HOLDER

Full name:..... NRC/Passport No:.....

Tel/Fax..... E-mail address.....

Postal Address:.....

Residential Address:.....

The above named Permit holder is hereby authorised, subject to any other written law, to export from the Republic of Zambia to ..... the following meat of wild animals/wild animals/trophies

.....

.....

.....

.

CONDITIONS OF ISSUE

1. This permit is valid until:.....
2. The above mentioned wild animals/meat of wild animals/trophies have been approved for export by a Veterinary health export certificate No:.....
   dated.....and issued at:.....

....
Date Director General

Note White (Original) copy to Permit holder
Yellow copy to the Director General or agent
Blue copy to be retained in the book.

78

REPUBLIC OF ZAMBIA

THE ZAMBIA WILDLIFE ACT
(ACT NO. 12 OF 1998)

LFZAWA FORM 43A

THE ZAMBIA WILDLIFE
(LICENCES AND FEES) REGULATIONS, 2007

APPLICATION FOR AN EXPORT/IMPORT/RE-EXPORT PERMIT
(Regulation 23(2))

TO: The Director General - ZAWA

A. Details of Applicant/Exporter:

Full Name:…… NRC/Passport No……..

Tel/Fax…… E-mail address……..……

Postal Address……

Residential Address:……..

B. Details of Importer:

Full Name:…… NRC/Passport No……..

Postal Address……..……

Residential Address:……..
I……..hereby apply for an authority to export/re-export/import the wildlife specimen as per the attached details on the wildlife trophy inspection from attached hereto.

Signature of applicant…….. Date:……..

2. TO BE FILLED BY DIRECTORATE OF RESEARCH, PLANNING & INFORMATION.
Documents verified by:
Name……..Designation……..

Recommendation:……..

Signature:……..Date:……

3. TO BE FILLED BY DIRECTORATE OF CONSERVATION & MANAGEMENT

Documents verified by:
Name……..Designation……

Recommendation:……..

Signature:……..Date:……

4. APPROVED BY……Date……

Note: This application must always be accompanied by a completed Form ZAWA 32B.
The applicant must attach appropriate authorisation documents from the Veterinary Authorities from both the Exporting and Importing countries if necessary.

Appendix II

SECOND SCHEDULE
(Regulation 34)

(Regulations 2,3,4,5,6,7,8,9,10,11,12,13,14, 17,18,19,20,21,22,23,24,25,26,27,28, 29,31 and 32)

PRESCRIBED FEES

Licences, Permits, Basic fees etc

Category	Fees payable (fee units)		
	Citizen	Established	Non Residents(US$)
1. Resident Hunting Licence	500	695	N/A
2. Bird hunting Licence	450	625	100
3. Game Management Area Permit	278	348	150

Table 1

4. Fees in respect of species of game animals

The following game animals may be purchased individually, on a Resident or Non Resident hunting Licence, if available on quota.

Item	Species	Citizens (fee units)	Established (fee units)	Non Residents (US$)
(a)	Baboon	278	417	60
(b)	Buffalo	13,889	19,445	1,600
(c)	Bush baby	556	834	50
(d)	Bushbuck	1,112	1,667	380
(e)	Bushpig	445	612	320
(f)	Civet	528	834	680
(g)	Duiker, C	889	1,389	350
(h)	Eland	16,667	25,000	2,500
(i)	Grysbok	889	1,389	250
(j)	Hartebeest, Liechtenstein	4,445	8,334	780
(k)	Honey Badger	556	834	100
(l)	Hyaena	473	656	250
(m)	Impala	1,112	1,667	120
(n)	Jackal, Side Stripped	473	656	260
(o)	Kudu, Greater	13,889	25,000	1,600
(p)	Monkey, Vervet	278	417	50
(q)	Oribi	1,667	2,223	250
(r)	Otter	234	334	190
(s)	Porcupine	234	334	190
(t)	Puku	1,945	2,778	420
(u)	Reedbuck	2,223	3,334	420
(v)	Serval Cat	334	556	600
(w)	Springhare	278	417	50

(x)	Warthog	2,223	3,334	360
(y)	Waterbuck, Common	4,445	8,334	840
(z)	Waterbuck, Defassa	5,000	10,000	1,200
(aa)	Wild Cat	334	556	570
(bb)	Wildebeest, Blue or /Brindled	4,445	8,334	780
(cc)	Zebra	8,334	13,889	720
	Reptiles			
(a)	Bells' Hinged Tortoise	150	195	15
(b)	Leopard Tortoise	194	250	20
(c)	Monitor Lizard	389	667	35
(d)	Pancake Tortoise	389	667	35

Birds

Item	Common Name
(a)	Fulvous Whistling Duck
(b)	White-faced Whistling Duck
(c)	White-Backed Duck
(d)	Egyptian Goose
(e)	Spur-Winged Goose
(f)	Knob Billed Duck
(g)	African Pygmy Goose
(h)	African Black Duck
(i)	Yellow-Billed Duck
(j)	Cape Teal
(k)	Pintail
(l)	Red-Billed Teal
(m)	Hottentot Teal
(n)	Garganey
(o)	Northern Shoveler
(p)	Cape Shoveler
(q)	Southern Pochard
(r)	Coqui Francolin
(s)	White throated Francolin
(t)	Crested Francolin
(u)	Shelley's Francolin
(v)	Red-winged Francolin
(w)	Red-billed Francolin
(x)	Natal Francolin
(y)	Hildebrandits Francolin
(z)	Swaisons' Francolin
(aa)	Red-necked Francolin
(bb)	Common quail
(cc)	Harlequin Quail
(dd)	Blue Quail
(ee)	Crested Guinea fowl
(ff)	Helmeted Guinea fowl

Note

(i) The capture of any species of a game animal in item 4 paragraphs (a) to (cc), onto any land which is set aside as a game ranch or game farm in Zambia, for the purpose of keeping such species of game animal in captivity on such land, shall be by Auction or tender

(ii) The capture of any species of a game animal in item 4 paragraphs (a) to (cc), onto any land which is set aside as a game ranch or game farm in Zambia, for the purpose of keeping such species of game in captivity on such land, shall be as per fees prescribed under the respective Resident Hunting Licence.

(iii) The capture from the wild, for the purpose of export, of any species of game animal in item 4 paragraphs (a) to (cc), shall cost 10% higher than the fee indicated under a Non Resident Hunting Licence and, include an Export handling charge per consignment.

(iv) The capture from land which is set aside as a game ranch or game farm in Zambia, for the purpose of export, of any species of game animal in item 4 paragraphs (a) to (cc), shall be at no cost but, include a handling charge per consignment.

(v) No more than five different species of game animal, of which no more than one game animal per species, may be purchased under a Resident Hunting licence.

(vi) The fees for a species of game animal under a Resident Hunting licence shall apply to any citizen of Zambia.

(vii) Any additional game animal of any one species, when available on quota, shall be sold at 50 per cent more than the prescribed price.

(viii) All species of game animals, with the exception of Eland, when available on quota, can be purchased as second animal of the same species, by any *bonafide client* of a safari hunting outfitter.

(ix) In these notes "established resident" means any holder of a certificate attesting to a status as an established resident under section *thirty-three* of the Immigration and Deportation Act.

(x) A Non Resident Hunting licence in respect of a classical or deluxe safari, shall enable a bona fide client of a safari hunting outfitter, to purchase species of game animal set out in Table 1, within the overall quota of a species of game animal, prescribed for the safari hunting outfitter, for which the licence holder is a bona fide client.

(xi) A fee unit is equal to K180.00.

TABLE 3

6. Export and Import Fees for live species of game animals and their trophies shall be as prescribed in Table 7 (f, g,) and tables 7(a) and 7(b).

NOTE:

All exports and imports shall be subject to a handling charge of 1,948 Fee Units per Consignment.

7. Export and Import fees for live species of protected animal, their trophies and Ivory shall be as prescribed in Table 7(f, g) and tables 7(a)and 7(b).

NOTE:

All exports and imports shall be subject to a handling charge of 1,948 Fee Units per consignment.

TABLE 4

8 Fees for Collection of Species of non-game and protected animals not covered on Table 1and 2:

	Fee Units
Crocodile eggs	28/egg

NOTE:
The fees for this table are per species of non-game animal or per item, as the case may be.

Table 5

9. Fees for Entry into a National Park

(a) Park Entry

National Park	Citizens (fees units)	Residents/SADC) US$	Non Residents) US$	Self Drives(residents/Non Residents) US$
Category A				
South Luangwa	139/person/day	20/person/day	25/person/day	30/person/day
Lower Zambezi	139/person/day	20/person/day	25/person/day	30/person/day
North Luangwa	112/person/day	15/person/day	20/person/day	25/person/day
Mosi-oa-tunya	84/person/day	5/person/day	10/person/day	15/person/day
Category B	**Citizens (fees units)**	**Residents/SADC) US$**	**Non Residents) US$**	
Kafue	112/person/day	278/person/day	15/person/day	
Lochnivar	84/person/day	139/person/day	10/person/day	

Sumbu	84/person/day	139/person/day	10/person/day	
West Lunga	84/person/day	139/person/day	10/person/day	
Kasanka	84/person/day	139/person/day	10/person/day	
Luambe	112/person/day	278/person/day	15/person/day	
Blue lagoon	84/person/day	139/person/day	10/person/day	
Category C				
Other parks	56/person/day	85/person/day	5/person/day	
Category C				
School Parties	28/student/day	35/student/day	5/student/day	

(b) Aircraft landing/Vehicle Entry/Vessel Entry

		Locally registered (fee units)	Foreign registered (US$)
	Vehicles≤ 3tons net weight	85/day	15/Vehicle/day
	Vehicle ≥3tons net weight	140/day	30/Vehicle/day
	Vessel ≤50 Horse Power	85/day	15/Vehicle/day
	Vessel ≥50 Horse Power	140/day	30/Vehicle/day
	Aircraft	556/day	50/Vehicle/day
(c)	**Angling/Camping/Mooring**		
	Camping	105/person/day	5/person/day
	Angling	105/person/day	30/person/day
	Mooring in a National Park	140/person/day	30/person/day
	Boating	174/person/day	20/person/day
	Canoeing/Rafting	140/person/day	20/person/day

Table 6

10. Fees in respect of traditional Fish artisans

Item		
		Fee Units
(a)	Artisanal fishing	1,389
(b)	Boat usage	84/day/vessel
(c)	Canoe usage	56/day/vessel
(d)	Vehicle entry	278/day/Vehicle

Table 7

11. Miscellaneous Fees

Item		
(a)	Trophy Dealer's Permit	2,778 per annum
(b)	Export or Import handling fee: Game meat	1945/consignment
(c)	Any Record/Register book or Form	278 per copy
(d)	Certificate of Valuation of Trophies	417 per copy*
(e)	Certificate of Ownership of Trophies	278 - 834 per copy*
(f)	Import Permit Game Trophies	1,112 - 4,445/consignment/copy**

(g)	Import Permit Wild animals and Birds	2,778 - 27,778/consignment/copy***		
(h)	Replacements of Licences, Certificates and Permits	1,339 - 3334 Full cost of licence, permit or certificate		
(i)	Re-export Permit	1,389 per copy		
(j)	Commercial Photographing (filming and sound recording	556 person/day/citizen/resident		
(k)	Commercial Photographing (filming and sound recording)	US$60 per person/day non-resident		
(l)	Commercial painting (artists)(Zambian)	556/person/week		
(m)	Commercial painting (artists)(non-Zambian)	US$100 per week		
(n)	Cites Stamp	US$5 each		
(o)	CITES Leopard Tag	US$15 each		
(p)	CITES Crocodile Tag	US$15 each		
		Citizens	**Established Residents**	**Non Residents**
(q)	Professional Hunting Licence	8,334	22,223	6,000
(r)	Apprentice Professional Hunters Licence	2,778	11,112	6,000
(s)	Professional Tour Guide's licence	1,112	11,112	6,000
(t)	Apprentice Professional Tour guides licence	1,112	8,334	2,000
(u)	Endorsement for Professional Hunter's Licence	278	556	50
(v)	Hunting Outfitters licence	US$ 1,500 - 3,500****		
(w)	Certificate of Ownership Game and protected animals and meat	278 per copy		
(x)	Permit to sell meat of game or protected animal	278 per copy		
(y)	Application form fee	56 per Application Form		
(z)	Consultancies by ZAWA personnel	To be negotiated on a case by case basis*****		
(aa)	Licence appeal fee	20% of value of licence		
(bb)	Export of Game and/or Protected animal meat	Three fee units/kg		
(cc)	Permit to keep domestic animals/birds in a National Park, Bird or wildlife Sanctuary	13,889 fee units		
	A Photographic Tour Operator located in a:			
(dd)	National Park	US$ 50/year		
(ee)	Game Management Area : Bush camp	US$ 1,000/year		
	: Permanent Camp	US$ 1,500/year		
	: Lodge	US$ 2,000/year		
	: Other services	US$ 1,000/year		

Note
*278 fee units for Citizens, 556 fee units for Residents, 834 fee units for Non Residents

Table 7 (a)

**Description of consignment Export and Import (trophies)	Fee units	Export/Import
1 to 10	1,389	1,389
11 to 50	1,667	1,667

51 to 100	2,500	2,500
101 to 250	3,056	3,056
251 to 500	3,334	3,334
More than 500	4,445	4,445

Table 7 (b)

***Description of consignment Export and Import (wild animals)	Fee units	Export/Import Fee units
1 to 5	2,778	2,778
6 to 10	5,556	5,556
11 to 20	8,334	8,334
21 to 50	11,112	11,112
51 to 100	16,667	16,667
More than 100	27,778	27,778

(i) A Restricted Professional Hunter's Licence shall cost 50% of paragraph (q)

**** US$3,500 for Prime Hunting Blocks, US$2,500 for Secondary/Specialised Hunting Blocks and Game Ranches, US$1,500 for Understocked Hunting Blocks,

*****70% shall be paid to the researchers and 30% to the institution.

Table 8

12. Fees in respect of research carried out in a National park, Bird/Wildlife Sanctuary, Game Management Are and Open Area shall pay research fees as follows

Item	Type of research	Duration	Citizen	Established residents	Non residents US$
	Basic research	≤ 3 months	1,112	1,390	175
	Basic research	>3-12 months	2,224	2,780	300
	Applied research	≤ 3 months	1,112	1,390	150
	Applied research	>3-12 months	1,668	2,085	225
	Applied and basic research	>12 months to 2 years	3,336	4,170	500
	Applied and basic research	>2 to 5 years	6,672	8,340	500
	Game Ranch Projects Review		1,667	8,334	1,000

Note

(i) A Zambian student shall pay 50% of the above rate

(ii) The Director General may waive fees for any category of researcher above.

MUCHINGA ADVENTURES, LTD.
PO BOX 390003, LUMUMBA RD, LUSAKA ZAMBIA –
CHIFUNDA GMA, ZAMBIA
JOHN AND LAURA DU PLOOY –
jcrserviceszambia@gmail.com

ENHANCEMENT REPORT 2016

I. DESCRIPTION OF COMPANY AND CONCESSION

Muchinga Adventures Ltd has been operating in Chifunda GMA since March 2015. The concession is 4900 square kilometres in size and provides a habitat for baboon, buffalo, chobe bushbuck, common duiker, crocodile, grysbok, hippo, hyaena, cookson wildeebeest, zebra, kudu, impala, puku, wild dog, elephant, leopard, lion and various other plains game and carnivore species. Our concession is in the north Luangwa and has 70km of river frontage with the North Luangwa National Park. Our area is a natural buffer zone for the national park where Frankfurt Zoological Society operates and protects the rhino. The lease is issued in partnership with the Chifunda GMA community and the Zambia Wildlife Authority, now the newly named Department of National Parks and Wildlife. Each party contributes to the welfare of the concession through their revenue share as per the lease agreement, signed in March 2015 till 2022. This is our third lease agreement with ZAWA, having operated in the adjacent concessions - Chanjuzi GMA and Nyaminga GMA from 2003 to 2012.

Muchinga Adventures Ltd was formed in 1993 and is a family owned and operated business. The du Plooy family has been in Zambia since the 1880's. The company is responsible for the full time employment of four full time professional hunters, forty five camp staff members embracing trackers, skinners, cooks, waiters and general workers. Our operations support forty scouts and a further one hundred and thirty people gain employment through jobs that cover the airstrip, opening roads, creating fire breaks, infrastructure development and annual camp building. There are 2143 families in the Game Management Area with more than 10,000 children, many of whom have lost one or both parents. Our employment significantly contributes to the support of the rural community and supports more than seven hundred dependents.

As part of our lease proposal we have a written concession plan that covers community and anti poaching responsibilities, we always exceed these commitments.

II. ANTI-POACHING

We are committed to a financial obligation each year towards law enforcement. We provide food rations covering corn meal, cooking oil, fish, beans, sugar and salt. This allows for a further six patrols a month to be conducted in the Game Management Area. Each team is equipped with uniforms, boots and food rations. We are committed to providing 210 litres of fuel per month to assist with resource monitoring of the wildlife, movement of the fishermen and spot checks at water sources throughout the Game Management Area. John du Plooy, the managing Director of Muchinga Adventures Ltd, is a senior honorary wildlife police officer and works closely with the Park Ranger to monitor the activities in the concession. He is based in the concession for six months each year, with daily movements through the GMA monitoring unusual activity.

Frankfurt Zoological Society (FZS) already has a presence in the region due to the rhino project in the national park. We work closely with the Zambian Wildlife Authority, the community and FSZ, Rather than doubling up on what FZS are doing we meet at the start of each safari season to discuss the next twelve months.

Last year it was identified that the scout's living conditions were not satisfactory; this was creating hardship especially in the rainy season. We provided roofs to forty houses for the scouts in the Game Management Area. This provided local employment to the community as well as improving conditions to the scouts and their families.

Last year the anti poaching efforts resulted in 94 wire snares, 28 muzzle loading firearms and 7 home made shotguns being seized. This year January to March 36 wire snares and one firearm have been seized. Two poached elephant were found dead with ivory removed, two lions were snared (one male and one female in two different locations); the human animal conflict is probably the biggest concern, Last year a leopard killed a child. Almost annually people are being mauled or killed by lion, elephant and buffalo. Elephant and buffalo are constantly destroying crops; tolerance to this is due only to the revenue being received by the community through safari hunting. The joint and consistently intense effort by ZAWA, the community, Frankfurt Zoological Society and us is keeping poaching to a minimum in this game management area.

The community directly benefit financially from the revenue of the hunting with a share in the funds raised. They get 50% of the trophy fee and 20% of the concession fee. This is in addition to other commitments from the company. The community funds the employment for up to thirty village scouts from this revenue. With the agreement of the community we have zoned areas for fishing to limit movement, disturbance to the habitat and encroachment in the concession. We endeavor to drive each road in the area every week to ensure that it is maintained and passable for anti poaching efforts. Firebreaks are maintained to protect the habitat for the wildlife and for the safety of the scouts who may be on foot patrols. Anti poaching patrols are done 365 days of the year in Chifunda GMA.

Our anti poaching and conservation commitment to the next year covers:

1. Food rations to increase six full patrols each month
2. Fresh meat as a protein source to the scouts
3. Fuel for resource monitoring
4. Money to conduct village sweeps
5. Rewards for information leading to the arrest and conviction of poachers
6. Rewards for the handing in or seizure of illegal firearms
7. Rewards for the handing in of snares to remove them from circulation

Item	Spend (USD)	Notes
Community revenue	48,000	Hunting revenue used for scout salaries
Food rations	8,000	Increases patrols by six per month
Diesel / petrol	12,000	Resource monitoring and anti poaching
Rewards	5,000	Between snares, illegal firearms and

		information
Infrastructure development, fire management and road maintenance	15,000	Includes employment
TOTAL	**$88,000**	

We are annually reviewed and any prospect of a future lease agreement is contingent on our current performance in wildlife protection and community obligations

III. COMMUNITY PARTICIPATION

A. Community Assistance Component

The concession has 15,000 people resident in the block. There are seven VAGS with five main villages in the concession. Each VAG has its own headman and the concession falls under the jurisdiction of HRH Chief Chifunda. The Community Resource Board is elected to handle the decisions for the Game Management Area residents. They directly receive 20% of the concession fee and 50% of the Government trophy fees.

We are also obligated to a US$20,500 annual payment for the community to use in projects of their choosing. The emphasis being on community welfare, wildlife conservation, education and medical care.

In addition to this we have committed to developing a business for the community. They have a community camp that is based at the crossing from North Luangwa National Park, which is ideal for any travellers crossing from Mpika to Chama or Lundazi. Our commitment is to rebuild the bush camp to an international standard, provide training of the camp staff and management so that they can realize a long term and sustainable financial return. This camp will be ready in 2016 and advertising and marketing has already been organized for prior to the opening.

There are projects/ assistance that are on going and are extra to our obligations and these are:

1. Toilets at the clinic (2016)
2. The employment of a teacher (2016)
3. A scholarship for the a deserving academic achieving student or adult in the field of education, medical care/medicine or wildlife/environmental conservation (2016)
4. Paid for the community meeting twice a year.
5. Employment of a liaison officer to help with communications between ZAWA, the community and our company

50% of the edible meat harvested is delivered to the community through the hunting season.

We are providing assistance with the community in their application for three secondary school classrooms.

Our relationship with ZAWA and the community is a collaborative one based on respect for our partners in the industry. ZAWA determines whether to allow us a future lease based on our performance in the current lease, we are monitored by an annual review.

B. Conflict Control

The Managing Director is a Senior Honorary wildlife Police Officer, he is in a position to provide assistance whenever required on the ground. Control and putting down of the problem animals is done by National Parks and Wildlife. Reports of wounded animals sighted are done by radio, all parties have. The community use fireworks bangers and loud noises to chase the animals from their fields. Education of the community members is done through discussions at the community meetings to disperse to each village member. Understanding the financial contribution by hunting and in each community member benefiting on a rotation basis of the fresh meat harvested has significantly led to a tolerance of wildlife.

IV. HABITAT PROTECTION AND CONSERVATION DEVELOPMENT

During hunting herd disturbance of the buffalo is kept to a minimum to encourage breeding and to encourage the lion not to look for alternate food sources close to the villages.

Fires are controlled and done with the community and the wildlife department to ensure that habitats are conserved so as not to put pressure on the wildlife during the dry season. Firebreaks are maintained, movement of people in the GMA is strictly monitored for a number of reasons including the prevention of unplanned fires.

There is no logging or mining in this concession. The community has chosen not to explore the revenue options of these industries whilst they have the hunting revenue.

The community have committed to not increasing the number of fields they have, thereby preventing further loss of habitat for the wildlife.

V. OTHER INFORMATION

A. Prey Base

In our former hunting block over a period of ten years we more than doubled the buffalo numbers to 700 strong in a single herd through anti poaching and hunting off take controls. We are using this same method and approach in Chifunda. This is the largest food source for the lion; this approach is also being used with all the wildlife in the block.

B. Lion Population Tracking

Lion are notoriously difficult to survey or census. To track the lion population trend in our concession we are bringing in the use of trail cameras, GPS units and sightings of the lion, spoor and footprints recorded by ZAWA, the community and ourselves. Conflict situations will also be studied in order to find solutions that help reduce these.

C. Lion Aging Approach

Dr Paula White involved our company in the lion-aging project from when it was started and we are constantly involved in educating our professional hunters in identifying age appropriate lion. Our company policy is to not harvest a lion below the age of 6 years old and to have a conservative visual attitude towards the aging of the lion. This is in the employment contract of each professional hunter. No pride lions will be harvested so as to reduce the incidents of cub mortality and disruption to the population of lion. We are

committed to attending workshops to help with lion aging, constant education of our employees and contributing to scientific research of lion.

We have had clients that have seen lion but not taken one due to being selective. We have voluntarily reduced our lion quotas when we feel that this has been required even when we were allowed more lion on quota. In one of our hunting blocks, Tondwa GMA, we removed lion, leopard, buffalo, hippo, waterbuck and hartebeest from the quota as it was felt that hunting these would be detrimental to these species.

D. Lion Hunting Revenue

Lion and elephant are our highest-value species. Revenue from these is expected to be more than 50% of our income. This will significantly help us in being able to meet our obligations to the community, to the anti poaching projects and to the protection of these species and their habitat. We committed to the second highest financial hunting commitment in Zambia to our partners in our concession proposal, we believe in a partnership where the community, the wildlife authority, the country and the wildlife all need to benefit from the relationship.

E. U.S. Hunters

Most of our clients (75%) are from the United States. These hunters have a conservation ethic and usually contribute above their fees to anti-poaching and our community projects. They are members of associations that expect and support ethical hunting practices. They support our conservative approach to the hunting of lion.

CONCLUSION

Muchinga Adventures Ltd is committed to the long term, sustainable and ethical practice of hunting lion. Our involvement in this practice allows us to improve the habitat of the lion, improving the attitude of the community in tolerance towards lion. Our anti poaching practices protect and enhance the lion in the concession, growing their numbers of prey and reducing down snare encounters. The community sees a real benefit from partnering in the hunting industry, we answer to them and the Wildlife Authority for our performance towards anti poaching and community obligations. Their involvement and recognition of the value of hunting has made them want to protect their wildlife and be pro active in reducing animal – human conflicts. We believe that lion hunting is a crucial and necessary part of conserving the whole of Chifunda GMA.

Signed: John du Plooy

Operator Name: MUCHINGA ADVENTURES LTD

Title: MANAGING DIRECTOR

ATTACHMENTS

No.	Title	Preferred Time Period
1	Map of concession	
2	Company lease with the Wildlife Authority & community Showing community and anti poaching commitment	2015
3	Company concession, anti-poaching, community assistance, or other written plan(s) This is the proposal summary put forward in our bid. Past commitments to community and anti poaching are demonstrated	2015 - 2022
4	Annual report for Chifunda GMA to Wildife Department	2015
5	Food rations to scouts with photos of anti poaching	2015
6	Meetings with the community	2015
7	Company elephant and lion aging policy	2015
8	Meat donations to the community	2015
9	Game meat distributions	2015
10	Proof of funds for community projects	2015
11	Letter from community leaders	2015

MUCHINGA ADVENTURES LTD
Hunting & Photographic Safaris

P.O. Box 390003
Lumumba Rd
Lusaka
Zambia

Tel: 260 977 774815
Email: johndp@zamnet.zm

1 December 2015

Director General
ZAWA
P/Bag 1
Chilanga
Zambia

Dear Sir

The allocation of Chifunda GMA after the main marketing conventions made this year a challenge. Discounts were offered on hunts and every effort made to bring clients in to hunt Chifunda GMA and we are happy to report the following:

1. Lodged performance bond with ZAWA 7th April 2015
2. Paid the 70% agreed upon K568,085 for bid fees for 2015 by 10 June 2015 to ZAWA
3. Paid US$116,530 trophy fees to ZAWA
4. 72.05% of the trophy fee financial value utilised
5. Outfitter license number 1025 issued 10 June 2015, paid US$3500 to ZAWA for this.
6. Had a meeting with HRH Highness Chief Chifunda, CRB and ZAWA in Chifunda on the 3rd April 2015.
7. Provided report to CRB meeting in July and September
8. Paid for both CRB, ZAWA and company meetings
9. Occupiers Public Liability Insurance was issued on the 9th April 2015
10. Annual radio license was renewed 1st June 2015
11. Built a main camp and paid K17,580 to the CRB for labour
12. 80% of the camp staff are from the community for the main camp.
13. Company contracts have been signed with main camp staff – these will be subject to NAPSA and PAYE in accordance with the Labour Laws of Zambia
14. The assistant or personal driver of the Professional Hunters are not Muchinga Adventures employees and are not included in the camp staff numbers
15. Built a tented camp, paid K10,000 to the CRB for this camp building
16. 80% of the staff for the tented camp are from the community
17. Staff houses have been built in the safari camp and payment of K4250 has been made to the CRB for the building of these.
18. K2900 paid to the bricklayers for camp building
19. More than 120 people in Chifunda have been given employment from camp building, opening roads, air strips and work that has been on going from Muchinga Adventures
20. Resident Professional Hunter for the 2015 season is John du Plooy.
21. K7560 paid to the CRB on 19 June 2015 towards opening of roads and helping fire management

22. K3,900 being paid to the CRB – allocated from office on 29/7/2015 for opening of roads and helping fire management.
23. Total paid for 2015 being K11,460 for fire management – this pledge for 2015 is completed.
24. K12,600 paid to the CRB on 11 June 2015 for the airstrip to be cleared, this is infrastructure development.
25. K8000 paid to the CRB 15 July 2015 for the roofs of 40 scout houses, this is infrastructure development.
26. Total paid for infrastructure development being K20,600 – this pledge for 2015 has been completed.
27. K10,000 for wildlife resource monitoring on 29 July 2015 to be paid to ZAWA in Chifunda for the year. This pledge is completed.
28. Law enforcement assistance is as follows:
    i. K5259 food rations for scouts was delivered in April 2015
    ii. K4200 was paid for scout food rations to ZAWA for 6 patrols on 30 June 2015
    iii. K5745 paid to ZAWA for rice and mealie meal for the scouts for the year on 20 June 2015
    iv. K1520 for fuel paid to ZAWA 30 June 2015
    v. K9179 of food rations being for August to end of October bought for scouts 2nd August 2015 – this is for six patrols per month
    vi. K6,395 to scout food rations September 2015
    vii. Total paid to law enforcement being K32,298 by 18 September 2015
    viii. Balance due on law enforcement being K27,702 before 31 December 2015.
29. 40 litres of fuel given to the ZAWA Warden in Chifunda
30. Liaison Officer – Anord Nkoma.
31. US$20,500 for community obligatory pledges paid in full, this pledge is done
32. Meat delivery – more than 50% of hunted meat has been delivered to community members and ZAWA in Chifunda GMA.
33. Agreed with the community that the community camp renovations will begin in 2016 as per the tender proposal
34. Donated roof sheets and ridges to HRH Chief Chifunda's Palace

Issues of concern that have been raised with the community for their attention are:

1. Snaring
2. Location and movement of fishermen
3. The camp John Coppinger erected in the GMA without permission
4. Proper monitoring of resident hunting

On 6th August John du Plooy had to put down an elephant in Chifunda GMA that charged and despite several warning shots from both the monitoring scout and the Professional Hunter she continued to charge. At 7 yards on full charge there was no option but to shoot her. This was immediately reported to the ZAWA Park Ranger, a phone call to ZAWA Chilanga, followed by the written reports and all protocols followed in a life threatening incident. All documents are attached in the report.

At the time of signing and throughout the year we had not been informed of anyone having a prior agreement with the Community or ZAWA for a non hunting camp in Chifunda. A bush camp, which we have since been told belongs to John Coppinger, was put up in the GMA during the season and led to an unpleasant situation as the hunters were not aware that these people were in the GMA. What is a disappointment to us is that the community were only paid K1560 by this camp being located in the GMA according to the information provided by the CRB to the company at the meeting in September. This is a loss of real income to ZAWA and the community as these types of activities should be in the park. However if these tourists

do need accommodation outside the park the community camp is available. The community and ZAWA in the GMA have informed us that this camp will not be allowed next year.

Please be aware that we have paid $62,200 and US$1,900 bid fee for 2016 being K836,505 has been paid in full to ZAWA.

Marketing has been on going through the year and the company directors will be travelling to New Zealand, Australia, USA, UK and Europe over the coming three months to maximise exposure. Both company directors will also be at the SCI convention in 2016 exhibiting in booth 5539. Footage of Tom Miranda and John du Plooy hunting together has been shown on main stream USA TV channels giving further exposure to the company, John du Plooy and Zambia.

We thank ZAWA for their support and understanding during what has been a tough year for the industry. The meeting upon signing the lease agreements to allow us to pay 70% of the concession fees for the year helped us in being able to discount the hunts to a level that allowed for bookings at short notice. Although this affects company profits it allowed for all obligations to be met with ZAWA and the community. The support by ZAWA to put Zambian outfitters in touch with agents in Europe was also most appreciated.

ZAWA on the ground in Chifunda GMA are to be commended for their professionalism and for their outstanding commitment to law enforcement in the region.

Muchinga Adventures Ltd is looking forward to a positive 2017 safari season, working with both ZAWA and the Community for the benefit of the GMA, the wildlife and Zambia.

Yours truly

John du Plooy
Managing Director

MUCHINGA ADVENTURES LTD
Hunting & Photographic Safaris

P.O. Box 390003
Lumumba Rd
Lusaka
Zambia

Tel: 260 977 774815
Email: johndp@zamnet.zm

BREAKDOWN OF CHIFUNDA GMA SAFARI PAYMENTS TO ZAWA 2015

(15 November 2015)

	Kwacha	US$
Bid Fee K811550 @ 70%	K568,085	
Permit to hunt a GMA – 32 @ US$150		US$4800
Bird Licences 28 @ US$100		US$2800
Safari Trophy Fees		US$116,530
Safari Operators Licence		US$3500
TOTAL	**K568,085**	**US$127,630**

Reference: Exchange Rate of US$1 – Kwacha 13.00 used as rate at time of hunting concluding in this GMA.

Total paid to ZAWA for 2015 being K2,227,275=00

(Two million, two hundred and twenty seven thousand, seven hundred and seventy five Kwacha.)



Muchinga Adventures Ltd

Chifunda GMA

December 2015

A good start to the lease agreement

Meetings pre season and end of season were held in Chifunda GMA

On being allocated Chifunda GMA, Muchinga Adventures went to the hunting block and had a meeting with the community CRB, HRH Chief Chifunda and ZAWA. All items of concern or interest for all groups was discussed.





MEETING THE C.R.B

CRB

Managing Director John du Plooy met with the community CRB, HRH Chief Chifunda and ZAWA shortly after the allocation of Chifunda GMA and there was an end of season meeting at the end of September.

Employment – more than 130 people

The main camp consisting of five grass thatch en suite chalets to an outstanding quality were built in the previous camp location. A luxuary tented fly camp was built 16km up stream at a location determined with the community and ZAWA. Employment for camp building, road opening, fire breaks being made, air strip being cleared, work done and camp staff during the year is more than one hundred and thirty men and women.



John du Plooy & Staff

John du Plooy was the resident Professional Hunter in Chifunda GMA. As Managing Director of the company and being based in the area it made communication and issues for the community easy to address quickly. 80% of the staff employed for the camp were from the community. Many of the staff were previously employed in the industry and training has been given where needed. Above are some but not all of the staff members. A second camp was also built further upstream to allow for better utilization of the safari quota and to provide further employment for the community.







Director Laura du Plooy with HRH Chief Chifunda

Director meetings

Director Laura du Plooy had meetings and met with ZAWA, CRB members and HRH Chief Chifunda during the course of 2015. Building good relationships is key to partnerships.





Meat to community

More than 50% of the edible meat was given to the community during the year. This was delivered to specific locations throughout the GMA and Village Headmen were responsible for distributing it to the community members under them. Meat was also given to the ZAWA scouts throughout the year. The meat distribution is fully shown in the sign sheets included in the report.

1. Meat was also delivered to HRH Chief Chifunda who distributed this amongst his subjects living close to him.

2. All meat was used responsibly and without wastage.

3. It is felt that the meat received by the community made a positive difference to the members

The roster system worked well and will be continued in 2016 for meat delivery.









Anti poaching and law enforcement

Muchinga Adventures support to ZAWA and law enforcement with the wildlife was given whole heartedly. All pledges in this regard were fulfilled. Problems such as snaring were reported. Roofs for the scout houses were given through the infrastructure development in the area, it was felt that this was a priority. As a company it is a pleasure to work with scouts who take their job seriously and are committed to the welfare of the wildlife, community and GMA. We look forward to continuing the support for anti poaching and wildlife law enforcement in 2016.

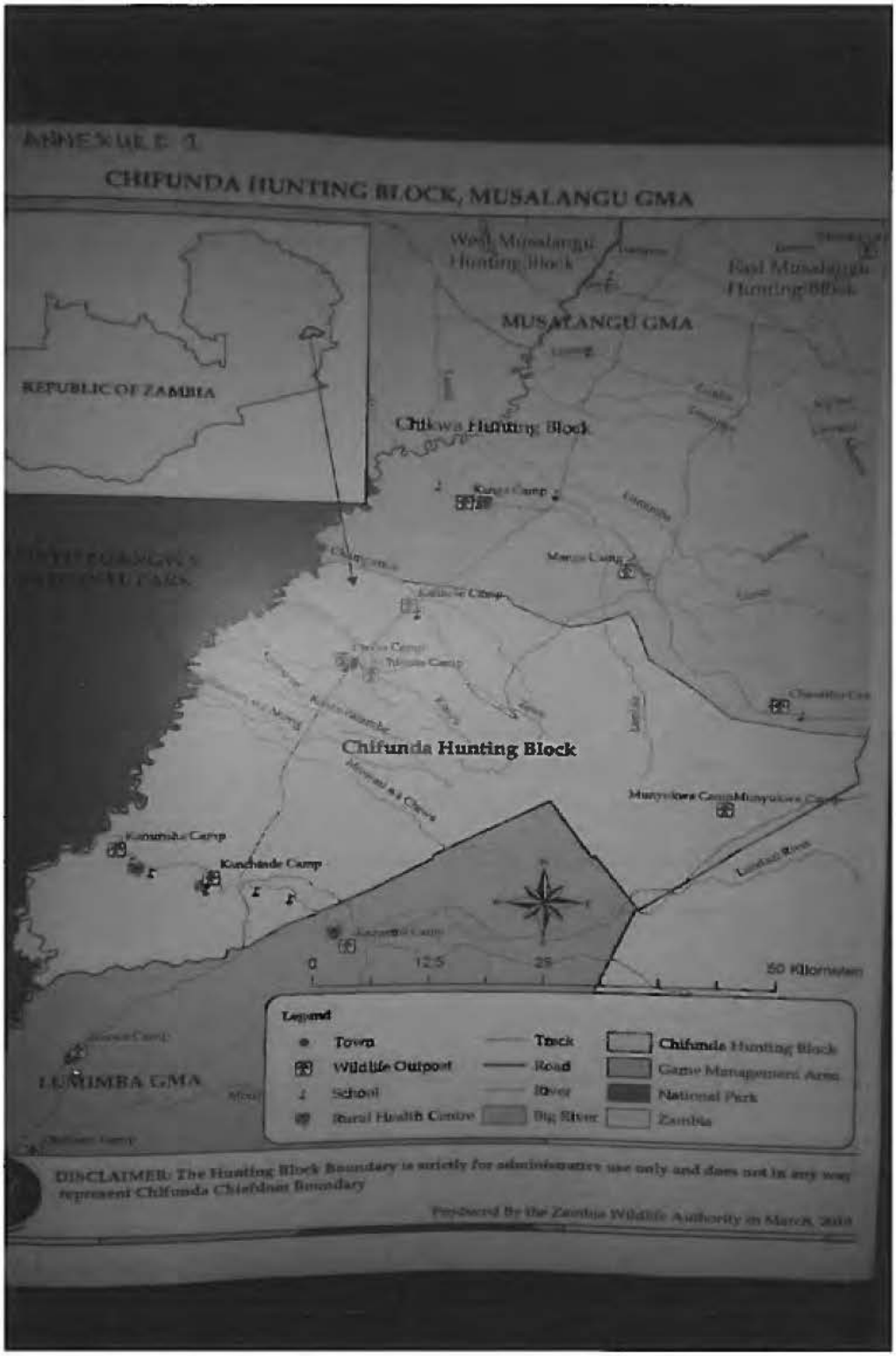
Working with ZAWA and the community throughout the year was on going. Food rations were delivered at the start of the lease agreement then a monthly allowance of food and fuel worked out so that this complimented the work being done by Frankfurt Zoological Society in the North Luangwa National Park. These photos show the handed over of the funds for the off season patrols and food rations, meat being given to ZAWA and food rations donated to the scouts for anti poaching. Fuel was also given.



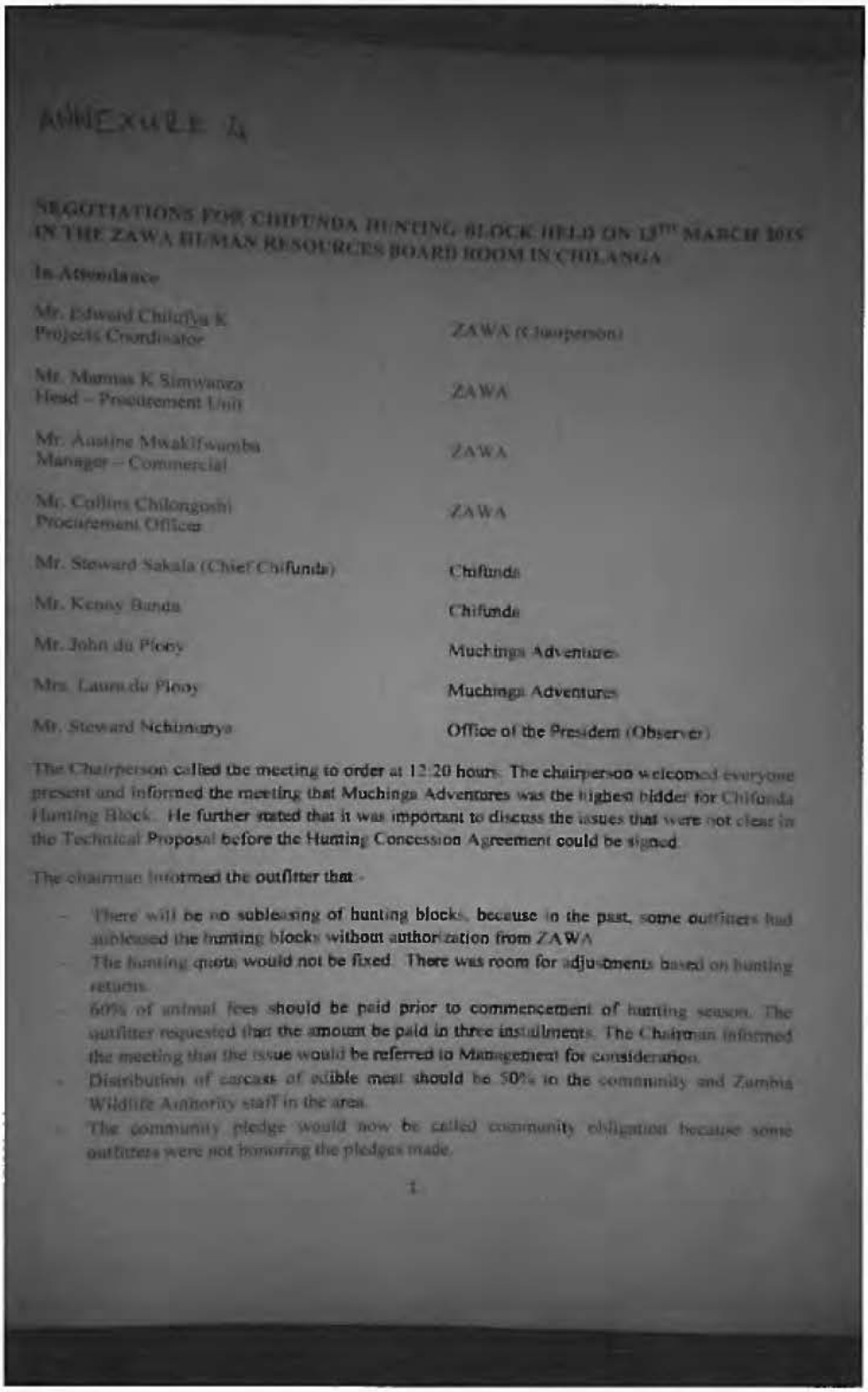




APPENDIX 1:


ANNEXURE 1
CHIFUNDA HUNTING BLOCK, MUSALANGU GMA
REPUBLIC OF ZAMBIA
MUSALANGU GMA
Chikwa Hunting Block
Chifunda Hunting Block
LUMIMBA GMA
0
12.5
25
50 Kilometers
Legend
Town
Wildlife Outpost
School
Rural Health Centre
Track
Road
River
Big River
Chifunda Hunting Block
Game Management Area
National Park
Zambia
DISCLAIMER: The Hunting Block Boundary is strictly for administrative use only and does not in any way represent Chifunda Chiefdom Boundary

APPENDIX 2



ANNEXURE 1A

NEGOTIATIONS FOR CHIFUNDA HUNTING BLOCK HELD ON 13TH MARCH 2015 IN THE ZAWA HUMAN RESOURCES BOARD ROOM IN CHILANGA

In Attendance

Mr. Edward Chilufya K Projects Coordinator	ZAWA (Chairperson)
Mr. Mumas K Simwanza Head – Procurement Unit	ZAWA
Mr. Austine Mwalilwumba Manager – Commercial	ZAWA
Mr. Collins Chilongoshi Procurement Officer	ZAWA
Mr. Steward Sakala (Chief Chifunda)	Chifunda
Mr. Kenny Bunda	Chifunda
Mr. John du Plooy	Muchinga Adventures
Mrs. Laura du Plooy	Muchinga Adventures
Mr. Steward Nchimunya	Office of the President (Observer)

The Chairperson called the meeting to order at 12:20 hours. The chairperson welcomed everyone present and informed the meeting that Muchinga Adventures was the highest bidder for Chifunda Hunting Block. He further stated that it was important to discuss the issues that were not clear in the Technical Proposal before the Hunting Concession Agreement could be signed.

The chairman informed the outfitter that -

- There will be no subleasing of hunting blocks, because in the past, some outfitters had subleased the hunting blocks without authorization from ZAWA
- The hunting quota would not be fixed. There was room for adjustments based on hunting returns.
- 60% of animal fees should be paid prior to commencement of hunting season. The outfitter requested that the amount be paid in three installments. The Chairman informed the meeting that the issue would be referred to Management for consideration.
- Distribution of carcass of edible meat should be 50% to the community and Zambia Wildlife Authority staff in the area.
- The community pledge would now be called community obligation because some outfitters were not honoring the pledges made.

1

Concerns and remarks by the Outfitter

- Clarification on Addendum III
  The chairperson informed the meeting that during the Tender opening, it was noted that most bidders did not receive Addendum III and it was agreed that the Community Obligation would be extracted from the Technical Proposals.
- The Outfitter wanted clarification on whether VAT was included when paying animal fees.

  The Head of Procurement responded by saying, ZAWA is a parastatal body and VAT was included on the fees until clarity is sought.

- The Outfitter raised concern on when the Concession would be in effect and if there would be hunting this year bearing in mind that most conventions had passed and lost time to market. He suggested if it was possible to effect the Agreement in 2016
- The chairperson stated that the Outfitter would be advised at the time of signing the hunting concession but if he has clients this year, hunting could be done.

The meeting agreed on the following -

- Community Obligations by the outfitter was agreed at USD 20,500.00 plus maintenance of a community bush camp. The money will be paid in US Dollars.
- The outfitter committed to pay ZMW10, 000.00 towards Fire Management.
- On Infrastructure development, the Outfitter committed to pay ZMW20, 000.00.
- The outfitter committed to pay ZMW60, 000.00 towards Law Enforcement support.
- The outfitter committed to pay ZMW10, 000.00 to wildlife resource monitoring.

The figures above are per annum for the period of the Concession.

Edward Chilufya K

Steward Sakala (Chief Chifunda)

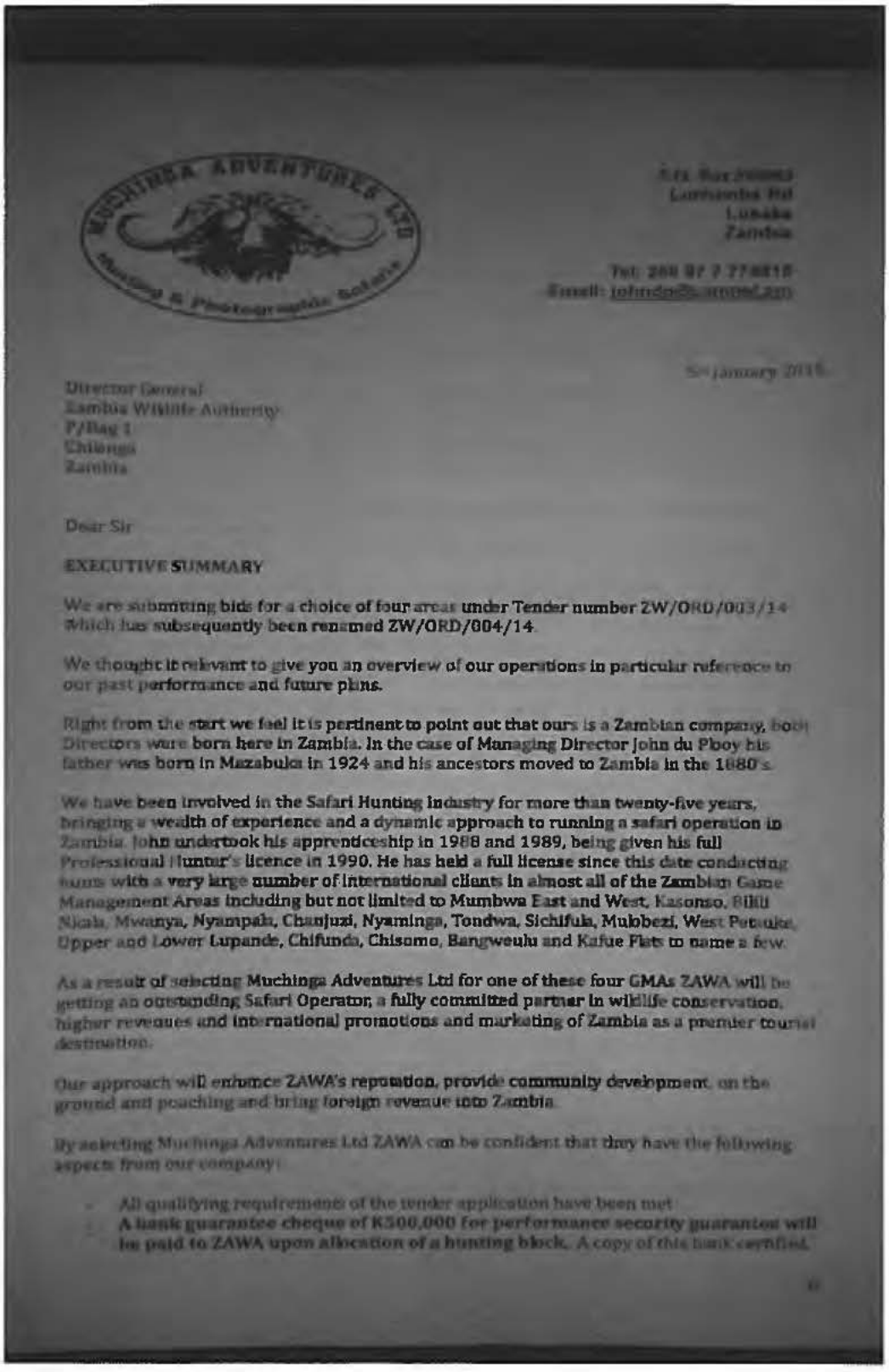
Kenny Banda

Mr. John du Plooy

Mrs. Laura du Plooy

APPENDIX 3:

SUMMARY OF TECHNICAL PROPOSAL - SUCCESFUL AWARDING OF CHIFUNDA GMA:



MUCHINGA ADVENTURES LTD
Hunting & Photographic Safaris

[redacted]
Lusaka
Zambia

Tel: [redacted]
Email: [redacted]

5th January 2015

Director General
Zambia Wildlife Authority
P/Bag 1
Chilanga
Zambia

Dear Sir

EXECUTIVE SUMMARY

We are submitting bids for a choice of four areas under Tender number ZW/ORD/003/14 which has subsequently been renamed ZW/ORD/004/14.

We thought it relevant to give you an overview of our operations in particular reference to our past performance and future plans.

Right from the start we feel it is pertinent to point out that ours is a Zambian company, both Directors were born here in Zambia. In the case of Managing Director John du Plooy his father was born in Mazabuka in 1924 and his ancestors moved to Zambia in the 1880's.

We have been involved in the Safari Hunting industry for more than twenty-five years, bringing a wealth of experience and a dynamic approach to running a safari operation in Zambia. John undertook his apprenticeship in 1988 and 1989, being given his full Professional Hunter's licence in 1990. He has held a full license since this date conducting hunts with a very large number of international clients in almost all of the Zambian Game Management Areas including but not limited to Mumbwa East and West, Kasonso, Bilili Nkala, Mwanya, Nyampala, Chanjuzi, Nyaminga, Tondwa, Sichifula, Mubbezi, West Petauke, Upper and Lower Lupande, Chifunda, Chisomo, Bangweulu and Kafue Flats to name a few.

As a result of selecting Muchinga Adventures Ltd for one of these four GMAs ZAWA will be getting an outstanding Safari Operator, a fully committed partner in wildlife conservation, higher revenues and international promotions and marketing of Zambia as a premier tourist destination.

Our approach will enhance ZAWA's reputation, provide community development, on the ground anti poaching and bring foreign revenue into Zambia.

By selecting Muchinga Adventures Ltd ZAWA can be confident that they have the following aspects from our company:

- All qualifying requirements of the tender application have been met
- A bank guarantee cheque of K500,000 for performance security guarantee will be paid to ZAWA upon allocation of a hunting block. A copy of this bank certified

- Zambian registered company since 1993
- Fully compliant with all regulations regarding ZRA, NAPSA, Workman's Compensation, Communications Authority and the Tourism Board
- Fully compliant with the ZAWA Hunting Regulations and ZAWA ACT
- Managing Director who's family has been in Zambia since the 1800's
- Highly experienced management team in the safari industry
- Integrity, honesty and business ethics in all aspects of the business
- Financially stable Directors and company
- A company with the equipment and means to fully outfit four safari camps and hunting areas to an international standard
- Muchinga Adventures Ltd has met all pledges, social and financial obligations with ZAWA and the Community during the 2003 to 2012 Lease Agreement for Chanjuzi GMA and Nyamunga GMA.
- Conduct business with honesty & integrity for the benefit of company & the clients
- Work with ZAWA and the communities to ensure that conservation supports development of rural communities
- Development of the Game Management Area in aspects such as improving existing roads and infrastructure
- Establish a broad market for hunting that warrants growth of business and the hunting industry in Zambia
- International Promotions and Marketing which is already in place
- Meet and Greet arrival and departure assistance for all clients
- Zambian Employment, all employees and management are Zambian born
- Encourage training and job creation for Zambians
- Safari Revenue brought into Zambia with taxes paid by all employees in Zambia
- Top Safari Camps & Staff with management who permanently reside in Zambia
- Support for ZAWA on the ground in the GMA
- Anti poaching support through food, equipment & logistical assistance
- Donate a second hand 4x4 vehicle within the lease agreement to the community for community support and anti poaching.
- Working with ZAWA and the Community to reduce poaching
- Effective conservation techniques with monitoring and rehabilitation of resources
- Choice for the community of option A. US$20,500 cash payment obligatory support or alternately option B US$15,500 cash support & the donation of 100% of a viable business. Once chosen by the community this is the annual obligatory support.
- Support of US$20,500 (at current exchange rate K133,250) or if chosen the US$15,500 annually for obligatory community projects and development within the GMA with a focus on Health, Education, Food Security, Safe drinking water, Employment and Poverty Reduction.
- As per option B donate 100% of a business to be owned and run by the community with conservative estimated worth K500,000 income over the lease agreement. Giving employment, skills, poverty relief and upliftment to the community. We will support and give advise to this business during the lease agreement.
- K1,205,250 community support in seven years (as under option B)
- Supporting Green Operations
- Top quality Professional Hunters and staff
- Long term commitment to the industry
- Twenty two years experience of exporting clients trophies from Zambia
- Facilities to safely store client trophies
- Fully compliant with all aspects of the trophy export process including TRACES, CITIES, Veterinary requirements and regulations in the country of import

During the time we were carrying out operations over the past twelve years we were ensuring that all aspects of the business were being attended to. We will carry this on in any lease agreement we are given, including the below:

1. Travelling overseas for marketing at major international hunting conventions and personal meetings with clients
2. Outfitting camps to a high international standard including generators, fridges, freezers, radio's, mosquito netted beds and attractively furnished chalets that had the option of solar lighting
3. Road building and maintenance each year providing employment to the community
4. Camp building prior to each safari season providing employment to the community
5. Employment of highly experienced camp staff, most coming from the community themselves
6. Providing assistance with all arrival and departure formalities for the international clients, ensuring the arrive in and depart from the hunting area in a timely fashion
7. Purchasing of all camp supplies for the duration of the safari season
8. Exporting of trophies to all clients in a timely manner
9. To provide assistance in anti poaching efforts
10. Develop support between the CRB, Chief, ZAWA and safari company to ensure a positive and healthy relationship for all parties involved
11. We trained a community member to be a Professional Hunter. This will be undertaken with advertising & the selection process for a candidate will begin by camp building.

The areas we operated in the Luangwa easily cater for the number of clients we have hunted in them. With effective management and the correct investment in the key aspects of anti poaching, community pledges and infrastructure we ended our prior leases knowing that we have made a huge positive impact within the GMA on both the wildlife and the communities.

We are a known, proven Zambian operation that ensures monies are brought into Zambia, taxes are paid to ZRA and employment is given to Zambians. Our track record for the past twelve years is emphasised throughout our application as this best demonstrates what we can do and hope we will be given the opportunity to continue doing the same in the future. We have included photographs in this bid demonstrating what we have done in the past as our actions support what we are capable of in the future.

Muchinga Adventures Ltd management has an active and constant presence in the GMA during the safari season, this allows for an effective line of communication ensuring a positive and healthy relationship between all parties. Muchinga Adventures Ltd is about hands on, on the ground involvement in all the projects and management of the company operations.

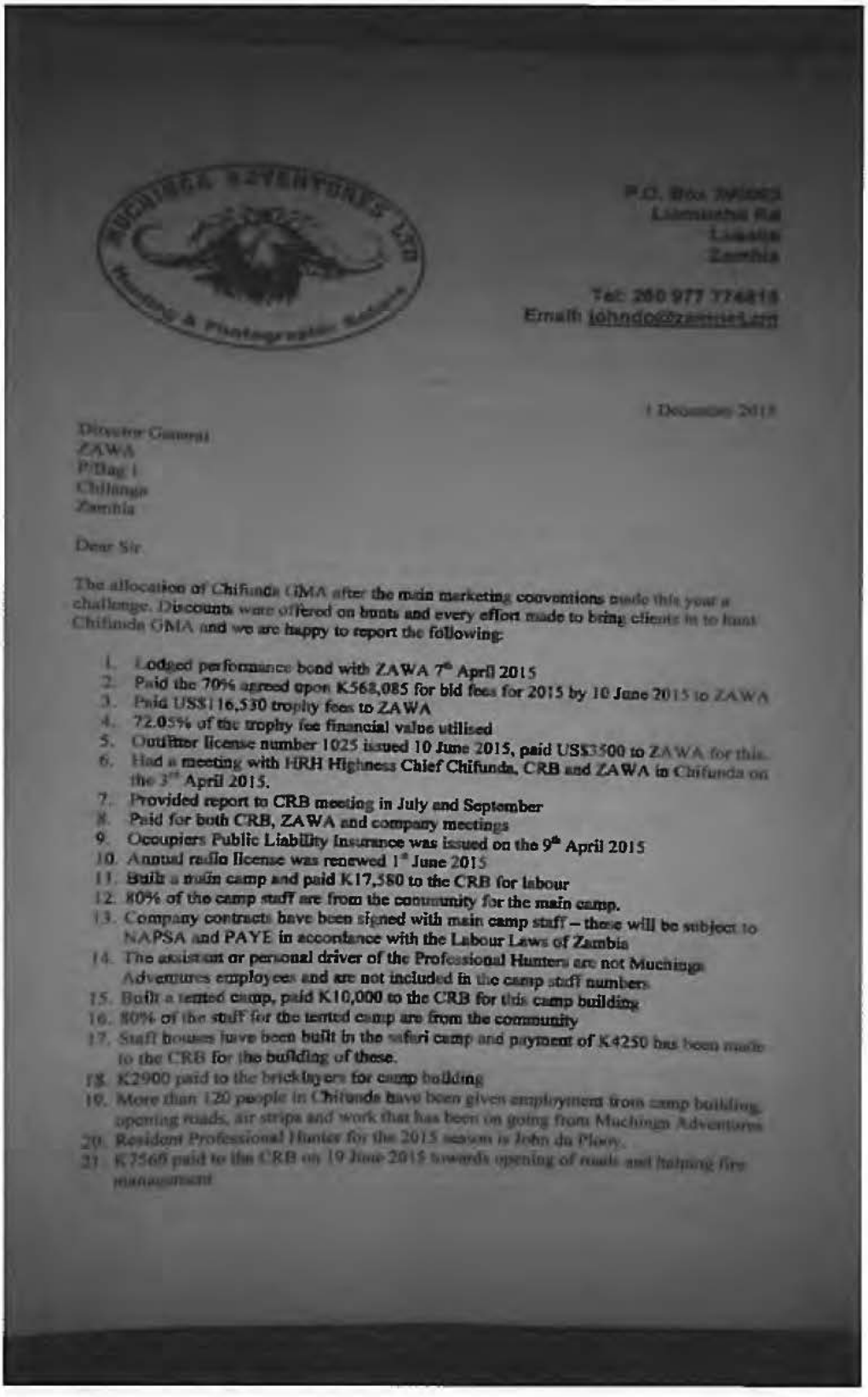
I am a proud Zambian who believes in sustainable, ethical, responsible, respectful and honest business practises that should, and must, benefit not only the wildlife and community but also Zambia as a whole.

We would like to thank you in advance for reading through our application for the areas we have submitted bids on and should there be any queries of any kind please do not hesitate to contact Laura or myself for clarification.

Yours truly

John du Plooy
Managing Director

APPENDIX 4:



MUCHINGA ADVENTURES LTD
Hunting & Photographic Safaris

P.O. Box [illegible]
Lusaka
Zambia

Tel: 260 977 774815
Email: johndp@zamnet.zm

1 December 2015

Director General
ZAWA
P/Bag 1
Chilanga
Zambia

Dear Sir

The allocation of Chifunda GMA after the main marketing conventions made this year a challenge. Discounts were offered on hunts and every effort made to bring clients in to hunt Chifunda GMA and we are happy to report the following:

1. Lodged performance bond with ZAWA 7th April 2015
2. Paid the 70% agreed upon K568,085 for bid fees for 2015 by 10 June 2015 to ZAWA
3. Paid US$116,530 trophy fees to ZAWA
4. 72.05% of the trophy fee financial value utilised
5. Outfitter license number 1025 issued 10 June 2015, paid US$3500 to ZAWA for this.
6. Had a meeting with HRH Highness Chief Chifunda, CRB and ZAWA in Chifunda on the 3rd April 2015.
7. Provided report to CRB meeting in July and September
8. Paid for both CRB, ZAWA and company meetings
9. Occupiers Public Liability Insurance was issued on the 9th April 2015
10. Annual radio license was renewed 1st June 2015
11. Built a main camp and paid K17,580 to the CRB for labour
12. 80% of the camp staff are from the community for the main camp.
13. Company contracts have been signed with main camp staff – these will be subject to NAPSA and PAYE in accordance with the Labour Laws of Zambia
14. The assistant or personal driver of the Professional Hunters are not Muchinga Adventures employees and are not included in the camp staff numbers
15. Built a tented camp, paid K10,000 to the CRB for this camp building
16. 80% of the staff for the tented camp are from the community
17. Staff houses have been built in the safari camp and payment of K4250 has been made to the CRB for the building of these.
18. K2900 paid to the bricklayers for camp building
19. More than 120 people in Chifunda have been given employment from camp building, opening roads, air strips and work that has been on going from Muchinga Adventures
20. Resident Professional Hunter for the 2015 season is John du Plooy.
21. K7566 paid to the CRB on 19 June 2015 towards opening of roads and helping fire management

22. K3,900 being paid to the CRB – allowed from office on 20/7/2015 the opening of roads and helping fire management
23. Total paid for 2015 being K11,460 for fire management – this pledge for 2015 is completed.
24. K12,800 paid to the CRB on 11 June 2015 for the airstrip to be cleared, this is infrastructure development.
25. K8000 paid to the CRB 15 July 2015 for the roofs of 30 mud houses, this is infrastructure development.
26. Total paid for infrastructure development being K20,600 – this pledge for 2015 has been completed.
27. K10,000 for wildlife resource monitoring on 29 July 2015 to be paid to ZAWA in Chifunda for the year. This pledge is completed.
28. Law enforcement assistance is as follows:
    i. K5259 food rations for scouts was delivered in April 2015
    ii. K4200 was paid for scout food rations to ZAWA for 6 patrols on 30 June 2015
    iii. K5745 paid to ZAWA for rice and mealie meal for the scouts for the year on 20 June 2015
    iv. K1520 for fuel paid to ZAWA 30 June 2015
    v. K9179 of food rations being for August to end of October bought for scouts 2nd August 2015 – this is for six patrols per month
    vi. K6,395 to scout food rations September 2015
    vii. Total paid to law enforcement being K32,298 by 18 September 2015
    viii. Balance due on law enforcement being K27,702 before 31 December 2015.
29. 40 litres of fuel given to the ZAWA Warden in Chifunda
30. Liaison Officer – Anord Nkoma.
31. US$20,500 for community obligatory pledges paid in full, this pledge is done
32. Meat delivery – more than 50% of hunted meat has been delivered to community members and ZAWA in Chifunda GMA.
33. Agreed with the community that the community camp renovations will begin in 2016 as per the tender proposal
34. Donated roof sheets and ridges to HRH Chief Chifunda's Palace

Issues of concern that have been raised with the community for their attention are:

1. Snaring
2. Location and movement of fishermen
3. The camp John Coppinger erected in the GMA without permission
4. Proper monitoring of resident hunting

On 6th August John du Plooy had to put down an elephant in Chifunda GMA that charged and despite several warning shots from both the monitoring scout and the Professional Hunter she continued to charge. At 7 yards on full charge there was no option but to shoot her. This was immediately reported to the ZAWA Park Ranger, a phone call to ZAWA Chilanga, followed by the written reports and all protocols followed in a life threatening incident. All documents are attached in the report.

At the time of signing and throughout the year we had not been informed of anyone having a prior agreement with the Community or ZAWA for a non hunting camp in Chifunda. A bush camp, which we have since been told belongs to John Coppinger, was put up in the GMA during the season and led to an unpleasant situation as the hunters were not aware that these people were in the GMA. What is a disappointment to us is that the community were only paid K1560 by this camp being located in the GMA according to the information provided by the CRB to the company at the meeting in September. This is a loss of real income to ZAWA and the community as these types of activities should be in the park. However if these tourists

do need accommodation outside the park the community camp is available. The community and ZAWA in the GMA have informed us that this camp will not be allowed next year.

Please be aware that we have paid $62,200 and US$1,900 bid fee for 2016 being K836,503 has been paid in full to ZAWA.

Marketing has been on going through the year and the company directors will be travelling to New Zealand, Australia, USA, UK and Europe over the coming three months to maximise exposure. Both company directors will also be at the SCI convention in 2016 exhibiting in booth 5539. Footage of Tom Miranda and John du Plooy hunting together has been shown on main stream USA TV channels giving further exposure to the company, John du Plooy and Zambia.

We thank ZAWA for their support and understanding during what has been a tough year for the industry. The meeting upon signing the lease agreements to allow us to pay 70% of the concession fees for the year helped us in being able to discount the hunts to a level that allowed for bookings at short notice. Although this affects company profits it allowed for all obligations to be met with ZAWA and the community. The support by ZAWA to put Zambian outfitters in touch with agents in Europe was also most appreciated.

ZAWA on the ground in Chifunda GMA are to be commended for their professionalism and for their outstanding commitment to law enforcement in the region.

Muchinga Adventures Ltd is looking forward to a positive 2017 safari season, working with both ZAWA and the Community for the benefit of the GMA, the wildlife and Zambia.

Yours truly

John du Plooy
Managing Director

APPENDIX 5:



Food rations were donated to the scouts on a monthly basis either as shown above or by providing the money to the ZAWA Park Ranger to purchase fresh supplies. Funds have also been paid to ZAWA for the anti poaching food rations and fuel for the rainy season and until May 2016.

Resource Monitoring was paid to ZAWA – this has been used for monitoring the fishermen, their movements and fish stocks in the GMA as well as monitoring the hippo as the river started to dry up and pressure was put on the hippo in the Luangwa River.

There was some snaring that was reported to ZAWA and this was given attention during the year.

We would like to commend ZAWA and all anti poaching efforts in Chifunda GMA. The dedication and effort by ZAWA in this region is outstanding and the wildlife populations have been protected.

30 June 2015

ANTI POACHING IN CHIFUNDA GMA

This serves to confirm that the following have been paid to the Park Ranger ZAWA by Muchinga Adventures Ltd:

K7.59 x 200 Litres of diesel for anti poaching for the month of July total of K1520

Received by:

Stanley Mainde P/Ranger

Witnessed by: Bandat Kenny C/person crb

REPUBLIC OF ZAMBIA
ZAMBIA WILDLIFE AUTHORITY
SOUTH LUANGWA AREA MANAGEMENT UNIT
JUL 2015
SOUTH MUCALANGA SECTOR
WILDLIFE CAMP
P.O. BOX 530007 LUNDAZI

MUSENGA ADVENTURES LTD
Hunting & Photographic Safaris

P.O. Box 320701
Lumumba Rd
Lusaka
Zambia

Tel: 260 97 7 774915
Email: johndo@zamnet.zm

29 July 2015

SCOUT FOOD RATIONS – CHIFUNDA GMA – AUGUST TO END OF OCTOBER

This serves to confirm that the following food rations have been given to the scouts in Chifunda GMA. This covers from 1st August – 31 October 2015

2 bags kapenta x 20kg = 40kg
72kg x sugar
72 x D cell toreb batteries ever ready
36 x GPS battery cells
1440g x yeast
40kg x flour
50 x boxes matches
24 x packets tea leaves
40 x litres cooking oil
20kg x salt
75 x packets soya relish
6 x 100 litres thobwa
LUCKY STAR 5X30=150
This is in addition to the rice and mealie meal which has already been bought.

Received by: [signature] [illegible]

Signed by: [signature] Mwila Mumba C.D.C Secretary

Date stamp: [illegible] 04/08/15

MUCHINGA ADVENTURES LTD
Hunting & Photographic Safaris

P.O. Box 390003
Lumumba Rd
Lusaka
Zambia

Tel: 260 977 774815
Email: johndp@zamnet.zm

20 June 2015

ANTI POACHING – CHIFUNDA GMA

This serves to confirm that K5745 (Five thousand seven hundred and forty five Kwacha) has been paid to the ZAWA Park Warden in Chifunda GMA for 15 bags of rice and 36 bags of mealie meal. This has been purchased from the local community and includes grinding.

Received by:

Name & Position:
S. Mainde
P/ Ranger.
28/6/15

Witnessed by:

REPUBLIC OF ZAMBIA
ZAMBIA WILDLIFE AUTHORITY
CHIFUNDA AREA MANAGEMENT
JUN 1
MI CALANGA SECTOR
WILDLIFE CAMP
P.O. BOX 530007 LUNDAZI

REPUBLIC OF ZAMBIA
ZAMBIA WILDLIFE AUTHORITY
CHIFUNDA AREA MANAGEMENT
28 JUN 2015
MI CALANGA SECTOR
WILDLIFE CAMP
P.O. BOX 530007 LUNDAZI

MUCHINGA ADVENTURES LTD
Hunting & Photographic Safaris

P.O. Box 390003
Lumumba Rd
Lusaka
Zambia

Tel: 260 97 7 774815
Email: johndp@zamnet.zm

28 September 2015

CHIFUNDA GMA – LAW ENFORCEMENT

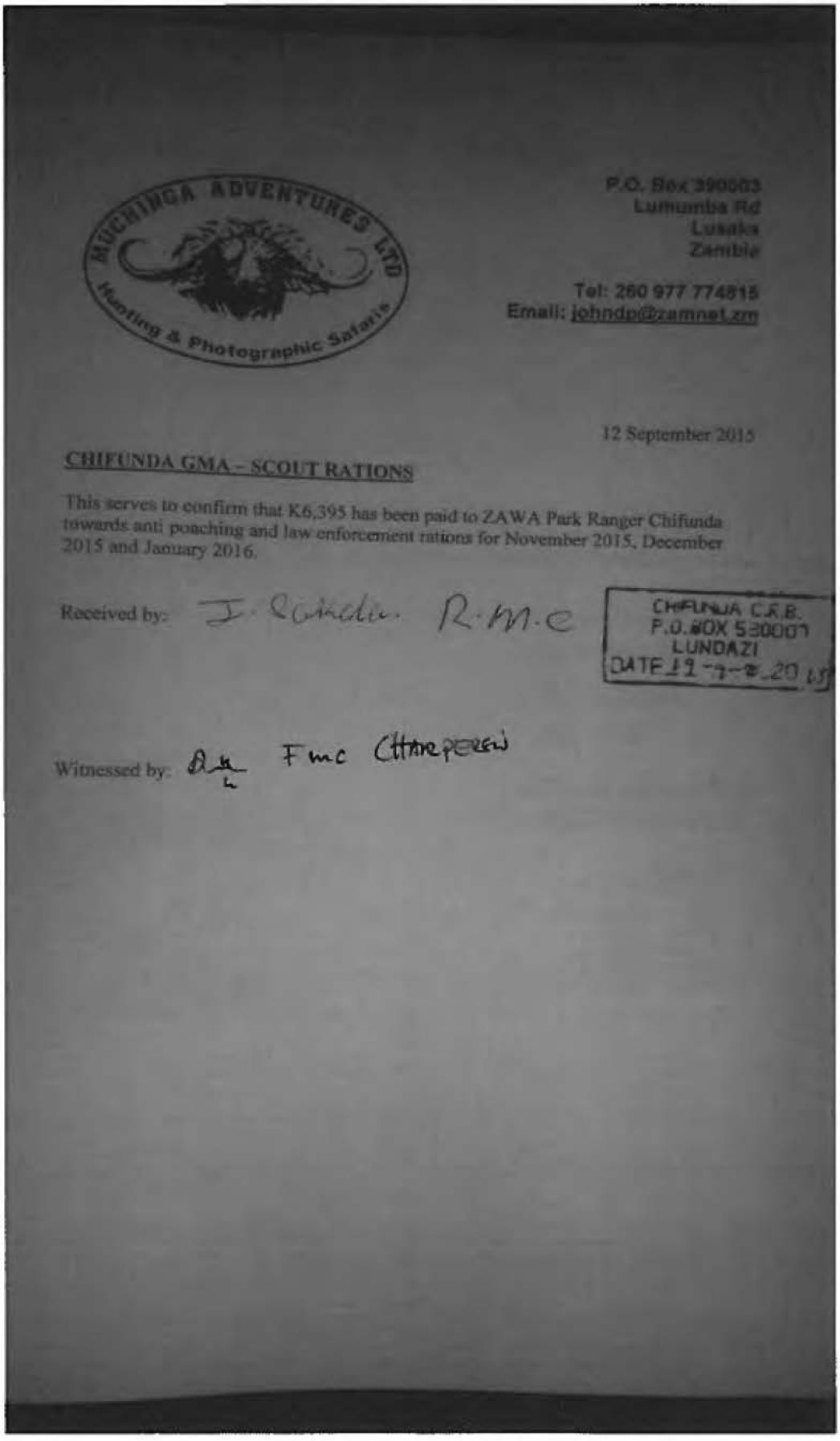
This serves to confirm that K27,702 (twenty seven thousand, seven hundred and two Kwacha) has been paid to the Park Ranger ZAWA for law enforcement through the rainy season till the end of May 2016. This is to be used for fuel, food rations, transport of poachers, extra patrols, educational anti poaching and conservation programs in the GMA or any manner that ZAWA sees as appropriate for law enforcement requirements in Chifunda GMA.

Received by: Banda Kenny — Chairman G

Witnessed by: J Sakala. RMC

CHIFUNDA G.M.A.
P.O.BOX 510001
LUNDAZI
DATE 30-09-2015

MUCHINGA ADVENTURES LTD
Hunting & Photographic Safaris



P.O. Box 390003
Lumumba Rd
Lusaka
Zambia

Tel: 260 977 774815
Email: johndp@zamnet.zm

12 September 2015

CHIFUNDA GMA – SCOUT RATIONS

This serves to confirm that K6,395 has been paid to ZAWA Park Ranger Chifunda towards anti poaching and law enforcement rations for November 2015, December 2015 and January 2016.

Received by: J. Sakala R.M.C

CHIFUNDA C.R.B.
P.O. BOX 530007
LUNDAZI
DATE 19-9-2015

Witnessed by: [signature] FMC CHAIRPERSON

Anti poaching and law enforcement

Muchenga Adventures support to ZAWA and law enforcement with the wildlife was given whole heartedly. All pledges in this regard were fulfilled. Problems such as roaring were reported. Roofs for the scout houses were given through the infrastructure development in the area, it was felt that this was a priority. As a company it is a pleasure to work with scouts who take their job seriously and are committed to the welfare of the wildlife, community and GMA. We look forward to continuing the support for anti poaching and wildlife law enforcement in 2016

Working with ZAWA and the community throughout the year was on going. Food rations were delivered at the start of the lease agreement then a monthly allowance of food and fuel worked out so that this complimented the work being done by Frankfurt Zoological Society in the North Luangwa National Park. These photos show the handed over of the funds for the off season patrols and food rations, meat being given to ZAWA and food rations donated to the scouts for anti poaching. Fuel was also given.







APPENDIX 6:

COMMUNITY MEETINGS CHIFUNDA GMA 2015



On being allocated Chifunda GMA Managing Director of Muchinga Adventures Ltd John du Plooy went to the hunting block and had a meeting with the community and Community Resource Board. This was to introduce himself and the company to the community and to address any concerns that the community may have. Issues such as camp building, labour, fishermen and meat distribution were discussed.

Throughout the season as John du Plooy was based in the GMA and as such there were meetings with HRH Chief Chifunda, the CRB and ZAWA Park Ranger as needed. Director Laura du Plooy was based in Lusaka but still travelled to Chifunda GMA meeting with HRH Chief Chifunda, the CRB Chairperson and the ZAWA Park Ranger.

At the end of September as many of the hunts for the season has been done John du Plooy meet with the Chifunda CRB to review the pledges, all monies paid and to confirm that 60% of the trophy value had been successful achieved.

It has been a positive working relationship and the hunting was very welcomed for bringing employment, meat, revenue, community and wildlife support.

P.O. Box [illegible]
[illegible]
Lusaka
Zambia

Tel: 260 977 774[illegible]
Email: [illegible]

ZAMBIA WILDLIFE AUTHORITY
DIRECTOR GENERAL'S OFFICE
PRIVATE BAG 1, CHILANGA

Director General
ZAWA
P/Bag 1
Chilanga

13 April 2011

Dear Sir

RE: CHIFUNDA GMA – MEETINGS WITH COMMUNITY & SCOUTS

Please be advised that on the 3rd April Managing Director John du Plooy and Professional Hunter Nicholas Wightman attended meetings in Chifunda GMA with His Royal Highness Chief Chifunda, the Community Resource Board, ZAWA Park Ranger, community members including Head Teachers, Village Headmen, Health Representatives, a local Court Judge and Area Councillor. A full CRB meeting was held and issues discussed covered:

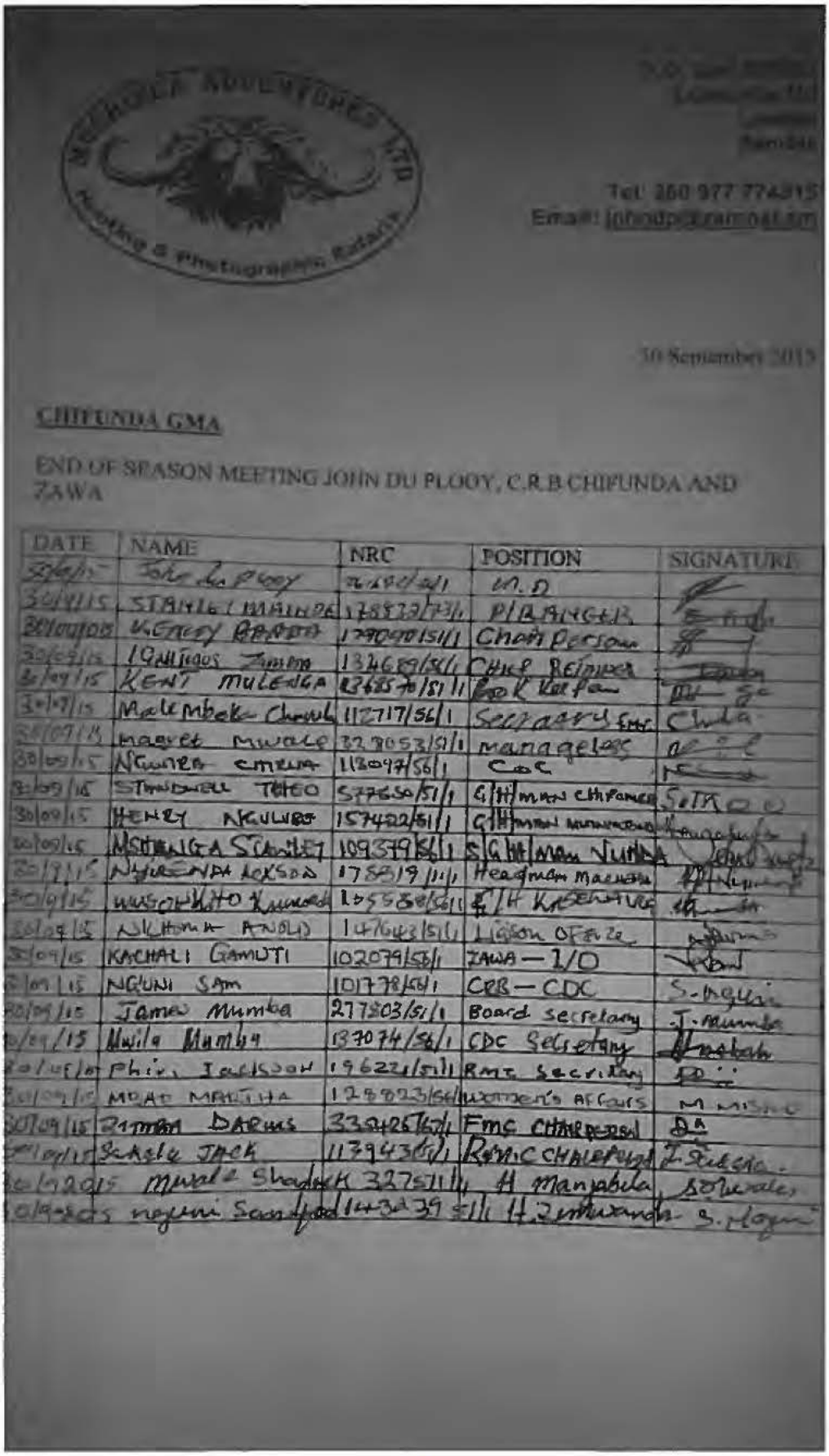
1. Introductions
2. The lease agreement
3. Pledges
4. 80% employment of community members
5. Camp building
6. Meat distribution
7. The working relationship between CRB, ZAWA and the company
8. Anti poaching
9. Community concerns

The Managing Director had further discussions with the ZAWA Park Ranger and senior scouts in the area. The anti poaching program already in place with the Frankfurt Zoological Society is very effective and as such Muchinga Adventures Ltd will enhance what is already in place and give support to the scouts as identified by themselves. This includes:

1. Food rations
2. Torch batteries
3. Chlorine
4. First aid kit
5. Diesel
6. Computer and printer
7. Measuring tapes
8. GPS sets to be with every Professional Hunter with a safari client for the scouts to use.
9. Uniforms

Further to this the Managing Director handed over anti poaching rations to the Chifunda GMA scouts that covered:

1. Mealie Meal
2. Sugar
3. Cooking oil



WILDHOLT ADVENTURES LTD
Hunting & photographic Safaris

Tel: 260 977 774315
Email: [redacted]

30 September 2015

CHIFUNDA GMA

END OF SEASON MEETING JOHN DU PLOOY, C.R.B CHIFUNDA AND ZAWA

DATE	NAME	NRC	POSITION	SIGNATURE
30/9/15	John du Plooy	216961/61/1	M.D	
30/9/15	STANLEY MAHINDA	178839/56/1	P/B RANGER	
30/09/15	VINCENT BANDA	179049/51/1	Chairperson	
30/09/15	IGNATIOS ZIMBA	134689/56/1	CHIEF REPRESENTATIVE	
30/09/15	KENT MULENGA	134570/51/1	Book Keeper	
30/09/15	Malembeka Chewe	112717/56/1	Secretary EMC	Chewe
30/09/15	Margret Mwale	329053/91/1	Manageress	
30/09/15	NGUNDA EMELIA	112097/56/1	CDC	
30/09/15	STANDWELL THEO	527650/51/1	GAME MAN CHIPANGA	
30/09/15	HENRY NGULUBE	157422/51/1	GAME MANAGER	
30/09/15	MSENGA STANLEY	109379/56/1	SGM Nunda	
30/9/15	NYIRENDA LOXSON	178519/11/1	Headman Mapanza	
30/9/15	MUSONDA ANNOD	165586/56/1	F/H KASEMPA WEST	
30/09/15	NKHOMA ARNOLD	147643/51/1	Liason Officer	
30/09/15	KACHALI GAMUTI	102079/56/1	ZAWA – I/O	
30/09/15	NGUNI SAM	101778/56/1	CRB – CDC	S. Nguni
30/09/15	James Mumba	277303/51/1	Board secretary	J. Mumba
30/09/15	Mwila Mumba	137074/56/1	CDC Secretary	
30/09/15	Phiri Jackson	196221/51/1	RMT Secretary	
30/09/15	MOAD MAKUNGA	128823/56/1	Women's Affairs	M Mishec
30/09/15	Zimba DARIUS	330426/61/1	EMC CHAIRPERSON	DA
30/09/15	Sakala JACK	117943/61/1	RMC CHAIRPERSON	J Sakala
30/9/2015	Mwale Shadrick	327511/1	H Manyabila	Mwale
30/9/2015	ngoma Sandford	143239/51/1	H Zimbwanda	S. Ngoma

APPENDIX 7

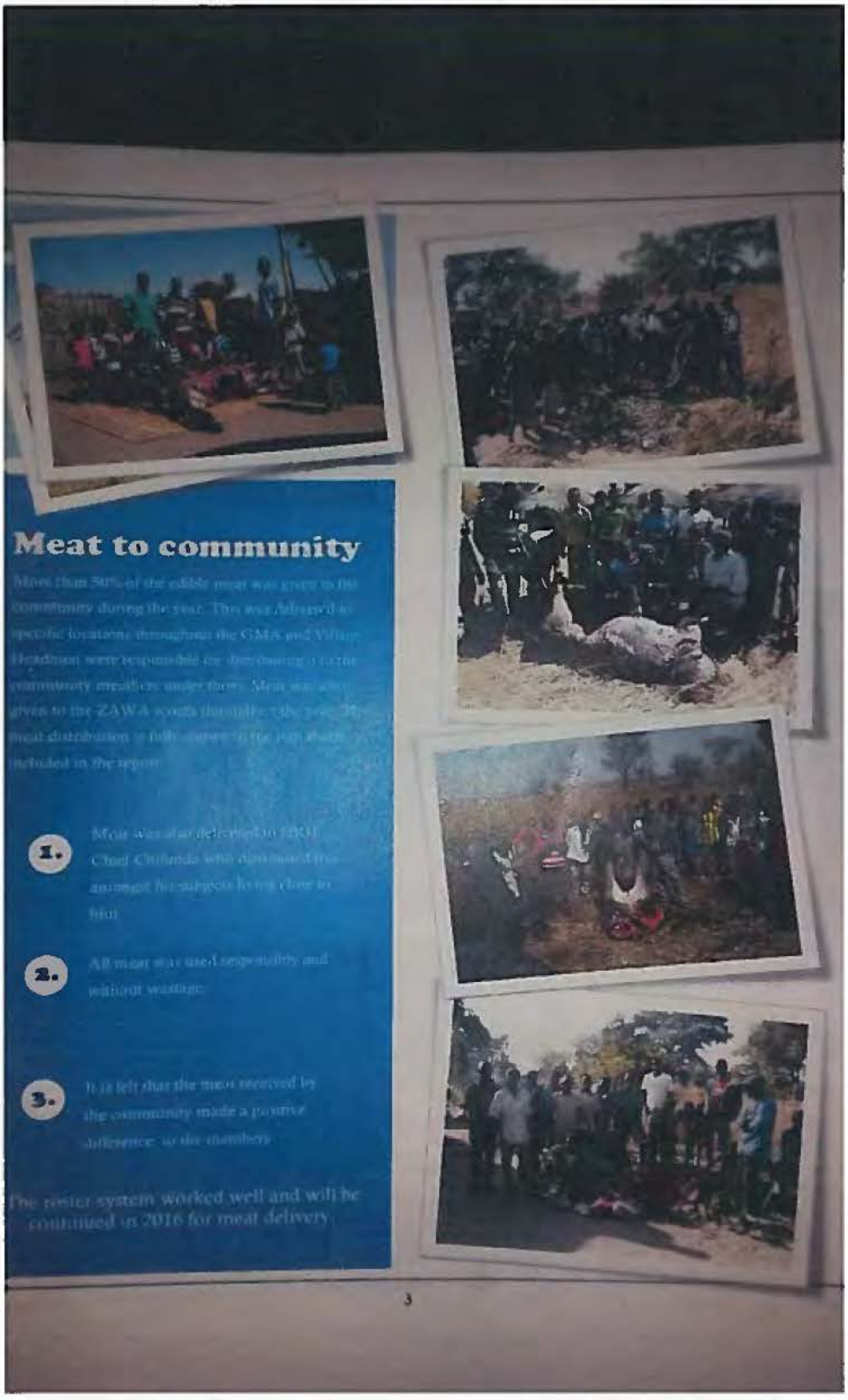
Lion and elephant: Policy adopted in March 2015

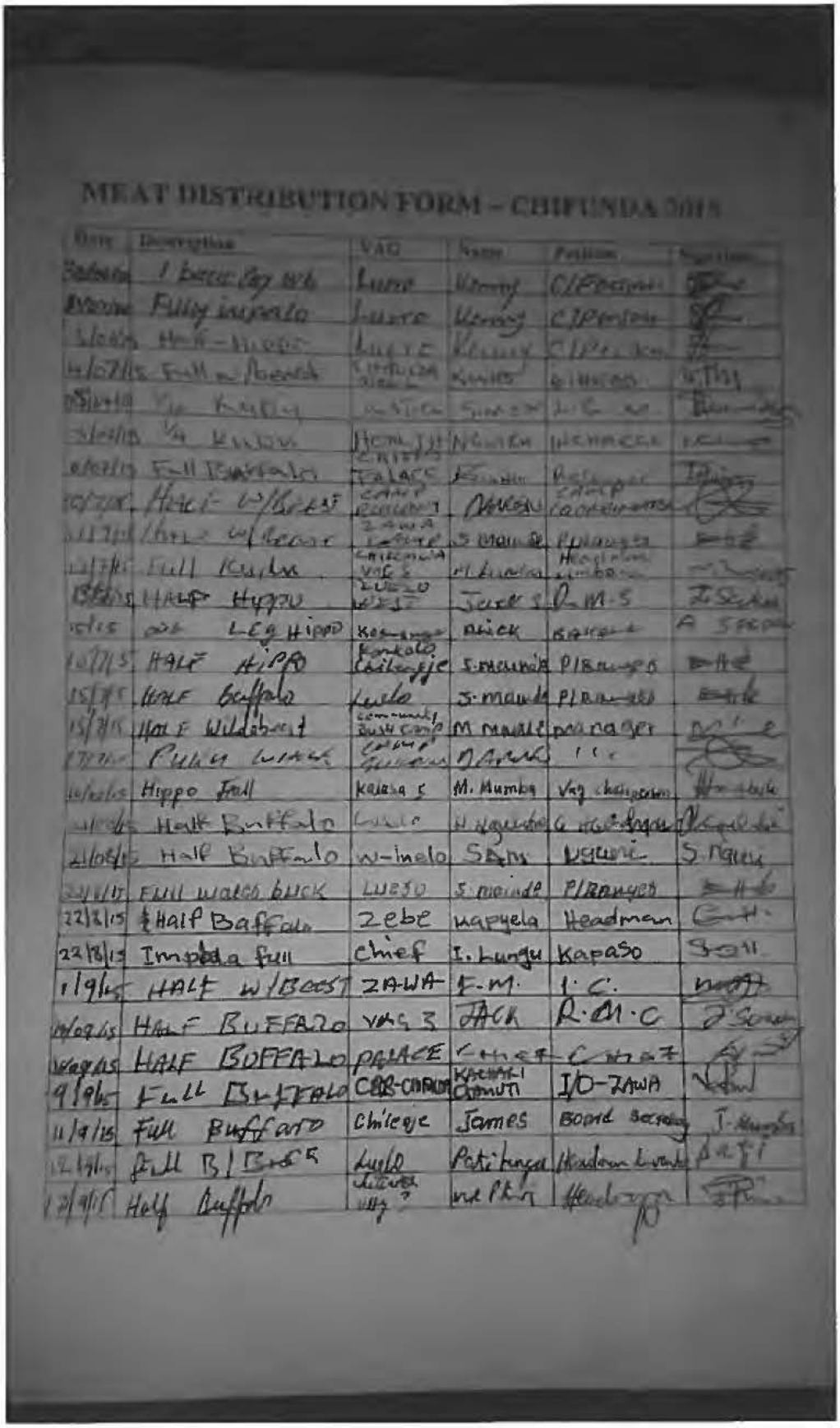
1. Elephant: Zambia has strict regulations regarding the weight of elephant harvested. The elephant must be a mature bull will tusks each weighing 15kg. Failure to adhere to these regulations may result in the trophy being seized, a fine and penalties to the company and professional hunter. No elephant that is considered to be under weight will be harvested and the hunter undertakes the safari in the knowledge that the elephant trophy may not be successfully harvested during the hunt. Ethical hunting practices and the laws of Zambia will be adhered to at all times. The professional hunter and game scout have the final say in the event of any discussions or disputes in the field. Meat from the elephant is donated to the community.

2. Muchinga Adventures Ltd has been a long-term participant of the lion aging study of Dr Paula White. By booking a safari with Muchinga Adventures the hunting client is accepting of the following terms and conditions:

1. Ethical hunting practices and the Zambian law and regulations will be adhered to at all times
2. The professional hunter and game scout have the final say in identifying that a lion trophy is an adult lion of six years or more in age
3. Lion under the age of 6 will not be harvested
4. Only a male lion will be hunted
5. No callers are used in the hunting of the lion
6. No lion in a pride will be harvested
7. A sample of skin and a tooth from the lion will be retained for evaluation purposes
8. Photos of the lion will be taken for evaluation purposes
9. The hunting client understands that they may return home without a lion trophy if one of six years or more is not found to harvest

APPENDIX 8:





MEAT DISTRIBUTION FORM – CHIFUNDA 2015

Date	Description	VAG	Name	Position	Signature
28/6/15	1 Large Cow M/B	Luwo	Wenny	CIP Chifunda	
29/6/15	Fully impala	Luwo	Wenny	CIP Chifunda	
30/6/15	Half - Buffalo	Luwo	Wenny	CIP Chifunda	
1/7/15	Full w/Bones	Kafulwa Village	Kenny	CIP Chifunda	
2/7/15	Full Kudu	Kafulwa Village	Kenny	CIP Chifunda	
3/7/15	1/4 Kudu	Nchelenge Central	Nelson	Nchelenge	
4/7/15	Full Buffalo	Palace	[illegible]	Nchelenge	
5/7/15	Half - W/Bones	Camp Kashiba Zawa	Nelson	Camp coordinator	
6/7/15	Half w/bones	Zawa Camp	S. Mainde	Ranger	
7/7/15	Full Kudu	Kafulwa Village	M. Kunda	Nchelenge	
8/7/15	HALF Hippo	Luwo West	Jere S.	R.M.S	
9/7/15	1/2 LEG Hippo	Kasanga	Mick	Kapaso	
10/7/15	HALF HIPPO	Kankolo Collage	S. Mwanza	P/Ranger	
15/7/15	Half Buffalo	Luwo	S. Mainde	P/Ranger	
15/7/15	Half Wildebeest	Community Bush Camp	M Mainde	P/Ranger	
17/7/15	Full Impala	Camp Kashiba	Nelson	I/C	
18/7/15	Hippo Full	Kasesa 5	M. Mumba	Veg chairperson	
19/7/15	Half Buffalo	Luwo	H Nguenda	C Member	
21/07/15	Half Buffalo	W-inalo	Sam	Village	S Ngulu
21/7/15	Full Waterbuck	Luwo	S. Mainde	P/Ranger	
22/7/15	½ Half Buffalo	Zebe	Mapyela	Headman	
22/7/15	Impala full	Chief	I. Lungu	Kapaso	
1/9/15	HALF W/BOOST	ZAWA	F.M.	I.C.	
1/9/15	Half BUFFALO	Vag 3	JACK	R.O.I.C	
1/9/15	HALF BUFFALO	PALACE	Chief	Chief	
9/9/15	Full Buffalo	CBR-CHIEF	Kashiba Community	I/C-ZAWA	
11/9/15	Full Buffalo	Chiefje	James	Board Secretary	
12/9/15	full Buffalo	Luwo	Patrick	Headman Luwo	
13/9/15	Half Buffalo	Luwo Village	[illegible]	Headman	

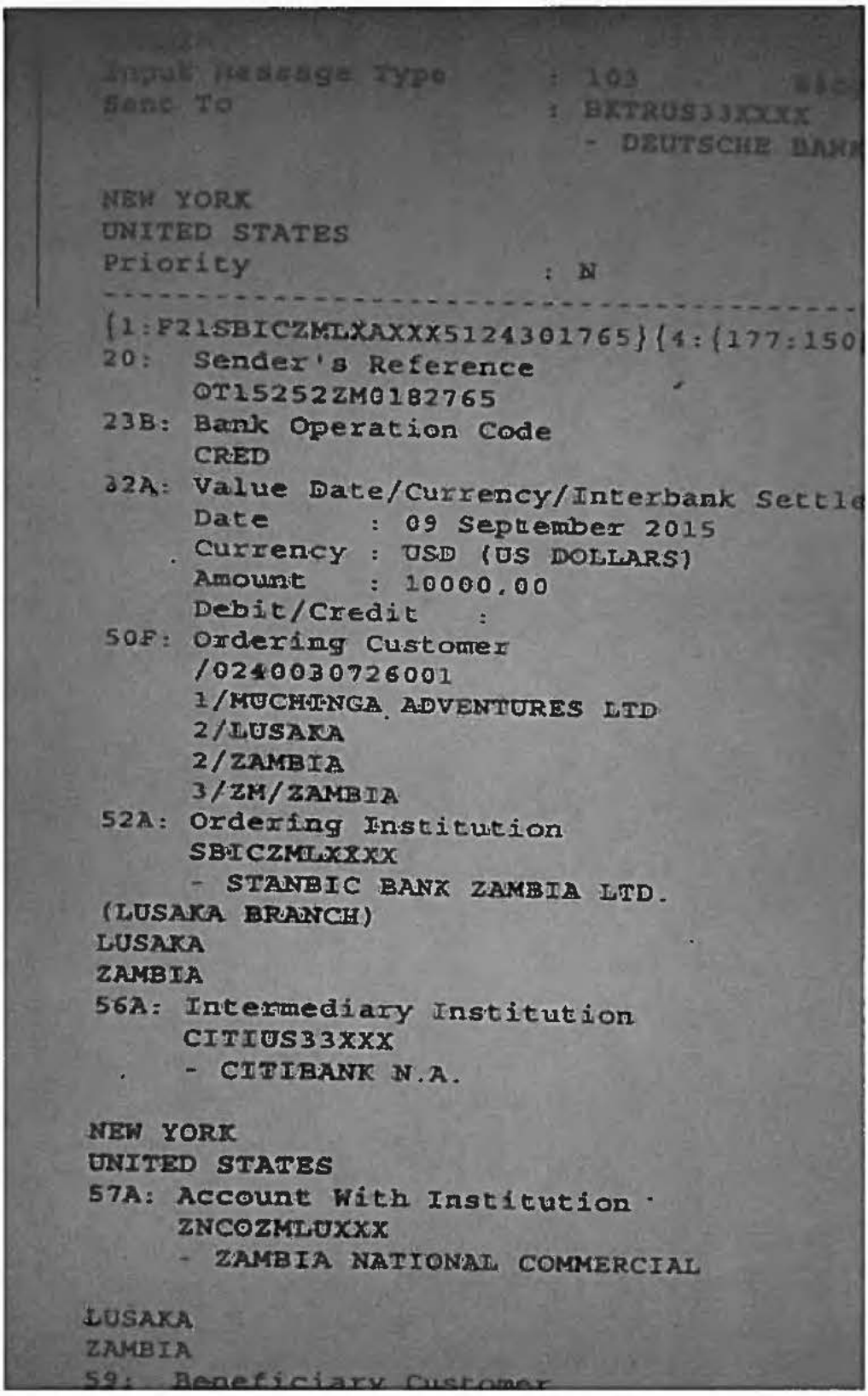
MEAT DISTRIBUTION FORM – CHIFUNDA 2015

Date	Description	VAG	Name	Position	Signature
19/9/15	Half Wildebeest	V Chiefs	[illegible]	V Chiefs	[illegible]
19/9/15	Full warthog	V Chiefs	[illegible]	V Chiefs	[illegible]
24/9/15	Half Hippo	Chifunda [illegible]	[illegible]	[illegible]	[illegible]
26/9/15	Full Buffalo	VAG 5	[illegible]	CDC	[illegible]
27/9/15	1/4 Log Buffalo	Chifunda School	Nyirenda Stephen	Head Teacher	[illegible]
27/9/15	1/4 Log Buffalo	Chifunda [illegible]	[illegible] Simon	Court Messenger	[illegible]
27/9/15	1/4 Log Buffalo	Agriculture	Lyweli Shumba	Agriculture	[illegible]
27/9/15	1/4 Log Buffalo	Chifunda	Mr-1 Nkhoma	CDE	[illegible]
28/9/15	Full Puku	Lielo Camp	Kachali Ganyati	ZAWA-I/O	[illegible]
28/9/15	Full Bush Buck	Chifunda [illegible]	[illegible]	[illegible]	[illegible]
28/9/15	1/4 Hippo	Vag 4	[illegible]	[illegible]	[illegible]
28/9/15	1/4 Hippo	Vag 7	Jacobo	RMC	[illegible]

MEAT DISTRIBUTION FORM – CHIFUNDA 2015

Date	Description	VAG	Name	Position	Signature
07/04/15	Two legs of Puku	Bibi Camp	John Banda	W.A.G	[illegible]
[illegible]	Full Buffalo	Zebe	[illegible]	R.M.C	[illegible]
[illegible]	Full Chicken of Puku	Zawa	[illegible]	[illegible]	[illegible]
[illegible]	Half Hippo	Vag one	J. [illegible]	Board Secretary	J. [illegible]
[illegible]	One back Leg Hippo	Fisherman	B. Sikala	Fisherman	[illegible]
08/08/15	Full Buffalo	Chinguzi	Zimmer [illegible]	FMC	[illegible]
20/09/15	Half Buffalo	CBC	Mugrit	Manager	[illegible]
21/09/15	Half Buffalo	Zebe	Leonard	Headman	[illegible]
22/09/15	Half Buffalo	Palace	Jacob	Chief	[illegible]
22/9/15	Whole Zebra	3	Sam	CDR	S. [illegible]
23/09/15	Full Buffalo	Palace	Fashion [illegible]	Chief Coleman Fokon	F [illegible]
23/09/15	Full Puku	Loeto Camp	G. Kachali	Zawa/ID	[illegible]
[illegible]	Half Impala	Lucas	S K Kakada		[illegible]
20/08/15	Half Buffalo	Zebe		Headman Zamwanda	[illegible]

APPENDIX 9:



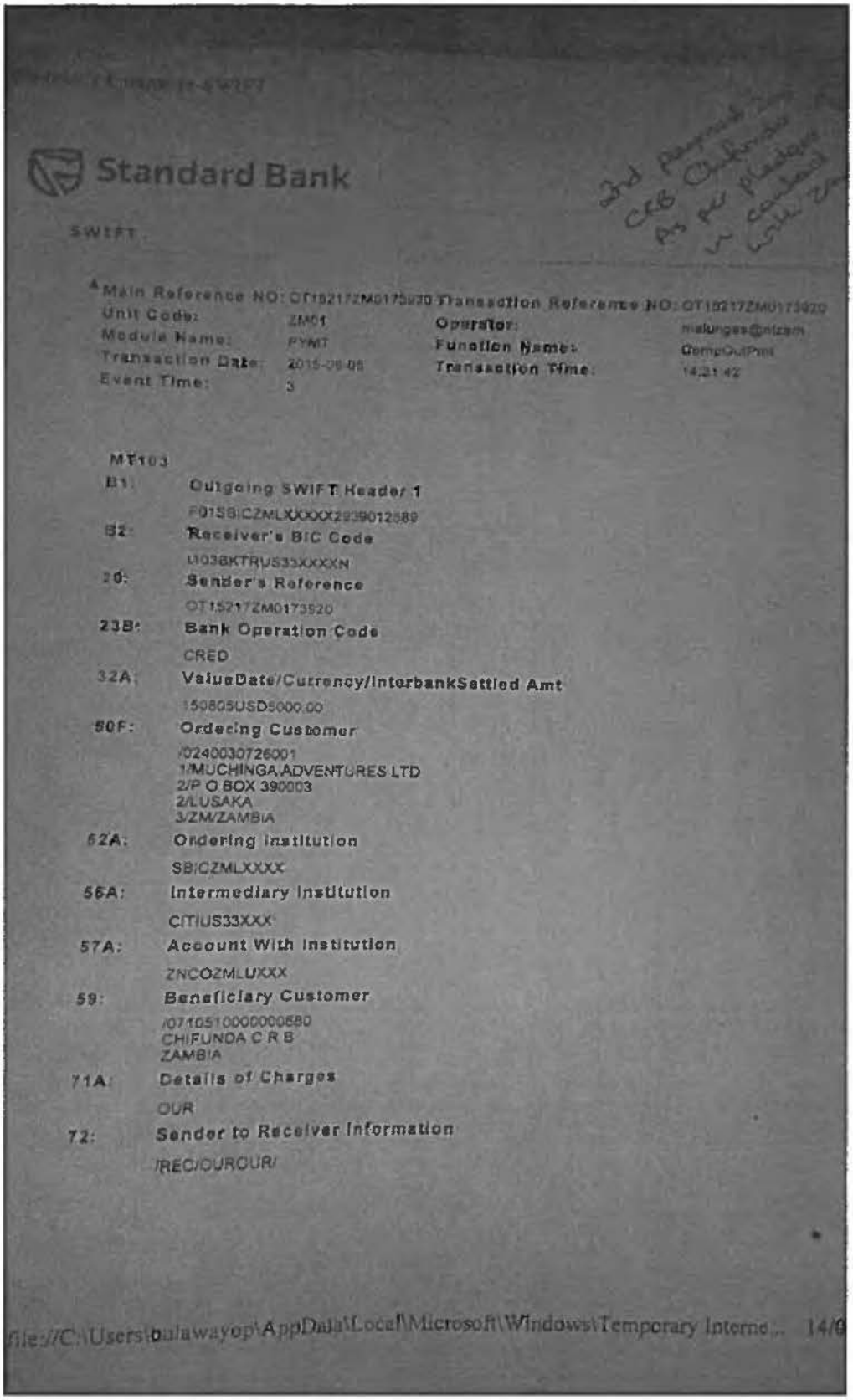
Input Message Type : 103
Sent To : BKTRUS33XXXX
- DEUTSCHE BANK

NEW YORK
UNITED STATES
Priority : N

{1:F21SBICZMLXAXXX5124301765}{4:{177:150
20: Sender's Reference
OT15252ZM0182765
23B: Bank Operation Code
CRED
32A: Value Date/Currency/Interbank Settle
Date : 09 September 2015
Currency : USD (US DOLLARS)
Amount : 10000,00
Debit/Credit :
50F: Ordering Customer
/0240030726001
1/MUCHINGA ADVENTURES LTD
2/LUSAKA
2/ZAMBIA
3/ZM/ZAMBIA
52A: Ordering Institution
SBICZMLXXXX
- STANBIC BANK ZAMBIA LTD.
(LUSAKA BRANCH)
LUSAKA
ZAMBIA
56A: Intermediary Institution
CITIUS33XXX
- CITIBANK N.A.

NEW YORK
UNITED STATES
57A: Account With Institution
ZNCOZMLUXXX
- ZAMBIA NATIONAL COMMERCIAL

LUSAKA
ZAMBIA
59: Beneficiary Customer



Standard Bank

SWIFT

2nd payment [illegible] CRB Chifunda As per pledge in contact with [illegible]

Main Reference NO: OT15217ZM0173920 Transaction Reference NO: OT15217ZM0173920

Unit Code:	ZM01	Operator:	malunges@ntzam
Module Name:	PYMT	Function Name:	CompOutPmt
Transaction Date:	2015-06-05	Transaction Time:	14:31:42
Event Time:	3		

MT103

B1: **Outgoing SWIFT Header 1**
F01SBICZMLXXXXX2939012589

B2: **Receiver's BIC Code**
I103BKTRUS33XXXXN

20: **Sender's Reference**
OT15217ZM0173920

23B: **Bank Operation Code**
CRED

32A: **ValueDate/Currency/InterbankSettled Amt**
150805USD5000.00

50F: **Ordering Customer**
/0240030726001
1/MUCHINGA ADVENTURES LTD
2/P O BOX 390003
2/LUSAKA
3/ZM/ZAMBIA

52A: **Ordering Institution**
SBICZMLXXXX

56A: **Intermediary Institution**
CITIUS33XXX

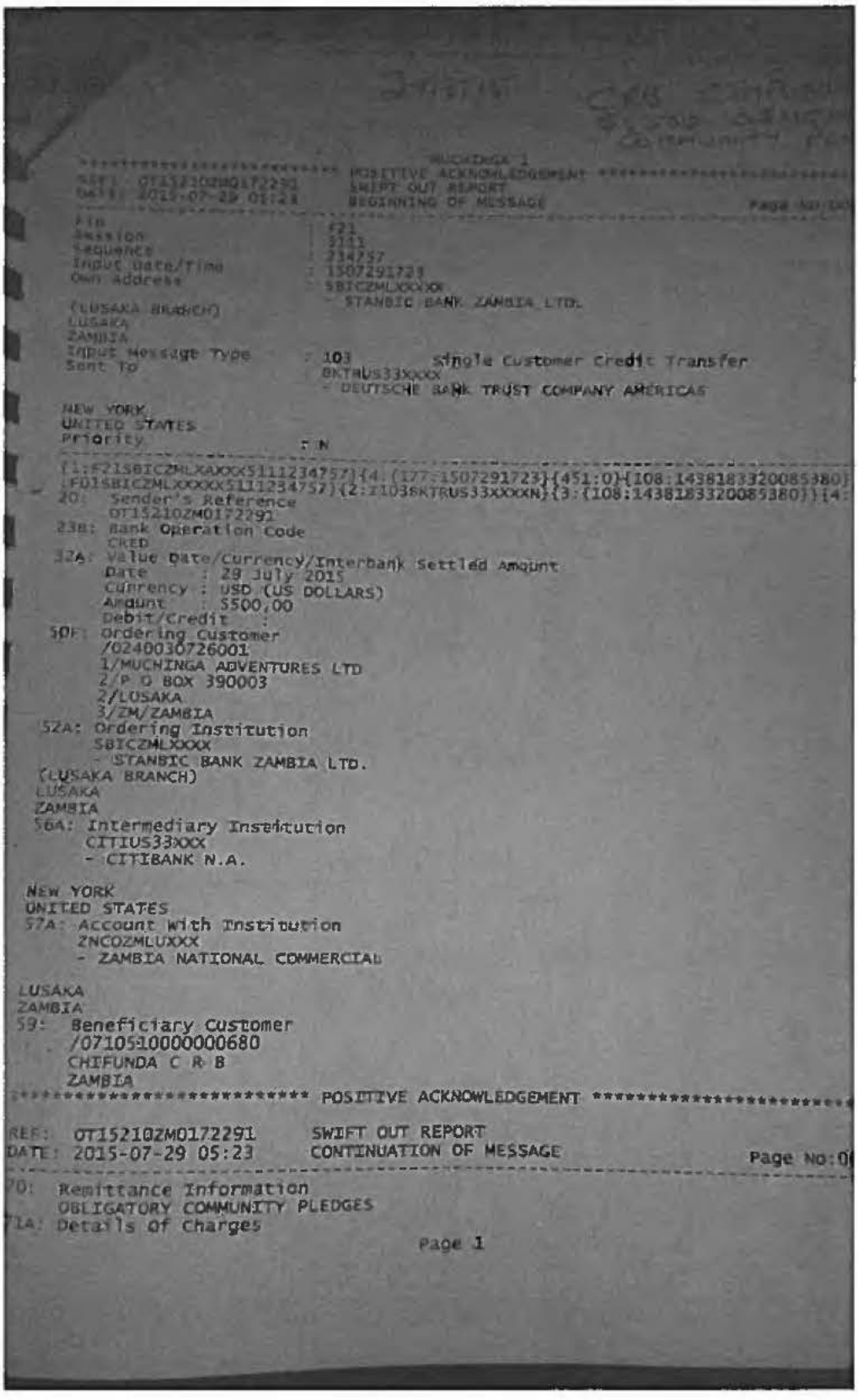
57A: **Account With Institution**
ZNCOZMLUXXX

59: **Beneficiary Customer**
/0710510000000680
CHIFUNDA C R B
ZAMBIA

71A: **Details of Charges**
OUR

72: **Sender to Receiver Information**
/REC/OUROUR/

file://C:\Users\bulawayop\AppData\Local\Microsoft\Windows\Temporary Interne... 14/0



MUCHINGA 1
********** POSITIVE ACKNOWLEDGEMENT **********
REF: OT152102M0172291 SWIFT OUT REPORT
DATE: 2015-07-29 01:23 BEGINNING OF MESSAGE Page No:1

File : F21
Session : 5111
Sequence : 234757
Input Date/Time : 1507291723
Own Address : SBICZMLXXXXX
- STANBIC BANK ZAMBIA LTD.
(LUSAKA BRANCH)
LUSAKA
ZAMBIA
Input Message Type : 103 Single Customer Credit Transfer
Sent To : BKTRUS33XXXX
- DEUTSCHE BANK TRUST COMPANY AMERICAS
NEW YORK
UNITED STATES
Priority : N

{1:F21SBICZMLXAXXX5111234757}{4:{177:1507291723}{451:0}{108:1438183320085380}
:F01SBICZMLXXXXX5111234757}{2:I103BKTRUS33XXXXN}{3:{108:1438183320085380}}{4:
20: Sender's Reference
OT152102M0172291
23B: Bank Operation Code
CRED
32A: Value Date/Currency/Interbank Settled Amount
Date : 29 July 2015
Currency : USD (US DOLLARS)
Amount : 5500,00
Debit/Credit :
50F: Ordering Customer
/0240030726001
1/MUCHINGA ADVENTURES LTD
2/P O BOX 390003
2/LUSAKA
3/ZM/ZAMBIA
52A: Ordering Institution
SBICZMLXXXX
- STANBIC BANK ZAMBIA LTD.
(LUSAKA BRANCH)
LUSAKA
ZAMBIA
56A: Intermediary Institution
CITIUS33XXX
- CITIBANK N.A.

NEW YORK
UNITED STATES
57A: Account With Institution
ZNCOZMLUXXX
- ZAMBIA NATIONAL COMMERCIAL

LUSAKA
ZAMBIA
59: Beneficiary Customer
/0710510000000680
CHIFUNDA C R B
ZAMBIA
********** POSITIVE ACKNOWLEDGEMENT **********

REF: OT152102M0172291 SWIFT OUT REPORT
DATE: 2015-07-29 05:23 CONTINUATION OF MESSAGE Page No:0

70: Remittance Information
OBLIGATORY COMMUNITY PLEDGES
71A: Details of Charges

Page 1

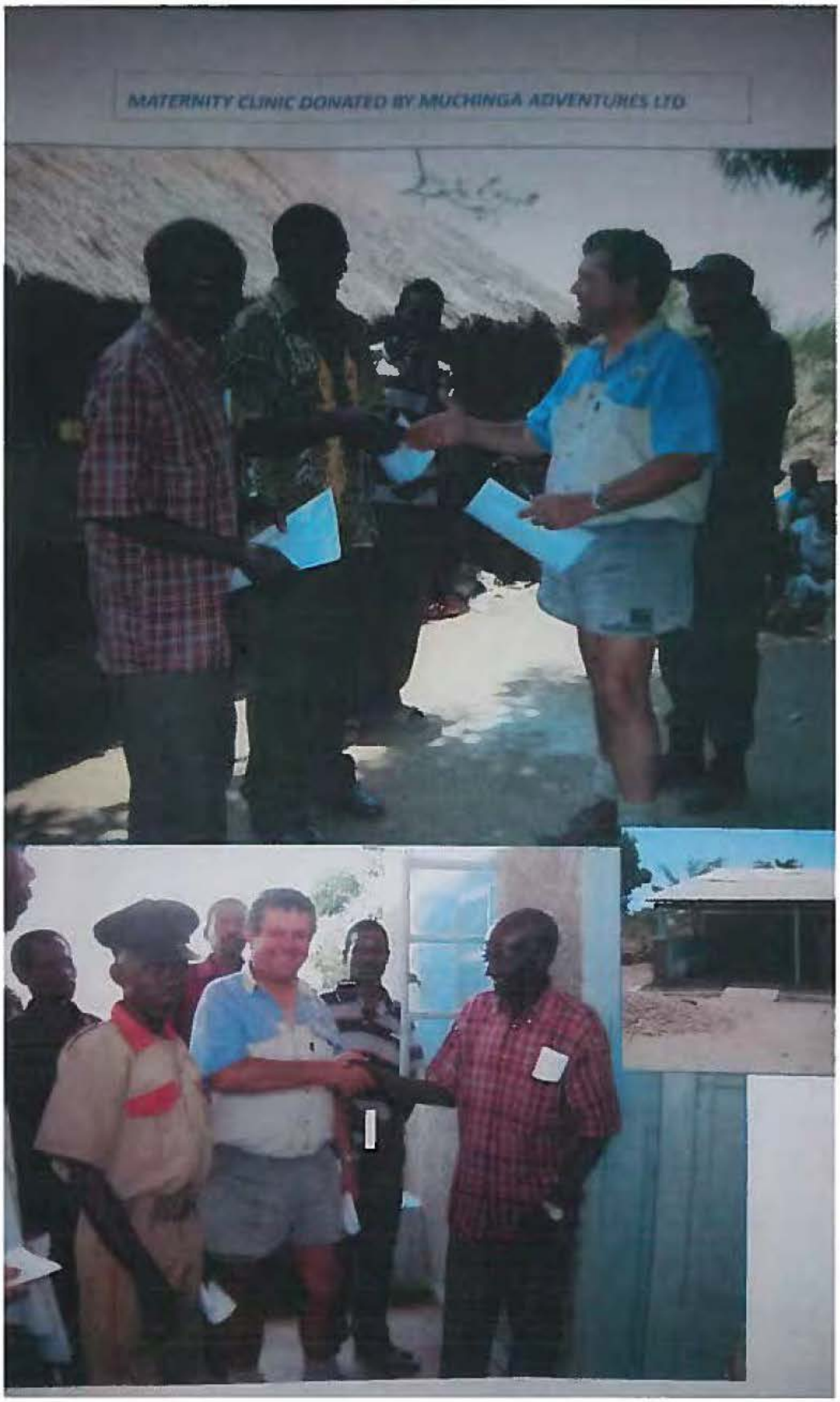
PAST EXPERIENCE IN COMMUNITY & ANTI POACHING BY MUCHINGA ADVENTURES LTD



Above is one of four vehicles donated to the community.



Shown above is Managing Director John du Plooy donating bicycles, tractor oil, tractor spares and anti poaching rations to the community. John is committed to working on the ground with communities to see future


MATERNITY CLINIC DONATED BY MUCHINGA ADVENTURES LTD

ANTI POACHING BY MUCHINGA ADVENTURES





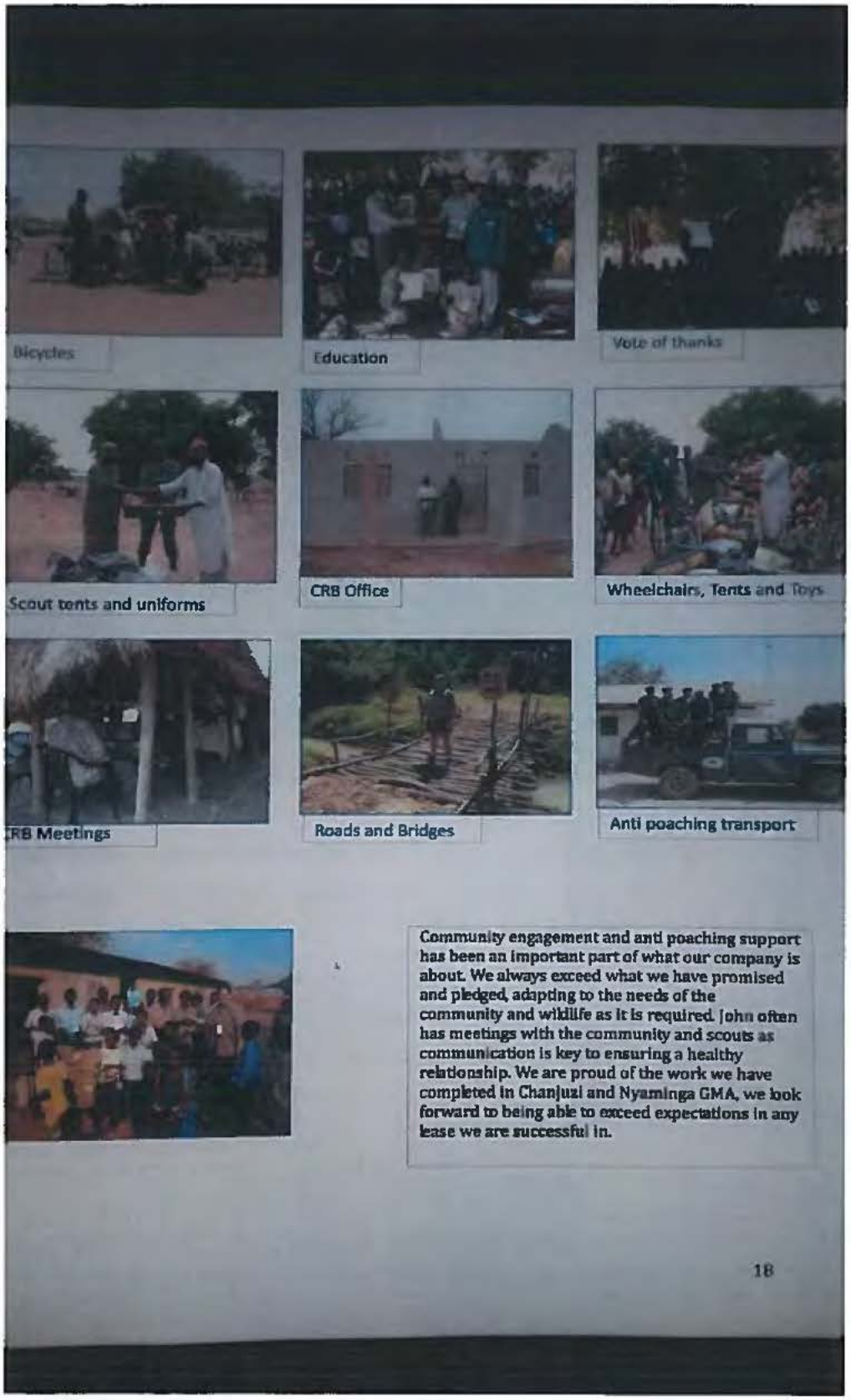




Shown are confiscated weapons, anti poaching rations and the donated vehicle given for patrols



15


Bicycles
Education
Vote of thanks
Scout tents and uniforms
CRB Office
Wheelchairs, Tents and Toys
CRB Meetings
Roads and Bridges
Anti poaching transport
Community engagement and anti poaching support has been an important part of what our company is about. We always exceed what we have promised and pledged, adapting to the needs of the community and wildlife as it is required. John often has meetings with the community and scouts as communication is key to ensuring a healthy relationship. We are proud of the work we have completed in Chanjuzi and Nyaminga GMA, we look forward to being able to exceed expectations in any lease we are successful in.
18



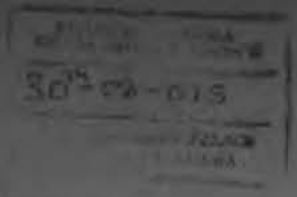
The Managing Director is a hands on person who likes to give back.



Shown here are one of the meetings with the CRB.

Road development and infrastructure is done annually.

Commitment has been given to:
Community welfare – done annually
Wildlife resources – monitoring & measuring
Rehabilitation and improvement – including water holes
Anti poaching – through equipment, money & food rations
Education – books, desks and material items
Health – maternity clinic, improving existing clinics
Building of 23 scouts houses
CRB Transport
Skills and development training
Employment from within the community
Training of community member to be a Professional Hunter



His Excellency President
Edgar C. Lungu
State House

Your Excellency.

My Subject and I, would like to Express our humble gratitude to you and the Honaurable Minister of Arts and Tourism in Proceding with tender and allocating of our hunting block. We are aconstitue ncy of five thousand Subject.

When hunting was closed we Suffered.

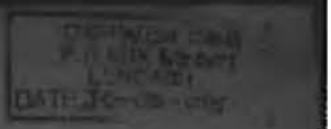
① Money was difficult ~~to pay~~ for the community Pledges. ② People in the community did not eat meat. ③ ~~with Poaching~~, Infrynstructure, fire management, resource monitoring and development inthe area was not going.

The Leopard and lion hunting will greatly enhance the livelihood and welfare of my People I thank you for announcing the opening of the cats.

This extra Income and employment will go along way to alleviating Poverty and uplifting the lives of my People.

Sincerely,

HRH Chief Chitimba



TO THE MINISTRY OF ARTS AND
TOURISM.
LUSAKA.
Zambia

Dear Sir/madam.

RE: THANKING FOR MINISTER OF ARTS AND TOURISM IN PROCEDING WITH TENDER AND ALLOCATING OF OUR HUNTING BLOCK. IN CHIE CHIFUNDA'S CHIEFDOM.

With above metioned reference the ministry has done very wel. In our Chiefdom due to these things ① Muchinga Safari is now paying the Community Pledges. ② 80 Percent of workers are coming from our Community ③ People in the community are given meat ④ anti Poaching fire management, resource monitoring is given by Muchinga Safari in our area. We also thank to the director of Muchinga Safari and his P.H. for good Co-oparation with the Chief, Zam Cr.b and the Community. through the minis of tourism for allowing the hunting Safari.

Yours truly Kenny Banda
CRB CHAIRPERSON

Gmail

Regina Lennox <regina.lennox.cf@gmail.com>

Enhancement information for African lion and elephant

Regina A. Lennox <regina.lennox@conservationforce.org> Wed, Feb 24, 2016 at 10:28 AM

To: "Vannorman, Tim" <tim_vannorman@fws.gov>
Cc: Rosemarie Gnam <rosemarie_gnam@fws.gov>, bryan_arroyo@fws.gov, "John J. Jackson, III" <jjw-no2@att.net>
Bcc: John Jackson <jjjiii@att.net>

Dear Tim,

In the email below, please find links to four recent videos documenting the benefits of conservation hunting in Tanzania, Zambia, and Zimbabwe. These videos include interviews with government officials, anti-poaching scouts, safari operators, landowners, and others. They demonstrate the enhancement generated by lion hunting: it protects the most habitat, provides the backbone for anti-poaching, and incentivizes community participation in wildlife conservation. Without hunting, these benefits would be lost, and the wildlife would be lost. As Tanzania's former Minister of Natural Resources and Tourism put it in the video titled "Custodians of Wilderness": "So for those who are anti-hunting and would like to see hunting closed: if hunting is completely gone, you're gonna kill Selous, you're gonna kill all the 28 game reserves in this country for sure, and all the wildlife coming out of the protected areas into the open areas for example will be gone."

Please consider this information in evaluating whether to issue import permits for hunting trophies of African lion and elephant, including but not limited to elephant trophies from Tanzania and Zimbabwe and lion trophies from Tanzania, Zambia, and Zimbabwe (including but not limited to the applications already submitted by Conservation Force, such as the applications submitted on January 26, 2016, which include MA86474B-0 and MA86472B-0, and MA88388B).

There are many important points in these videos which document and demonstrate enhancement. A few examples are included here, but the videos should be considered on the whole.

First, in the video "Custodians of Wilderness," safari operators discuss and demonstrate their community development programs. Among other things, Derrick Hurt of Robin Hurt Safaris/Robin Hurt Wildlife Foundation points out that over $100,000 in community assistance was spent in one schoolyard in one village – all proceeds from hunting, and the Hurt Foundation makes clear to the community these benefits come directly from the protection of wildlife.

Another representative from the Hurt Foundation points out that there are around 50 hunting companies in Tanzania with 3 to 4 blocks each, meaning there are approximately 200 vehicles patrolling hunting areas every day, adding an incredible amount of anti-poaching value to protect the lion's prey base. This Tanzania video is available at: http://theconservationimperative.com/.

Second, in the video "The Fate of the African Lion: Tanzania," a representative of the Friedkin Conservation Fund points out there is a lot of pressure on the boundaries of hunting areas in Tanzania because of the extensive population growth and human, livestock, and agricultural encroachment. The hunting areas are buffer zones for the national parks and the private sector bears the cost of opposing the encroachment pressure. But if the hunting areas disappeared, the pressure would be on the national parks directly. In his words: "What is interesting in Tanzania is that when the hunting concessions were designated as such, a lot of them were designated around the national parks. And this forms a buffer zone around the national park. If these [hunting]

areas become degazetted or lose viability ... the human pressures that are occurring on those hunting concessions can be directly transferred onto the national parks. And we're talking national treasures ... This happened in Kenya..."

Put differently, hunting areas play a key role in maintaining the viability of national parks, and thus serve to expand and better protect habitat and prey base and keep human-wildlife conflicts out of the treasured national parks. This Tanzania video is available at: http://theconservationimperative.com/?p=124.

Third, the video "The Fate of the African Lion: Zambia" focuses on several hunting concessions in Game Management Areas in Zambia. It interviews a former poacher turned anti-poaching officer who talks about the communities around the Game Management Areas benefiting from the sustainable use of lion and turning away from poaching. This Zambia video is available at: http://theconservationimperative.com/?p=118.

Last but not least, the video "The Fate of the African Lion: Bubye Valley Conservancy" describes the history and conservation of the conservancy and current challenges it faces, including an overpopulation of lion. The video shows how the revenue generated by lion hunting pays for extensive anti-poaching to protect the prey base and important populations of black and white rhino (among other species; put differently, the hunting of one species pays for the protection of many). Bubye Valley Conservancy derives its income from hunting, and hunting has proven to be the most viable use for the area, which is proven because ranching and other uses were tried. As Bubye Valley's anti-poaching manager notes: "Having this large unit of land set aside for wildlife has meant that endangered species like black and white rhinoceros thrive here. We've got important populations of cheetah, wild dog as well, brown hyena, pangolins ... So under the umbrella of hunting, this whole habitat is benefiting a whole variety of other species that are not consumptively hunted but they're benefiting from this wildlife area. Without hunting, we would be very hard put to justify keeping this big expensive land in its current land use."

The video also evidences the community assistance program of Bubye Valley Conservancy, which includes among other things, a clinic, a water supply for a school, and a meat donation system that gives local chiefs the choice about how to use the meat (i.e., whether to eat or sell it). The game meat donation program is a "direct spinoff" of the hunting, and builds a strong relationship with the chiefs. Poachers from these communities are taken to the chiefs' courts and prosecuted there, and "asked to compensate for the value of the animals killed and the compensation goes back to the community kitty." This is a powerful community engagement system that benefits the wildlife directly.

The video emphasizes that Bubye's lion population has to be managed (because the conservancy is fenced and the lion will over-eat the plains game). The options are hunting or culling, but hunting offers a better value generation. As the video concludes: "Bubye Valley Conservancy is one of the most ambitious, self-sustaining private sector initiatives for wildlife conservation in Africa today. It is not reliant on donor or government handouts for its existence. It is an extremely efficient game sanctuary with a comprehensive management plan which includes detailed research projects. It also provides a land use model not only for Zimbabwe, but the whole of Africa and beyond. But, it is reliant on sport-hunting for its survival." This Zimbabwe video is available at: http://theconservationimperative.com/?p=112.

Please let us know if you have any questions about these videos.

Kind regards,

Regina

--

Regina A. Lennox
Conservation Force
3240 S I-10 Service Road W, Suite 200

Metairie, Louisiana 70001 USA
504-837-1233 (office)
919-452-8652 (cell)
regina.lennox@conservationforce.org

AUGUST 5, 2015 (HTTP://THECONSERVATIONIMPERATIVE.COM/?P=118)

The Fate of the African Lion: Zambia. (http://theconservationimperative.com/?p=118)

ZIG MACKINTOSH (HTTP://THECONSERVATIONIMPERATIVE.COM/?AUTHOR=1)

AFRICAN WILDLIFE CONSERVATION (HTTP://THECONSERVATIONIMPERATIVE.COM/?CAT=7)

My Page (http://www.facebook.com/theconservationimperative)
Like 116 Share

Zambia has one of the most diverse wildlife populations in the world thanks to the wide variety of habitats. Although there are no mountainous regions, there are lakes, swamps, vast flood plains, large permanent rivers, high rainfall plateaus, vast miombo woodlands, Kalahari sand and expansive grasslands which attract nearly three hundred different mammals and seven hundred and fifty bird species.

Zambia's Protected Areas cover over 77,000 square miles or 30% of the country's total landmass in the form of 19 National Parks and 36 Game Management Areas.

The Game Management Areas or GMAs, are tourist hunting concessions that were opened up in a number of tribal lands in the 1970's. This created a revenue stream as well as a supply of meat for the local communities. The establishment of GMAs created buffer zones between the various National Parks and rural communities.

Game Management Areas are classed as Prime, Secondary and Depleted according to game variety and density and the position of the area relative to the National Parks.

GMA's are leased to Zambian-registered safari hunting operators for a period of 10 years. These operators are responsible for both managing the GMA's and protecting the interests of the resident

communities.

This 18-minute movie looks at an interesting experiment in wildlife conservation with a safari operator and the Kaindu community.



MENU

()

PERMALINK (http://theconservationimperative.com/?p=118)

SHARE ()

(HTTP://THECONSERVATIONIMPERATIVE.COM /?P=128)

(http://theconservationimperative.com/)

(HTTP://THECONSERVATIONIMPERATIVE.COM /?P=112)

ALL RIGHTS RESERVED © 2015

(http:// fac /the https



The New York Times | http://nyti.ms/1Np431H

AFRICA

A Hunting Ban Saps a Village's Livelihood

By NORIMITSU ONISHI SEPT. 12, 2015

SANKUYO, Botswana — Lions have been coming out of the surrounding bush, prowling around homes and a small health clinic, to snatch goats and donkeys from the heart of this village on the edge of one of Africa's great inland deltas. Elephants, too, are becoming frequent, unwelcome visitors, gobbling up the beans, maize and watermelons that took farmers months to grow.

Since Botswana banned trophy hunting two years ago, remote communities like Sankuyo have been at the mercy of growing numbers of wild animals that are hurting livelihoods and driving terrified villagers into their homes at dusk.

The hunting ban has also meant a precipitous drop in income. Over the years, villagers had used money from trophy hunters, mostly Americans, to install toilets and water pipes, build houses for the poorest, and give scholarships to the young and pensions to the old.

Calls to curb trophy hunting across Africa have risen since a lion in Zimbabwe, named Cecil by researchers tracking it, was killed in July by an American dentist. Several airlines have stopped transporting trophies from hunts, and lawmakers in New Jersey have introduced legislation that would further restrict their import into the United States.

But in Sankuyo and other rural communities living near the wild animals, many are calling for a return to hunting. African governments have also condemned, some with increasing anger, Western moves to ban trophy hunting.

"Before, when there was hunting, we wanted to protect those animals because we knew we earned something out of them," said Jimmy Baitsholedi Ntema, a villager in his 60s. "Now we don't benefit at all from the animals. The elephants and buffaloes leave after destroying our plowing fields during the day. Then, at night, the lions come into our kraals."

In early 2014, this sparsely populated nation became one of a few African countries with abundant wildlife to put an end to trophy hunting, the practice at the core of conservation efforts in southern Africa. President Seretse Khama Ian Khama of Botswana, a staunch defender of animal rights, stated that hunting was no longer compatible with wildlife conservation and urged communities like Sankuyo to switch to photographic tourism. The decision was cheered by animal welfare groups in the West.

But Botswana is an outlier. Government officials and conservationists in most African countries staunchly support trophy hunting, including Zambia, which is going back to hunting after a short-lived suspension.

"Zambia has always hunted from time immemorial," Jean Kapata, Zambia's minister of tourism, said in a phone interview. "Zambia is a sovereign nation, and therefore people should respect the rules we have in our country."

Zambia recently lifted a two-year-old ban on hunting leopards, and lion hunting is likely to resume next year. In 2013, Zambia curbed trophy hunting and imposed a blanket ban on hunting the big cats, also in an effort to replace trophy hunting with photographic tourism.

But that brought little income compared to hunting, Ms. Kapata said, while lions increasingly stalked villages for livestock. During the hunting ban, a local councilor was killed by a lion, she said.

"We had a lot of complaints from local communities," Ms. Kapata said. "In Africa, a human being is more important than an animal. I don't know about the Western world," she added, echoing a complaint in affected parts of Africa that the West seemed more concerned with the welfare of a lion in Zimbabwe than of Africans themselves.

Zambia's quick reversal points to the central role that trophy hunting has played in managing wildlife in southern Africa, where the industry's emergence in the 1960s helped restore degraded habitats and revive certain species.

In South Africa, the biggest market, hunting occurs on private game ranches. But in the rest of the region, it takes place mostly on communal lands where villages like Sankuyo are supposed to receive a cut of the fees paid by trophy hunters.

Sankuyo, a village of around 700 people, sits just east of the Okavango Delta in northern Botswana, which has one of the richest concentrations of wildlife in Africa. In 1996, Sankuyo signed on to a community-based natural resources program that focused on hunting and was supported by the United States government.

In 2010, Sankuyo earned nearly $600,000 from the 120 animals — including 22 elephants, 55 impalas and nine buffaloes — that it was allowed to offer to trophy hunters that year, said Brian Child, an associate professor at the University of Florida, who is leading a study on the impact of the ban. Botswana's wildlife officials, who set the annual quotas, last allowed a lion to be hunted in Sankuyo in 2006.

Among the benefits to the community, 20 households chosen by lottery received outdoor toilets, all painted in pastel colors that stand out in a village turned brown in the dry season. Standpipes were installed in courtyards, connecting 40 families to running water.

"That's what made people appreciate conservation," said Gokgathang Timex Moalosi, 55, Sankuyo's chief. "We told them, 'That lion or elephant has paid for your toilet or your standpipe.' "

Where trophy hunting benefits communities, locals are more motivated to protect wild animals as a source of revenue, experts say. But in most places without

trophy hunting, they are simply considered a nuisance or danger, and locals are more likely to hunt them for food or to kill them to defend their homes and crops.

Dr. Child, an expert on wildlife management in Africa, said trophy hunting had failed to benefit many communities because of mismanagement and corruption. But in the countries where trophy hunting had worked well — Botswana, until the ban; Namibia; and Zimbabwe, until its economy collapsed in the past decade — it had accomplished the twin goals of generating income and protecting wild animals.

"When hunting was introduced, we actually ended up killing less animals," Dr. Child said. "That's the irony."

With hunting now banned, there are growing signs that more wild animals could be killed, experts say. Lions, which used to feast on the meat of elephants left behind by hunters, are increasingly entering villages looking for livestock. In the past two years here in Sankuyo, villagers have killed two lions that wandered into residential areas.

Botswana's swelling population of elephants, accounting for a third of the total in Africa, is clashing increasingly with a growing human population. Poaching rings trafficking in ivory to East Asia have targeted elephants elsewhere on the continent. According to the International Union for Conservation of Nature's Red List of Threatened Species, African elephants are classified as "vulnerable," below "endangered" and "critically endangered," and their population is increasing.

"We're experiencing an exponential increase in conflicts between animals and human beings," said Israel Khura Nato, the head of the Botswana Department of Wildlife's problem animal control unit in Maun, a town two hours from here.

According to the department, such conflicts recorded nationwide rose to 6,770 in 2014 from 4,361 in 2012. Poaching incidents increased to 323 in 2014 from 309 in 2012.

More poisoned vultures have been found in this area, possibly killed by poachers seeking to conceal their hunts, said Lucas Rutina, an ecologist at the University of Botswana's Okavango Research Institute near Maun. Residents of

communities that used to derive an income from trophy hunting no longer attend conservation workshops at the institute, he said.

"Now they are going back to hating animals," Dr. Rutina said.

Galeyo Kobamelo, 37, said he had lost all 30 goats in the kraal just outside his family compound to lions and hyenas since the hunting ban. Elephants had destroyed his fields of sorghum and maize.

With the hunting ban, his family no longer receives the free meat that hunters left behind. His mother, Gomolemo Semalomba, 58, no longer receives a pension, about $100 twice a year.

"Now we don't eat meat anymore," she said, pointing to a table with plates of cabbage, beans and maize meal.

Mr. Moalosi, Sankuyo's chief, said he hoped to bring back some of the benefits after his village made a successful transition to photographic tourism.

But experts say that sightseeing tourists gravitate to prime areas with dense concentrations of wildlife, like the Okavango Delta's Moremi Game Reserve west of here. They rarely venture to peripheral areas like Sankuyo, or even more remote corners, which do, however, draw hunters.

"Photographic tourism is not that viable in those areas," said Joseph Mbaiwa, the Okavango Research Institute's acting director.

In Sankuyo, William Moalosi is one of dozens of people that the hunting ban has left jobless. Many have left Sankuyo to seek work in Maun.

Mr. Moalosi, 40, worked for eight years as a tracker and driver, earning about $100 a month. He used some of the money to replace his old house, made of branches and the mud from a termite mound, with a modern structure. He lost his crops of maize and watermelons to marauding elephants a few months ago.

Villagers, including the chief, identified Mr. Moalosi as the man who had shot and killed a lioness last month. The animal had climbed a tree to jump down into a

kraal with goats; unable to get out of the enclosure, the lioness posed a danger to the village, which gave the community the right to kill the animal.

But sitting outside his house, flanked by neighbors, Mr. Moalosi denied he was the shooter. He said he knew nothing about the circumstances of the animal's death, a statement that drew knowing smiles from his neighbors.

"We are living in fear since lions and leopards now come into our village," he said. "Elephants cross the village to go to the other side of the bush. The dogs bark at them. We just run into our houses and hide."

A version of this article appears in print on September 13, 2015, on page A6 of the New York edition with the headline: A Hunting Ban Saps a Village's Livelihood.

© 2015 The New York Times Company

PLOS | ONE

RESEARCH ARTICLE

Provisioning of Game Meat to Rural Communities as a Benefit of Sport Hunting in Zambia

Paula A. White[1]*, **Jerrold L. Belant**[2]

1 Center for Tropical Research, Institute of the Environment and Sustainability, University of California Los Angeles, Los Angeles, California, United States of America, 2 Carnivore Ecology Laboratory, Forest and Wildlife Research Center, Mississippi State University, Starkville, Mississippi, United States of America

* paw@carnivoreconservation.com

Abstract

Sport hunting has reportedly multiple benefits to economies and local communities; however, few of these benefits have been quantified. As part of their lease agreements with the Zambia Wildlife Authority, sport hunting operators in Zambia are required to provide annually to local communities free of charge i.e., provision a percentage of the meat obtained through sport hunting. We characterized provisioning of game meat to rural communities by the sport hunting industry in Zambia for three game management areas (GMAs) during 2004–2011. Rural communities located within GMAs where sport hunting occurred received on average > 6,000 kgs per GMA of fresh game meat annually from hunting operators. To assess hunting industry compliance, we also compared the amount of meat expected as per the lease agreements versus observed amounts of meat provisioned from three GMAs during 2007–2009. In seven of eight annual comparisons of these GMAs, provisioning of meat exceeded what was required in the lease agreements. Provisioning occurred throughout the hunting season and peaked during the end of the dry season (September–October) coincident with when rural Zambians are most likely to encounter food shortages. We extrapolated our results across all GMAs and estimated 129,771 kgs of fresh game meat provisioned annually by the sport hunting industry to rural communities in Zambia at an approximate value for the meat alone of >US$600,000 exclusive of distribution costs. During the hunting moratorium (2013–2014), this supply of meat has halted, likely adversely affecting rural communities previously reliant on this food source. Proposed alternatives to sport hunting should consider protein provisioning in addition to other benefits (e.g., employment, community pledges, anti-poaching funds) that rural Zambian communities receive from the sport hunting industry.

CrossMark
click for updates

OPEN ACCESS

Citation: White PA, Belant JL (2015) Provisioning of Game Meat to Rural Communities as a Benefit of Sport Hunting in Zambia. PLoS ONE 10(2): e0117237. doi:10.1371/journal.pone.0117237

Academic Editor: Asim Zia, University of Vermont, UNITED STATES

Received: April 3, 2014

Accepted: December 22, 2014

Published: February 18, 2015

Copyright: © 2015 White, Belant. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Data Availability Statement: All relevant data are within the paper.

Funding: These authors have no support or funding to report.

Competing Interests: The authors have declared that no competing interests exist.

Introduction

Sport hunting in Africa represents an important form of revenue-generating tourism [1],[2]. Additional reported benefits include conservation of biodiversity through protection of large tracts of land that might otherwise be converted to agricultural or domestic livestock use [3–7] and selective hunting of potentially dangerous or destructive species that can increase local people's tolerance for coexistence [8–10]. However, others report that sport hunting contributes little to rural economies or livelihoods [11].

Employment, revenues from hunting fees and licenses, contributions to community capital projects, and funding of anti-poaching scouts are potential benefits that rural communities may receive from sport hunting [12],[13]. Access to game meat has been described as the most tangible benefit to rural communities [14]; however, comparatively little effort has been made to characterize meat provisioning. Notable exceptions are Namibian communal conservancies that report annually on game meat revenues attributable to sport hunting [15], and the comprehensive summary of game meat distributions in Africa compiled by TRAFFIC which considered sport hunting in addition to game ranching and culling [14]. In Zambia, a 1971 report based on household surveys estimated that sport hunting provided 112 tonnes of dressed game meat to rural Zambians countrywide [16] (cited in [12]). We are unaware of more recent studies in Zambia, including studies that quantified provisioning at the GMA scale. In addition, we found no record of previous attempts to examine the patterns or scope of meat distributions.

Food security in developing nations is a primary focus of aide organizations worldwide [17–21]. In Zambia, 48% of the population was undernourished in 2012–2014 [22] and 19% of Zambian households were recently classified as chronically food insecure [20] defined as a continuously inadequate diet caused by the inability to acquire food [23]. Food shortage is defined as an individual receiving less than 2,200 kilocalories per day [18]. Donor aide programs provide supplemental food typically consisting of maize, sorghum, or other cereals. Although high-protein cereals are being developed [24], at present recommended daily protein requirements (50 gm/day)[25] are rarely met in Zambia [22],[26].

As part of their official lease agreements with the Zambia Wildlife Authority (ZAWA), sport hunting operators in Zambia are required to provide to rural communities a proportion of game animals harvested by clients each year. This meat is distributed free of charge to villages that reside within game management areas (GMAs) where sport hunting occurs. To legally obtain protein outside of GMAs, rural Zambians must raise their own livestock, fish, or purchase meat. Livestock husbandry is costly and precluded in some areas due to diseases [27], inadequate grazing, or presence of tsetse flies *Glossina* spp. [28]. To fish legally requires purchasing a permit and access to lakes, rivers, or seasonal ponds. Purchasing meat is expensive: about US$10/kg for beef, US$7/kg for chicken, and US$15/kg for dried fish (i.e., kapenta *Limnothrisa* sp.). Most (64%) Zambians live on less than US$1.00/day [29]. Thus, high expense makes obtaining animal protein cost prohibitive for most rural Zambians.

Obtaining sufficient amounts of protein is a widespread problem faced by rural people in many parts of Africa. Alternatives for meeting the protein requirements are being explored in other countries. In particular, game ranching, communal conservancies [30],[31], and other forms of community-based wildlife conservation programs [32] show promise. However, despite a few earlier attempts, these programs in Zambia are limited in scope, highly localized, and poorly developed [14], meaning that currently most rural Zambians do not have access to meat through these means.

Presently, the only other alternative for rural Zambians to obtain meat is illegally through poaching of wild animals or purchase of poached meat (herein referred to as bushmeat). Global concerns over the prevalence and extent of bushmeat poaching are increasing rapidly [33],[34].

Studies cite the unsustainable nature of the bushmeat trade [34] and the loss of potential income that results from poaching compared to the value of the same animals to photographic tourism or sport hunting [35].

We quantified the annual provisioning of fresh game meat by the sport hunting industry to rural communities in Zambia. Specifically, we characterized the expected and observed amounts of meat provisioned and the timing and spatial extent of meat distributions to rural communities. Finally, we discuss meat provisioning in the context of rural livelihoods, in particular food security and bushmeat poaching, in relation to Zambia's 2013–2014 hunting moratorium.

Methods

Zambia Wildlife Authority ranks GMAs as prime, secondary, or understocked based on species occurrence and animal abundance [36]. Prime GMAs include species that are fairly abundant and include highly valued trophies (e.g., African lion *Panthera leo*, leopard *P. pardus*, roan antelope *Hippotragus equinus*, and sable antelope *H. niger*) and that can accommodate five or more classical safaris and seven or more mini safaris per hunting season. Secondary GMAs include species less abundant but that generally can sustain three to four classical safaris and a minimum of five mini safaris per hunting season. Understocked GMAs contain species assemblages that are intact but with populations low enough that no hunting quota or only a minimum hunting quota is allowed [37]. Quotas are set annually for each GMA based on their ranking, an evaluation of the hunting operators' performance in the GMA during the previous season, and input from regional ZAWA scouts, ZAWA ecologists and representatives of the rural communities located within the GMAs. We obtained quotas from 2007 to 2009 from ZAWA for each of 30 GMAs in Zambia where sport hunting occurred. These 30 GMAs cover 84,033km^2 and represent 11% of Zambia's total land area. We excluded non-edible trophy species (African lion, leopard, spotted hyena *Crocuta crocuta*, Nile crocodile *Crocodylus niloticus*, small carnivores, and primates) from all calculations.

Sport hunting operators in each GMA are mandated by their lease agreements to utilize (i.e., hunt) $\geq$ 60% of their annual quota and distribute $\geq$ 50% of all game animals harvested each year to rural communities located in the GMA where the hunting occurred. Thus, 60% of the allocated quota of game species represents the estimated minimum number of edible animals harvested annually by sport hunters in Zambia; half of which represents the minimum amount of game meat that communities may expect to receive in a given year.

We collected data on meat provisioning from three GMAs (1 prime, 1 secondary, 1 understocked). During the study, each GMA was operated by individual hunting companies under a ten-year (2002–2012) lease agreement with ZAWA and the local communities. Zambia's sport hunting season occurred each year from 1 May to 31 December; however, sport hunting declines during the hottest months (mid-October to early November) and is typically discontinued when the rainy season begins in late November (P. White, personal observation).

We used reported live [38] and dressed weights [25] of game species to estimate harvested biomass. We used body weights for subspecies that occurred in Zambia when available. For species whose dressed weights were not available, we used conversion rates from a closely related species within the same genus. Reported dressed weights excluded offal; however, rural Zambians routinely consume organ meats (e.g., heart, liver, kidneys) in addition to skeletal muscle and bones which are boiled for additional nutrition (P. White, personal observation). Thus, dressed carcass weights represent minimum estimates of the amount of edible meat.

For each of the three GMAs sampled, we calculated the annual amount of meat expected through provisioning during 2007–2009 (data for 2008–2009 only were available for the

understocked GMA). We converted the number and species of animals represented by 50% of the utilized quota to kgs using the same dressed weight calculations as were applied to meat distribution logs (below). We also estimated the expected mean annual amount of meat provisioned in all GMAs where sport hunting occurred during 2007–2009. We excluded GMAs not hunted during the previous lease period, specialized GMAs, private game ranches, and conservancies. We used 60% of the allocated quotas at 50% distribution and converted these values to dressed weights to estimate the total kgs of meat expected to be provisioned countrywide.

We estimated the amount of meat provisioned annually during the 2005–2011 hunting seasons for the sampled prime and secondary GMAs and for five seasons during 2004–2011 for the understocked GMA. We obtained this information from meat distribution logs provided to ZAWA by hunting operators. Logs included date, species, portion of carcass distributed (e.g., half, whole), and generally a description of the recipient location (e.g., name of village, clinic, school, game scout post). Each log entry represented one animal or portion of an animal distributed to one location as verified by signature of the receiving party. We calculated dressed weights (kgs) from species and amount of provisioned meat as described previously.

To assess performance of the sport hunting industry in meeting its meat provisioning requirements, we compared annual expected and observed amounts (kgs) of provisioned meat in the three sampled GMAs during 2007–2009. We also summarized the amount (kgs) of meat provisioned and number of distribution events by month and year. When possible, we determined locations of distribution events using Google Earth, survey charts, and 1:250,000 scale topographic maps (Surveyor General, Lusaka, Zambia) and estimated distances from the recipients' locations to the provisioning hunting camp to determine the spatial extent of meat provisioning.

We used generalized linear mixed-effects models in program R (version 3.0.2; R Development Core Team 2013) [39] to estimate differences in response variables among GMAs and months. Response variables were the amount of meat provisioned and number of distribution events; explanatory variables were GMA and month. We included year as a random effect. We used least-squares difference means tests to compare differences among GMAs and months. We report means with ± 1 standard deviation and set statistical significance at $\alpha = 0.05$.

Results

Mean expected annual amount (kgs) of meat distributed countrywide was 129,771 ± 15,862 kgs during 2007–2009, representing 2,359 ± 320 individual animals of 20 species (Table 1). The mean expected annual amount of meat provisioned from 2007 to 2009 was greater for the prime (6187.3 ± 262.1 kgs) and secondary (5810.0 ± 248.6 kgs) GMAs than for the understocked (1204.0 ± 0 kgs) GMA. Similarly, the observed amount of meat provisioned annually during 2004–2011 varied among GMAs ($F_{2,16} = 21.97$, $P < 0.001$), with the prime (5832.1 ± 1579.9 kgs; $n = 7$) and secondary (6495.0 ± 1876.1 kgs; $n = 7$) GMAs provisioning greater ($P < 0.05$) amounts of meat than the understocked (973.4 ± 390.3 kgs; $n = 5$) GMA. Considering paired 2007–2009 data only, the observed amounts (kgs) of meat provisioned in prime and secondary GMAs exceeded what was expected each year (Fig. 1). In the understocked GMA, observed amounts exceeded expectations in one of two years.

The mean annual number of distribution events varied among GMAs ($F_{2,16} = 17.32$, $P < 0.001$), with more distribution events ($P < 0.05$) in the prime GMA (39.3 ± 8.7) than in the secondary (24.9± 8.9) and understocked (13.8 ± 8.1) GMAs. Annual number of distribution events in the secondary and understocked GMAs were similar ($P > 0.05$). The timing of distributions varied across months ($F_{5,95} = 7.13$, $P < 0.001$) with more distribution events during

Table 1. Mean (± SD) annual harvest quotas and expected amounts (kgs) of dressed meat provisioned during normal hunting seasons in Zambia, 2007–2009.

	Allocated Quota Countrywide		Mandatory 60% Utilization of Allocated Quota		Mandatory 50% Distribution of Utilized Quota		Expected Dressed Meat Provisioned (kg)	
Species	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Cape buffalo (*Syncerus caffer*)	295.3	20.6	177.2	12.4	88.6	6.2	31,718.8	2217.6
Bushbuck (*Tragelaphus scriptus*)	160.0	24.3	96.0	14.6	48.0	7.3	1344	204.4
Bush pig (*Potamochoerus larvatus*)	56.7	21.1	34.0	12.7	17.0	6.3	629	234.5
Common duiker (*Sylvicapra grimmia*)	95.7	22.3	57.4	13.4	28.7	6.7	315.7	73.6
Eland (*Taurotragus oryx*)	46.3	15.5	27.8	9.3	13.9	4.7	5740.7	1920.8
Lichtenstein's hartebeest (*Alcelaphus buselaphus*)	89.3	17.2	53.6	10.3	26.8	5.2	2572.8	496.6
Hippopotamus (*Hippopotamus amphibious*)	206.3	23.2	123.8	13.9	61.9	7.0	53853	6067.0
Impala (*Aepyceros melampus*)	344.7	18.9	206.8	11.3	103.4	5.7	3308.8	181.2
Greater kudu (*Tragelaphus strepsiceros*)	117.0	21.4	70.2	12.8	35.1	6.4	4598.1	840.1
Red lechwe (*Kobus leche*)	15.7	4.6	9.4	2.8	4.7	1.4	324.3	95.6
Oribi (*Ourebia ourebi*)	48.3	9.5	29.0	5.7	14.5	2.8	116	22.7
Puku (*Kobus vardoni*)	191.7	10.3	115.0	6.2	57.5	3.1	2357.5	126.2
Southern reedbuck (*Redunca arundinum*)	67.3	11.0	40.4	6.6	20.2	3.3	585.8	95.8
Roan (*Hippotragus equinus*)	45.7	13.6	27.4	8.2	13.7	4.1	2041.3	608.5
Sable (*Hippotragus niger*)	61.3	11.9	36.8	7.2	18.4	3.6	2318.4	451.0
Sitatunga (*Tragelaphus spekei*)	24.3	2.3	14.6	1.4	7.3	0.7	459.9	43.6
Warthog (*Phacochoerus africanus*)	182.0	30.1	109.2	18.1	54.6	9.0	2948.4	487.9
Waterbuck (*Kobus ellipsiprymnus*)	102.0	25.0	61.2	15.0	30.6	7.5	4375.8	1071.6
Wildebeest (*Connochaetes taurinus*)	74.3	18.0	44.6	10.8	22.3	5.4	3122	756.4
Zebra (*Equus quagga*)	135.7	19.6	81.4	11.8	40.7	5.9	7041.1	1017.5
Totals	2359.7	320.6	1415.8	192.4	707.9	96.2	129,771.4	15,861.5

Expected dressed meat provisioned calculated using live and dressed weights of game species after Skinner & Smithers (1990) and Bothma & du Toit (2010), respectively.

doi:10.1371/journal.pone.0117237.t001

July and September and fewer during May (Fig. 2). There was no interaction between GMA and month ($F_{10,95} = 1.32$, $P = 0.233$).

The observed amount (kgs) of meat provisioned each month varied among GMAs ($F_{10,95} = 1.24$, $P = 0.277$) with greater amounts of meat provisioned from the prime and secondary

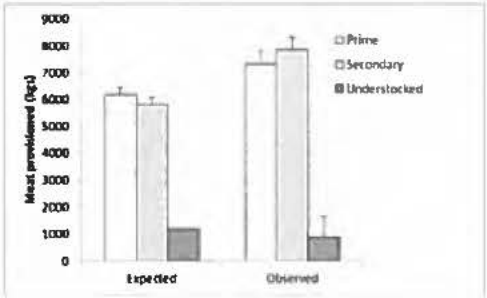


Fig 1. Expected versus observed amounts (kgs) of meat provisioned in each of three Game Management Areas (GMA), Zambia.

doi:10.1371/journal.pone.0117237.g001

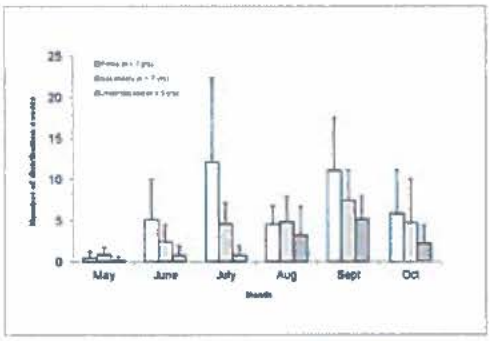


Fig 2. Mean (± SD) number of meat distribution events by month for three Game Management Areas, Zambia.

doi:10.1371/journal.pone.0117237.g002

GMAs than from the understocked GMA ($P < 0.05$; Fig. 3). Overall, mean total amounts (kgs) of meat provisioned were greatest in September and least in May ($F_{5,95} = 6.15$, $P < 0.001$). There was no interaction between GMA and month ($F_{10,95} = 1.32$, $P = 0.233$). In the prime GMA, mean meat provisioning in July and September exceeded 1,700 kgs/month. In the secondary GMA, mean monthly provisioning was 1,800 kgs in September and exceeded 1,250 kgs/month during July–October. The greatest mean monthly amount of meat provisioned in the understocked GMA was in September (> 400 kgs).

Distribution logs contained locations of meat recipients in 62% ($n = 518$) of entries, including 63% ($n = 275$) in the prime GMA, 78% ($n = 174$) in the secondary GMA, and 16% ($n = 69$) in the understocked GMA. Remaining entries were received by community-appointed liason officers who oversaw onward distribution. To assess the spatial extent of meat provisioning, we determined specific locations for 336 distribution events in relation to the locations of hunting camps that supplied the meat. Meat provisioning extended to > 50 km from sport hunting camps with most (70%) occurring within 20 km of camps (Fig. 4).

Discussion

In Zambia, provisioning of fresh game meat by sport hunting operators constituted an important source of protein for rural communities, with actual meat provisioned exceeding 6,000 kgs annually in the sampled prime and secondary GMAs. Meat provisioning by the hunting industry appeared reliable across years and exceeded expectation in each GMA and in every year

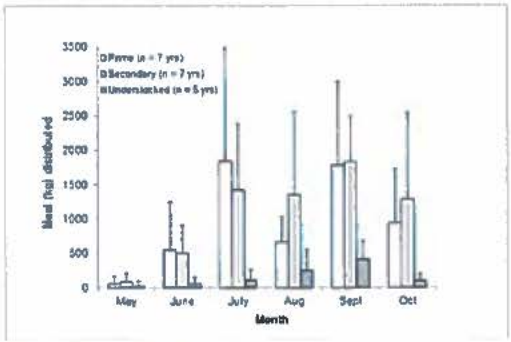


Fig 3. Mean (±SD) amount (kgs) of meat distributed by month for three Game Management Areas, Zambia.

doi:10.1371/journal.pone.0117237.g003

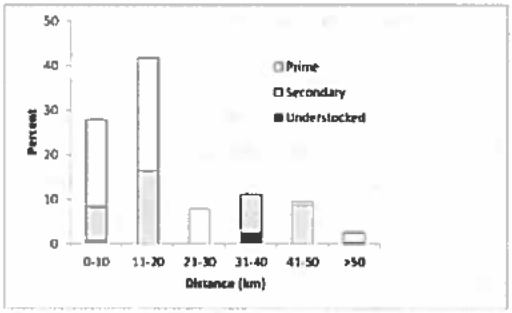


Fig 4. Distances from sport hunting camps of meat provisioned from three Game Management Areas, Zambia.

doi:10.1371/journal.pone.0117237.g004

except one (understocked GMA in 2009). Variations in the amount and timing of distributions appeared influenced in part by unpredictable short-term perturbations. For example, eruption of the Icelandic volcano and subsequent disruption to international flights in 2010 [40] caused the abrupt cancellation of numerous hunts and lowered the amount of meat distributed in some months that year (PHAZ, personal communication).

The provisioning of greater amounts of meat than expected resulted when operators successfully hunted more than the minimum 60% required of their annually allocated quota (P. White, unpublished data). These results illustrate a potential conflict of interest; ZAWA receives revenues based on GMA ranking (prime GMAs carry the highest fees) as well as the number of animal licenses sold. Therefore, ZAWA could be motivated to rank GMAs as high as possible and to allocate larger quotas in order to receive greater revenues from hunting operators [37]. Local communities also receive a portion of each animal license fee, and receive more meat when allocated quotas are high, especially for large-bodied species. Thus, community representatives engaged in quota setting exercises may also be motivated to support high quotas.

Likewise, hunting operators may be motivated to sell as many hunts as possible each year to maximize profits, especially in prime GMAs where fees are greater. However, an operator's future success is gauged on quality of trophies obtained in previous years. Trophy quality is judged on size and age rather than number of animals shot [41]. Further, lease periods of ≥ 10 years help promote good stewardship because holders of longer-term leases have a vested interest in conserving wildlife populations [42]. Zambian Wildlife Authority requirements of a minimum annual harvest could promote shooting of immature animals if allocated quotas are excessive. Despite existing protocols for post-season meetings designed to set quotas in accordance with best available information, allocated quotas are subject to later change by ZAWA's head office sometimes without consulting regional ecologists, hunting operators, or local communities. Subsequently, hunting operators occasionally request reduced quotas for certain species if they believe the allocated quota to be excessive in their GMA (PHAZ, personal communication). A more standardized methodololgy for monitoring trends in game population abundance, preferably including estimates of precision, could simplify setting of quotas and help ensure sustainable harvest.

The amount of meat and frequency of meat distributions was generally greater during months (e.g., September) when rural people are most likely to experience food shortages i.e., when alternative sources of food are exhausted and prior to annual crop production [43]. With a hunting moratorium in place since January 2013 throughout most of Zambia's GMAs, game meat supplied by the sport hunting industry has been almost eliminated. Over 60% of Zambia's

human population was classified as rural in 2013 and 83% of rural Zambian households are poor [44]. Most (20 of 30) of the GMAs analyzed in this study are in three of Zambia's poorest and most remote provinces (Northwestern, Eastern, and Southern) [44]. Zambia's poorest families whose crop production is insufficient to support themselves rely on income from casual labor to purchase food during shortages [43]. Food is the largest expenditure for Zambia's rural poor [45] for whom casual labor constitutes a major source of income [46]. However, most employment opportunities provided by sport hunting camps each year were lost during the current moratorium. This included casual work (road clearing, camp building) as well as seasonal jobs that lasted throughout the hunting season (camp staff, trackers and skinners, drivers and mechanics, etc.). In addition, commodities normally purchased by hunting camps from local communities (e.g., thatching grass, vegetables, maize meal) were not needed (P. White, unpublished data). Thus, in addition to the loss of provisioned meat, many rural people may lack the financial resources to legally purchase meat. During the similar time period (February 2013–February 2014) inflation in Zambia increased 7.6% [47]. The rate of inflation has since increased to 8.1% (November 2013–November 2014) with the cost of food contributing the most to the annual increase [48]. Zambia's poorest provinces have experienced the highest inflation rates countrywide [48].

In the absence of sport hunting, rural communities need alternatives to reliably and legally obtain meat. Solutions must be appropriate to local situations however [34], and consider the needs of humans and wildlife to avoid adverse effects [49–51]. Domestic livestock are excluded from many parts of Zambia due to tsetse flies [28] and can cause habitat degradation if overstocked [52]. Game ranching can provide a source of meat and African game meat has a greater protein content (> 20% per 100g) than domestic species (< 20% per 100g) [25]. But whereas sport hunting operators provision free meat as part of their lease agreements, ranchers may expect fair or subsidized prices for their product [53]. A shift to greater reliance on wild fisheries can result in depletion of fish stocks [33]; Zambia's native fish stocks are showing evidence of severe depletion [54],[55]. Communal conservancies that incorporate game and domestic stock could provide rural people with protein and income. These programs require considerable start-up investment and maintenance and a sport hunting component is often needed to ensure success, especially in the early stages [56],[57]. The most profitable conservancies include a sport hunting component [7],[15]; however, the income received by individuals is inversely related to human population density [10]. Benefits to residents diminish when conservation-benefit programs result in an influx of immigrants seeking to share in returns [58],[59].

Where alternative sources of food and income are not available, incidents of bushmeat poaching increase during the late dry season [35],[60],[61]. Many hunters sell bushmeat to obtain cash to purchase other foods [34], material goods [60], or to enhance their farming efforts thereby increasing the income potential of their crops [62]. Whether hunting for food or cash, expanding human populations coupled with the unsustainable hunting methods favored by bushmeat poachers have caused widespread concerns for the viability of wildlife populations and entire species [34],[63],[64]. Studies of bushmeat hunters in Zambia [60] and buyers in Zimbabwe [53] concluded that increasing the supply of free meat would help reduce bushmeat poaching.

Those most dependent on bushmeat for food are often the most remote and marginalized groups [33],[34],[49]. In Zambia, poor families are more likely to live ≥ 20 km from the nearest markets than families that are not poor [45]. Most of Zambia's GMAs are located in the poorest and most remote provinces [44]. Sport hunting operators in Zambia provisioned meat to at least 50 km from their hunting camps, which were situated in remote areas on average 84 km from the nearest towns ($N = 32$ camps). While the price of bushmeat can vary with distance to

source [65], average cost of bushmeat in Zambia in 2012 was US$4.75/kg of fresh game meat (P. White, unpublished data). Thus, the estimated replacement cost of game meat exceeds US $27,700/year for each prime GMA, US$30,850/year for each secondary GMA, and US$4,620/year for each understocked GMA. Countrywide, the estimated annual cost to purchase the equivalent of 129,771 kgs of fresh game meat is US$616,412, excluding butchering and delivery costs. At > 20% protein per 100g game meat, this is equivalent to 519,084 people days of protein per year. This figure is based on the recommended daily protein requirement of 50 gm/day [25] being fulfilled entirely by animal protein. In fact, Zambians on average obtain less than 20% of their dietary energy from animal protein [66]. Thus, although meat provisioned by sport hunting operators represents a small percentage of protein requirements for Zambians, it appears an effective means of distributing fresh, high quality meat to some of the most remote areas of the country with the greatest protein needs, thereby partially alleviating protein deficiencies in rural Africans. Elsewhere in Africa (e.g., Selous Game Reserve, Tanzania) where communities may be located too far from sport hunting camps to facilitate distribution of fresh meat, alternative sources of protein may be required.

The recent moratorium on sport hunting throughout much of Zambia created a crisis situation [67]. Bushmeat poaching is a serious problem in Zambia [14],[37] and the severity and rate of poaching has escalated during the current hunting closure [68]. Similarly, accelerated loss of wildlife occurred during previous (2000–2002) hunting closures in Zambia [4] and elsewhere (Kenya [9],[69]). Zambia's human population continues to increase (2.8% in 2010) [70]. From 1987–1997, Zambia's wildlife sector underperformed with regards its potential to supply game meat to rural people [14]. This included game ranching and cropping schemes in addition to sport hunting.

We characterized and quantified meat provisioning in Zambia. Large-scale sport hunting also occurs in the African countries of Namibia, Mozambique, Tanzania and Zimbabwe. In all five countries, over 60% of the total population is rural, with at least 25% of the population in each country categorized as undernourished [22]. With the exception of Namibia, each of these countries has lower than average GDPs compared to the mean for all African countries [71]. Globally, Zambia, Mozambique and Tanzania each rank in the bottom 20 of food supply of meat [66]. As in Zambia, most hunting areas in these other four countries are located in rural regions [72]. National governments and wildlife authorities are responsible for establishing hunting quotas and lease agreements including meat distribution requirements, thus extrapolation of meat provisioning in Zambia to other countries would be speculative, and wider-scale estimates are beyond the scope of this paper. However, the detailed information we provide for Zambia may serve as a template for future investigations of expected meat distributions in other countries or regions where hunting occurs.

While the amount of game meat provisioned annually by Zambia's sport hunting industry is substantial, a multi-use approach that incorporates sport hunting, game ranching, and communal conservancies for additional sources of protein and income in rural areas will likely be required to keep pace with the growing demand for meat and jobs. It is vital that Zambia's GMAs be afforded sound custody unless and until viable alternatives offering the same or greater benefits than sport hunting provided can be implemented.

Acknowledgments

This research was conducted under Zambia Employment Permit No. 008872 in partnership with Zambia Wildlife Authority who generously provided details of quotas. We thank members of the Professional Hunters Association of Zambia, Safari Hunter and Operator Association of Zambia, and numerous individuals who provided information. We thank D. Boyd,

E. Boydston and three anonymous reviewers for comments on an earlier draft of this manuscript.

Author Contributions

Conceived and designed the experiments: PAW. Performed the experiments: PAW. Analyzed the data: PAW JLB. Contributed reagents/materials/analysis tools: JLB. Wrote the paper: PAW JLB.

References

1. Booth VR (2009) A comparison of prices of hunting tourism in Southern and Eastern Africa. Budapest, Hungary: Joint Publication of FAO and CIC. 40 p. PMID: 25506961
2. Barnett R, Patterson C (2005) Sport hunting in the Southern African development community (SADC) region: An overview. Johannesburg, South Africa: TRAFFIC East/Southern Africa. 116 p. PMID: 25275211
3. Lewis D, Alpert P (1997) Trophy hunting and wildlife conservation in Zambia. Conservation Biology 11: 59–68.
4. Lewis DJ, Jackson JJ (2005) Safari hunting and conservation on communal land in southern Africa. In: Woodroffe R, Thirgood S, Rabinowitz A, editors. People and wildlife: Conflict or coexistence? Cambridge, UK: Cambridge University Press. pp. 239–251.
5. Lindsey PA, Alexander R, Frank LG, Mathieson A, Romanach SS (2006) Potential of trophy hunting to create incentives for wildlife conservation in Africa where alternative wildlife-based land uses may not be viable. Animal Conservation 9: 283–291.
6. Lindsey PA, Roulet PA, Romanach SS (2007) Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. Biological Conservation 134: 455–469. PMID: 17709564
7. Loveridge AJ, Reynolds JC, Milner-Gulland EJ (2007) Does sport hunting benefit conservation? In: Macdonald D, Service K, editors. Key topics in conservation biology. Malden, Massachusetts: Blackwell Publishing Ltd. pp. 222–238.
8. Bond I (1994) Importance of elephant hunting to CAMPFIRE revenue in Zimbabwe. TRAFFIC Bulletin 14: 117–119.
9. Norton-Griffiths M (1998) The economics of wildlife conservation policy in Kenya. In: Milner-Gulland E, Mace R, editors. Conservation of biological resources. Oxford, UK: Blackwell Science. pp. 279–293.
10. Leader-Williams N, Hutton JM (2005) Does extractive use provide opportunities to offset conflicts between people and wildlife? In: Woodroffe R, Thirgood S, Rabinowitz A, editors. People and wildlife: Conflict or coexistence? Cambridge, UK: Cambridge University Press. pp. 140–161.
11. Campbell R (2013) The $200 million question: how much does trophy hunting really contribute to African communities? A report for the African Lion Coalition. Melbourne, Australia: Economists at Large. doi: 10.1007/s13197-013-0993-z PMID: 25593984
12. Astle WL (1999) A history of wildlife conservation and management in the mid-Luangwa valley, Zambia. Bristol, UK: British Empire and Commonwealth Museum. 149 p. PMID: 25506965
13. Jackson JJ (1996) An international perspective on trophy hunting. In: Leader-Williams N, Kayera JA, Overton GL, editors. Tourist hunting in Tanzania. Gland, Switzerland and Cambridge, UK: IUCN. pp. 7–11.
14. Barnett R (1997) Food for Thought: The utilization of wildlife meat in East and Southern Africa. Nairobi, Kenya: TRAFFIC East/Southern Africa. 264 p. PMID: 25165803
15. NASCO (2013) The state of community conservation in Namibia: A review of communal conservancies, community forests and other CBNRM initiatives (2012 Annual Report). Windhoek, Namibia. 64 p. Available: http://nasco.org.na. Accessed 2014 Mar 11.
16. Stier JC (1973) Safari hunting in the Luangwa valley. Mimeograph. Department of Wildlife, Fisheries and National Parks. Chilanga, Zambia.
17. UN (2011) United Nations 2000 Millennium Declaration. Country development cooperation strategy 2011–2015. Resolution adopted by the General Assembly A/RES/55/2 Fifty-fifth session agenda item 60(b), 18 September 2000. Available: http://www.usaid.gov/zambia. Accessed 2013 Dec 12.
18. von Braun J, Vargas Hill R, Pandya-Lorch R, editors (2009) The poorest and hungry: Assessments, analyses, and actions. IFPRI 2020 Book. Washington, DC: International Food Policy Research Institute. 584 p. Available: http://www.ifpri.org. Accessed 2013 Dec 2.
19. WFP (2010) World Food Programme. Available: http://www.WFP.org. Accessed 2014 Mar 5.

20. FTF (2011) Zambia FY 2011–2015 multi-year strategy. Feed The Future. Available: http://www.feedthefuture.gov. Accessed 2014 Jan 2.

21. GAFSP (2013) Increasing incomes, reducing hunger. Annual Report. Washington, DC: Global Agriculture and Food Security Programme. Available: http://www.GAFSPFUND.ORG. Accessed 2014 Jan 29.

22. FAO (2014) Statistical Yearbook 2014 Africa Food and Agriculture. Report. Accra, Ghana: Food and Agriculture Organization of the United Nations, Regional Office for Africa. Available: http://www.fao.org. Accessed 2014 Nov 30.

23. WB (1986) Poverty and hunger: Issues and options for food security in developing countries. World Bank Policy Study. Washington, DC: World Bank.

24. Henley EC, Taylor JRN, Obukosia SD (2010) The importance of dietary protein in human health: Combating protein deficiency in sub-Saharan Africa through transgenic biofortified sorghum. In: Taylor SL, editors. Advances in food and nutrition research. Burlington, Massachusetts: Academic Press. pp. 21–52. doi: 10.1016/S1043-4526(10)60002-2 PMID: 20691952

25. Bothma JdP, du Toit JG (2010) Game ranch management. Pretoria, South Africa: Van Schaik Publishers. 979 p. PMID: 25506974

26. FAO (2010) Food balance sheets. FAO Statistics Division. Rome, Italy: Food and Agriculture Organization of the United Nations. Available: http://www.fao.org/statistics. Accessed 2014 Mar 6. PMID: 25506974

27. Lewis D (2005) Synergies between animal husbandry and wildlife conservation: perspectives from Zambia. In: Osofsky SA, Cleaveland S, Karesh WB, Kock MD, Nyhus PJ, Starr L, Yang A, editors. Conservation and development interventions at the wildlife/livestock interface: Implications for wildlife, livestock and human health. Gland, Switzerland and Cambridge, UK: IUCN. pp. 153–156.

28. Marks SA (2005) Large mammals and a brave people: Subsistence hunters in Zambia. New Brunswick, New Jersey: Transaction Publishers. 285 p. PMID: 25275211

29. ZCSO (2012) Zambia Central Statistical Office. Available: http://www.zamstats.gov.zm. Accessed 2014 Jan 1.

30. Weaver C, Hamunyela E, Diggle R, Matongo G, Pietersen T (2011) The catalytic role and contributions of sustainable wildlife use to the Namibia CBNRM programme. In: Abensperg-Traun M, Roe D, O'Criodain C, editors. CITES and CBNRM Proceedings of an international symposium on "The relevance of CBNRM to the conservation and sustainble use of CITES-listed species in exporting countries". Vienna, Austria: IUCN, Gland, Switzerland and IIED, London, UK. pp. 59–70.

31. Shurter S (2013) Gnusletter. IUCN Antelope Specialist Group. doi: 10.1007/s13197-013-0993-z PMID: 25593984

32. Baldus RD (2009) A practical summary of experiences after three decades of community-based wildlife conservation in Africa "What are the lessons learnt?" Budapest, Hungary: Joint Publication of FAO and CIC. 128 p. PMID: 25506961

33. Bennett EL (2002) Is there a link between wild meat and food security? Conservation Biology 16: 590–592.

34. Milner-Gulland EJ, Bennett EL, the SBC 2002 Annual Meeting Wild Meat Group (2003) Wild meat: the bigger picture. Trends in Ecology and Evolution 18: 351–357.

35. Lindsey PA, Balme G, Becker M, Begg C, Bento C, et al. (2013) The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. Biological Conservation 160: 80–96.

36. Nyirenda VR, Liwena S, Kaumba Chaka H (2008) Atlas of the national parks of Zambia. Lusaka, Zambia: New Horizon Printing Press. 47 p. PMID: 25506952

37. Simasiku P, Simwanza HI, Tembo G, Bandyopadhyay S, Pavy J (2008) The impact of wildlife management policies on communities and conservation in game management areas in Zambia. Lusaka, Zambia: Natural Resources Consultative Forum. 37 p. PMID: 25506952

38. Skinner JD, Smithers RHN (1990) The mammals of southern African subregion. Pretoria, South Africa: University of Pretoria. 771 p. PMID: 25144095

39. R Development Core Team (2013) R: A language and environment for statistical computing. Vienna, Austria. Available: http://www.Rproject.org. Accessed 2014 Mar 11.

40. Wikipedia (2014) Air travel disruption after the 2010 Eyjafjallajokull eruption. Available: http://en.wikipedia.org/w/index.php/600193963. Accessed 2014 Mar 18.

41. Damm GR (2008) Recreational trophy hunting: "What do we know and what should we do?" In: Baldus RD, Damm GR, Wollscheid K, editors. Best practices in sustainable hunting—a guide to best practices from around the world. CIC Technical Series Publication No.1. Budapest, Hungary: International Council for Game and Wildlife Conservation. pp. 5–11.

42. Baldus RD, Cauldwell AE (2004) Tourist hunting and its role in development of wildlife management areas in Tanzania. Dar es Salaam, Tanzania: GTZ—Wildlife Programme Tanzania. PMID: 25057686

43. FEWS (2014) Food Security Outlook Update. Available: http://www.fews.net. Accessed 2014 Mar 21.

44. IFAD (2014) International Fund for Agricultural Development. Available: http://ruralpovertyportal.org. Accessed 2014 Nov 30.

45. Ahmed AU, Hill RV, Smith LC, Frankenberger T (2007) The poorest and hungry: characteristics and causes. In: von Braun J, Hill RV, Pandya-Lorch R, editors. The poorest and hungry: Assessments, analyses, and actions: IFPRI 2020 book. Washington, DC: International Food Policy Research Institute. pp. 107–115. Available: http://www.ifpri.org. Accessed 2013 Dec 2.

46. ZVAC (2004) Zambia livelihood map rezoning and baseline profiling. Lusaka, Zambia.

47. ZCSO (2014) The Monthly February 2014. Zambia Central Statistical Office. Available: http://www.zamstats.gov.zm. Accessed 2014 Mar 25. doi: 10.1016/j.fsigen.2014.12.009 PMID: 25596557

48. ZCSO (2014) The Monthly November 2014. Zambia Central Statistical Office. Available: http://www.zamstats.gov.zm. Accessed 2014 Nov 30. doi: 10.1016/j.fsigen.2014.12.009 PMID: 25596557

49. Bennett EL, Blencowe E, Brandon K, Brown D, Burn RW, et al. (2006) Hunting for consensus: Reconciling bushmeat harvest, conservation, and development policy in West and Central Africa. Conservation Biology 21: 884–887.

50. CBD (2011) Incentive measures for the conservation and sustainable use of biological diversity: Case studies and lessons learned. CBD Technical Series No.56. Montreal, Canada: Secretariat of the Convention on Biological Diversity. 65 p. doi: 10.1016/j.racot.2011.11.003 PMID: 23594804

51. Gubbi S (2010) Are conservation funds degrading wildlife habitats? Economic and Political Weekly Vol XLV 26 June 2010, pp. 22–25.

52. Kgosikoma EO, Mojeremane W, Harvie BA (2013) Grazing management systems and their effects on savanna ecosystem dynamics: A review. Journal of Ecology and the Natural Environment 5: 88–94.

53. Lindsey PA, Romanach SS, Matema S, Matema C, Mupamhadzi I, et al. (2011) Dynamics and underlying causes of illegal bushmeat trade in Zimbabwe. Oryx 45: 84–95.

54. Haller T, Merten S (2008) "We are Zambians: Don't Tell Us How to Fish!" Institutional Change, Power Relations and Conflicts in the Kafue Flats Fisheries in Zambia. Human Ecology 36: 699–715.

55. IRIN (2014) Zambia: mosquito-net fishing threatens Lake Tanganyika. IRIN Humanitarian news and analysis. Available: http://www.irinnews.org/report/86565. Accessed 2014 Mar 18.

56. Weaver LC, Petersen T (2008) Namibia communal area conservancies. In: Baldus RD, Damm GR, Wollscheid K, editors. Best practices in sustainable hunting—A guide to best practices from around the world. CIC Technical Series Publication No. 1. Budapest, Hungary: International Council for Game and Wildlife Conservation. pp. 48–52.

57. Child BA, Musengezi J, Parent GD, Child GFT (2012) The economics and institutional economics of wildlife on private land in Africa. Pastoralism: Research, Policy and Practice 2:18. Available: http://www.pastoralismjournal.com/content/2/1/18.

58. Oates JF (1999) Myth and reality in the rain forest: How conservation strategies are failing in West Africa. Berkeley, California: University of California Press. 338 p. PMID: 25506965

59. Ahmed J, Bergstrom C, Bryceson I, Child B, Francis J, et al. (2001) Lessons learned: Case studies in sustainable use. International Union for the Conservation of Nature.

60. Brown T, Marks S (2007) Livelihoods, hunting and the game meat trade in northern Zambia. In: Davies G, Brown D, editors. Bushmeat and livelihoods: Wildlife management and poverty reduction. Malden, Massachusetts: Blackwell Publishing Ltd. pp. 92–105.

61. Becker M, McRobb R, Watson F, Droge E, Kanyembo B, et al. (2013) Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. Biological Conservation 158: 26–26.

62. Lewis DM (2007) Can wildlife and agriculture coexist outside of protected areas in Africa? A hopeful model and a case study in Zambia. In: Davies G, Brown D, editors. Bushmeat and livelihoods: Wildlife management and poverty reduction. Malden, Massachusetts: Blackwell Publishing Ltd. pp. 177–196.

63. Davies G, Brown D (2007) Bushmeat and livelihoods: Wildlife management and poverty reduction. Malden, Massachusetts: Blackwell Publishing Ltd. 274 p. doi: 10.1093/jxb/erm028 PMID: 25506957

64. Nasi R, Brown D, Wilkie D, Bennett E, Tutin C, et al. (2008) Conservation and use of wildlife-based resources: The bushmeat crisis. Montreal, Canada and Bogor, Indonesia: Secretariat of the Convention on Biological Diversity and Center for International Forestry Research. 50 p. PMID: 25506952

65. Brashares JS, Golden CD, Weinbaum KZ, Barrett CB, Okello GV (2011) Economic and geographic drivers of wildlife consumption in rural Africa. Proceedings of the National Academy of Sciences 108: 13931–13936. doi: 10.1073/pnas.1011526108 PMID: 21873180

66. FAO (2014) Food and Nutrition in Numbers. Rome, Italy: Food and Agriculture Organization of the United Nations. Available: http://www.fao.org. Accessed 2014 Nov 30. doi: 10.1016/j.fsigen.2014.12.009 PMID: 25596557

67. Bulletin and Record (2013) The killing fields of Zambia. Special Report. November 2013, Vol. 2. Lusaka, Zambia: Original Publishers Ltd.

68. SLCS (2013) Oct, Nov, Dec Newsletter. South Luangwa Conservation Society. Available: http://www.slcszambia.org.

69. King A (2011) No reason to conserve: Exploring the drivers and performance of wildlife conservation in Kenya. Community-based conservation: Case studies. In: Abensperg-Traun M, Roe D, O'Criodain C, editors. CITES and CBNRM Proceedings of an international symposium on "The relevance of CBNRM to the conservation and sustainable use of CITES-listed species in exporting countries". Vienna, Austria: IUCN, Gland, Switzerland and London, UK. pp. 78–85.

70. ZCSO (2014) Zambia in Figures: 1964–2014. Report. Lusaka, Zambia: Central Statistical Office. Available: http://wwwzamstats.gov.zm. Accessed 2014 Nov 30.

71. OECD (2012) African Economic Outlook. Organisation for Economic Co-operation and Development. Available: http://www.oecd-ilibrary.org. Accessed 2014 Dec 1. doi: 10.1016/j.asjsur.2012.06.010 PMID: 25554668

72. AfricaHunting (2014) Hunting Information by Country. Available: http://www.AfricaHunting.com. Accessed 2014 Dec 1.


2012 SAFARI HUNTING
REPORT
KAINDU NATURAL RESOURCES TRUST





Natural Resources Manager Green Kabinda

In the first year of safari operation Kaindu Natural Resources Trust in conjunction with the private sector and ZAWA realizes profits from Zambia's first community owned game ranch.

The results from the first year of operation have been unsurpassed in Zambia's game ranching history.

Not only has the Kaindu Game Ranch utilized over 90% of their allocated quota the trophy quality has only been matched by Zambia's prime hunting concessions. The continual support from ZAWA Research Department has to be commended as to the community scouts and Kaindu representatives who have diligently managed their natural resources.

It was recorded in the 2009 survey that only a handful of wild animals survived on the titled KNRT farm 10145 and that most indigenous species were absent. Illegal fishing and poaching was commonplace in the region.

In 2010 the KNRT entertained a partnership with the private sector in wildlife management and the company Royal Kafue Ltd was formed. The Kaindu community retains a significant shareholding in the development company and receives dividends from private sector investments in tourism.

Royal Kafue loaned the community equipment and the human resources in order to conduct safari hunting at an international standard and have attracted clientele from across the globe. The quality of hunting and the abundant wildlife has resulted in advanced bookings for both 2013 and 2014 with and estimated turnover ZK800,000,000 per annum.

From the first hunt alone the community realized a sum of ZK25,000,000, which was dedicated to social services. In addition safari licenses in excess of ZK15,000,000 were purchased and donated to the community for ceremonial purposes.

These communal lands have now become a valuable asset of which sustainable incomes can now be earned from the protection of the wildlife resource.

Green Kabinda.

KNRT NATURAL RESOURCES MANAGER.









The community game ranch saw 100% utilization of quota on trophy Lion, Buffalo, Sable, Roan, Hartebeest, Sitatunga and a host of other lesser species.

Hunting clients stated that it was without doubt one of Zambia's finest hunting destinations. Subsequent favorable reports have been posted on Internet hunting sites and YouTube. Without exception every client harvested their desired species and all of the animals were of record book class.

Two Sable measured in excess of 45 inches and the Lion was the biggest taken in the region in recent years. Two Roan in excess of 26 inches, and Buffalo of 40 inches were commonplace. The renowned professional hunter Andrew Baldry remarked that the hunting was beyond expectations and has managed to fully book his clients into the game ranch for 2013 and 2014.

The increase in wildlife and especially the more sought after species will warrant an increase in quotas across the board. Some species such a Zebra that were previously low numbers and can be included on the quota. Species such as Elephant and Hippopotamus are now resident and often seen within the vicinity of camp. Importa grasslands and woodland have been preserved from fire and logging. Whilst illegal fishing persists it is envisaged that the community will control and profit from this activity as a separate project for 2013.

Sitatunga, Black Lechwe and Tsessebe were also taken in Bangweulu swamps.

The increase in wildlife has reduced the annual livestock conflicts with Lion.



The sale of one successful Lion safari earned sufficient funds to establish the safari camp and infrastructure required for 2012 hunting season. It provided funds that enabled scouts to implement systems that reduced human and wildlife conflicts. Important species such as Lion and other fragile predator populations have increased dramatically under an intensive management program.

A special thank you must be extended to the Natural Resources Scouts who have worked tirelessly in the training in the protective management of their communal lands.



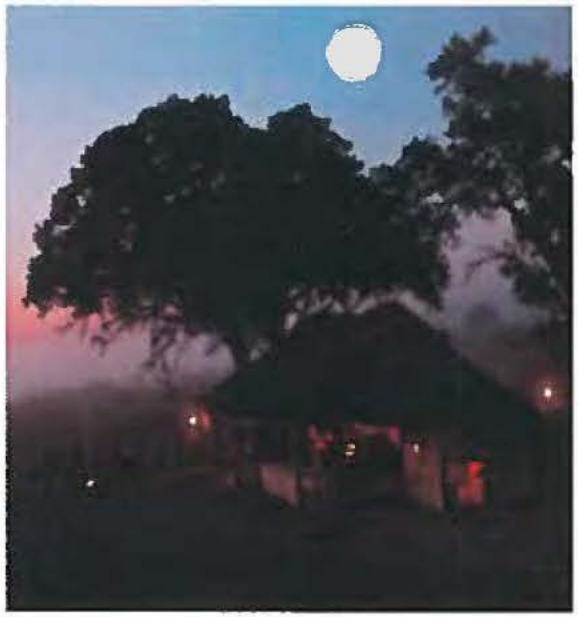
It is the community themselves with the full support of His Royal Highness Chief Kaindu who is to be commended for their desire to realize incomes from both their land sand natural resources.

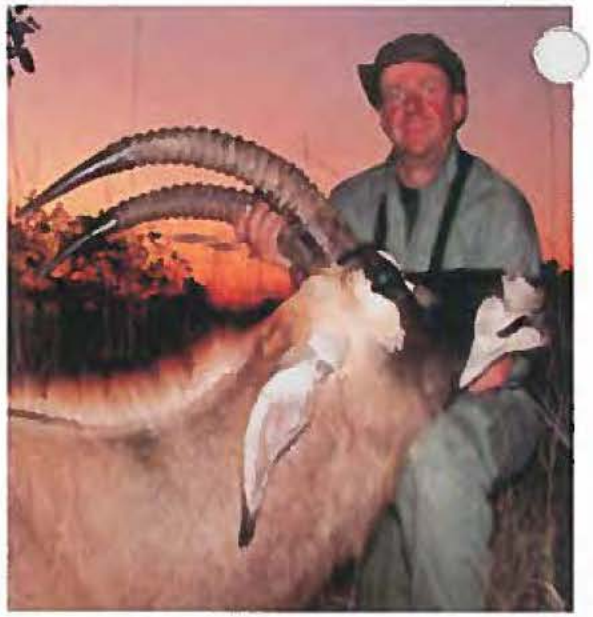
The cattle killing Lion (see photo bottom right) taken by client first client Jim Wojohowski from Alaska was one of the largest taken in recent years and proves that the community game ranch retains a healthy population of the specie.



It is envisaged that what with the increase in game populations and that research would conclude that the Lion numbers will follow suit. However as a conservation measure the KNRT feels the game ranch can sustain the off take of one mature male if proven problematic to the community.







KNRT

The Kaindu Natural Resources Trust has pursued this project since 2005. The model was initially supported by DANIDA and GRZ as Kaindu was identified as a Kafue community that did not derive benefit from safari hunting.

In 2010 the opportunity to partner the community was tendered and the successful applicants formed the development company Royal Kafue Ltd of which the community are shareholders. Safari hunting is but the first of a number of tourism activities earmarked for our lands. Profits from managed land use, tourism, game ranching and agriculture are already making a favorable impact on our society.

Our thanks to ZAWA and especially Mr. Siamakonda who has worked tirelessly to see this project launched

ROYAL KAFUE

A permanent 4 bed camp of international standards was constructed and equipped for the 2012 safari season. All staff were employed from the Kaindu community and trained in wildlife management and safari procedures by Mr. Green Kabinda and resident professional hunter Mr. Andrew Baldry.

The development company Royal Kafue Ltd loaned vehicles and auxiliary equipment.

Roads were cut and boundaries cleared. Natural resource management was implemented and staffed. Community scouts were equipped and communications installed courtesy of Mushingashi Conservancy.

The camp and the facilities are to be extended for the 2013 season

2012 CLIENT REFERENCES

JIM WOJOHOWSKI

'well done Kaindu and exceeded expectations'

RICHARD MARTIN

'my best African hunt ever. Well done'

MARK YOUNG

'congratulations to Royal Kafue and KNRT'

FAISAL AL ZAID

'never have I seen so many Sable. 10 out of 10'

TIM CARNEY

'fantastic area and people'

BEVAN JONES

'tops for Buffalo and Roan. Great hunt'



461

aindu Natural Resource Trust chairman Mr. Boniface Chisoshi sitting center with the attle killing Lion taken on the first safari by clients Mr. Jim and Joyce Wojohowski of laska. Natural Resources manager Mr. Green Kabinda is standing on the far right with his and picked team of community scouts and safari staff.

Where in Africa can one successfully hunt Lion, Roan, Sable, Sitatunga, Buffalo, Defassa Waterbuck and Hartebeest in one concession? The trophy quality was unbelievable! My ongratulations and thanks to the people of Kaindu for the most memorable and onderful safari '

Jim Wojohowski. 15 July 2012

AINDU NATURAL RESOURCES TRUST

BOX 83001 Mumbwa, ZAMBIA.

AIRMAN. Tel 0979006461

Chief Kaindu. Tel 0978146874

Royal Kafue and the Kaindu Natural Resources Trust

By Jim Wojciehowski

The year was 2007. The noise echoing across the water carried a disturbing message.

The mixture of human voices and cattle, coupled with rising smoke from campfires and drying racks, explained the complete lack of wildlife.

PH Andrew Baldry witnessed the spectacle from across the river in the Lunga Luswishi Game Management Area (GMA). He watched a piece of wild Africa rapidly being depleted of its resources with no plan for the future.

The land was owned by the Kaindu community and the title held by a trust – the Kaindu Natural Resources Trust, initially formed by the Danish International Development Agency; but the project floundered when the donors pulled out. The squatters that Baldry observed were not from the community.

Baldry, a fully licensed professional hunter for over 15 years, was very aware of the African adage: "If it pays, it stays." If the local game did not produce a sustained income for the local community, little could be done to stem the poaching and the rapid depletion of the area's wildlife resources.

Andrew made a plan to revive the once flourishing Eden. With the backing of the local community and chief, the concept eventually evolved into Royal Kafue, which would host its first-ever safari in June 2012.

With adequate financial backing, at least for the start-up, Andrew entered into a lease agreement with the community Trust, and instituted anti-poaching patrols by hiring local scouts who would be led by an infamous ex-commercial bush poacher, Green. Who is better suited to outwit a poacher than someone who knows all the tricks of the trade? Green's amazing tracking skills and knowledge of the local habitat also qualified him as head tracker once the safari camp opened for operation.

I first contacted Andrew about hunting together in the Luangwa Valley in 2010. The topic of what would become Royal Kafue came up via e-mail.

Royal Kafue was already in the works, but Andrew felt it would take at least four years for the area to begin to rebound: initially, he didn't want to inject any hunting pressure into the mix. But he was delighted with the rapid returning of game. He knew cats wouldn't return unless ample prey and cover existed.



After allowing the game in the "Kafue Royal" area several years to recover, in 2012 PH Andrew Baldry (L) successfully hunted lion with Jim Wojciehowski (R), generating income from hunting for the Kaindu Natural Resources Trust.

He'd secured a lion and a leopard on quota, plus a limited number of plains game. His assessment of the conditions was totally honest: "Expect game to be difficult to see in June and July. I plan on leaving the majority of the tall grass to give the cats cover."

I sent my money, including a sizable amount to cover trophy fees. It was obvious this start-up was financially taxing with no large financial backers. The many Skype conversations with Andrew gave me a feeling of trust in this man, as well as a drive to be part of this project, myself.

A partnership of need brought together PH Andrew Baldry, my wife Joyce, and me; but the true benefactor of this alliance is the wildlife of Royal Kafue and the community of Kaindu.

By the time we arrived in camp in June 2012, the game had returned in numbers far exceeding the hopes of Andrew and Green. They had prepared the area perfectly by selective burning, interspacing these areas with lush grass cover. Even the once transient buffalo population remained resident for our entire 21-day safari. And with the buffalo came the lion.

We heard lion regularly calling at night, and on the 15th morning in camp, while enjoying coffee in the predawn coolness, we heard them as they moved toward camp. As the light increased, the sound became louder.

We quickly grabbed our rifles and headed down the road on foot to try and intercept the moving chorus. The calls came from a hunting coalition of four mature lions – three males and a female. The group had decimated one of our baits; on their way to water, they were now approaching camp.

The lions hid as we passed on foot. The sound of brush moving behind our group made us turn in time to see two large, heavy-maned mature males and a lioness emerge from cover. The cats deemed us to be insignificant and crossed an open area into the tall grass. A fourth lion revealed himself to be a brute of a male and, with Andrew's challenging grunt, he stopped to evaluate the source of the call.

My frontal shot buckled the cat, and he spun to retreat noisily into cover. We found him dead 100 yards on, in deep cover, after a tense side-by-side follow-up on foot.

Luckily, the chairman and treasurer of the Kaindu Trust, Boniface and Joshua, were in camp and able to join the celebration. Later, they privately thanked me for helping to finance the start-up and contributing to its success. I assured them PH Andrew Baldry alone had earned their gratitude for the implementation of his vision.

Two months after the hunt, Andrew told me of his plans to sink boreholes to provide permanent water for the game. He is looking to attract like-minded investors to further the cause of Royal Kafue for the benefit of the game and the people of Kaindu.

Jim Wojciehowski is a physician assistant living in Alaska. An avid hunter-conservationist, he discovered the magic of Africa on his first trip in 2010. This was his third safari.

FIELD MANUAL TO FACILITATE LION STUDY IN NATIONAL PARKS, GAME MANAGEMENT AREAS AND OPEN AREAS IN ZAMBIA



ZAMBIA WILDLIFE AUTHORITY

CITATION

Field manual to facilitate lion study in National Parks, Game Management Areas and Open Areas in Zambia

Zambia Wildlife Authority
P/B 1
Chilanga
Tel. +260 01 278524
E-mail: info@zawa.org.zm

Compiled By

Kampamba G. and Chansa W.

June 2005

ACKNOWLEDGEMENTS

Accomplishing a task of this magnitude involves great sacrifice of staff time and enormous concentration. For this reason, the Zambia Wildlife Authority wishes to particularly thank the authors of this document Messrs George Kampamba and Wilbroad Chansa and the reviewers Messrs, Hopeson Simwanza, Changwe Kunda, Francesca Chisangano and Dr. Siamudaala. Mr. Chaka Kaumba prepared the distribution maps for which we all pay tribute for his competence and skill and Mwaka Nanyangwe Himoonde for typing the original manuscript.

FOREWORD

Lion is a species that require little description. It is a magnificent animal, which has been used as a symbol of power, courage and nobility on family crests, coats-of-arms, and national flags in great many civilizations. The lion's splendour is indeed undeniable. It is intimately connected with human history and has been killed in rituals of bravery and for their supposed powerful medicinal and magical effects.

In conservation of biodiversity, the lion occupies a top notch of the trophic level as a super predator keeping in check ungulates populations there by maintaining healthy populations of prey species. In tourism, it is important as one of the big five in photographic tourism and is a valued trophy animal in sport hunting. For this latter reason the species is part of the classical safari package. This signifies the species' importance in conservation of biodiversity, folk-role and sport.

Despite its nobility, and the important role it plays in the ecosystem, the species has been progressively exterminated in many parts of Zambia as a livestock marauder and is now almost confined to National Parks and Game Management Areas and few open areas adjacent to Protected Areas.

Zambia has been a source of quality lion trophy from our Game Management Areas, which is an indicator of a good stock of superior genes and a healthy lion population. Despite the quality trophies, the national population estimate remains uncertain. This presents a major challenge to managers and members of the hunting fraternity in ascertaining the sustainability of the consumptive utilization of the species.

This field aid will assist managers, members of the hunting fraternity, tour operators, Non-Governmental Organizations and individuals interested in the conservation of biodiversity, hobbyists, tourists and others interested in lion studies to help Zambia Wildlife Authority in this noble task of data collection. It is believed that over the next few years, we should be in a position to provide accurate population estimates and dispel the fears of the currently suspected over utilization of the species.

I am now happy to launch this field aid and hope that it will be put to good use in the field.

TABLE OF CONTENTS

ZAMBIA WILDLIFE AUTHORITY 1
CITATION 2
ACKNOWLEDGEMENTS 4
FOREWORD 5
TABLE OF CONTENTS 6
2.0 BACKGROUND 7
2.1 Taxonomic Notes 7
2.2 Distribution 8
2.2.1 Distribution in Zambia 10
3.0 POPULATION STATUS 11
3.1 Continental Estimates 11
3.1.1 Estimates for Zambia 11
3.1.2 Continental distribution by country 11
4.0 PROTECTION STATUS 12
5.0 BIOLOGY OF THE SPECIES 12
5.1 Reproductive Season 12
5.2 Estrus 12
5.3 Gestation 12
5.4 Litter size 12
5.5 Cub Mortality 12
5.6 Interbirth interval 13
5.7 Age at Maturity 13
5.8 Age at first Reproduction 13
5.9 Age at last Reproduction 13
5.10 Sex Ratio 13
5.11 Size of Pride 14
5.12 Number of Males in a Pride 14
5.13 Major Prey Species 14
5.14 Longevity 14
5.15 Lion Densities 14
5.16 Home Range Size 15
6.0 COUNTING LIONS 15
6.1 Difficulties in Counting Lions 15
6.2 Common methods used to determine population size 15
6.2.1 Aerial Survey 15
6.2.2 Ground Counts 15
6.2.3 Counts of Calls, Faeces, Footprints, or Food remains 16
6.2.4 Capture-Mark – Release- Recapture Method 16
6.2.5 Individual Recognition 16
7.0 STUDYING LION MOVEMENTS 17
8.0 LION STUDY PARTICIPANTS 17
REFERENCES ..... **Error! Bookmark not defined.**

1.0 INTRODUCTION

The commencement of this initiative to conduct Lion study is based on the current international pressure to amend the Appendix listing for lion from Appendix II to Appendix I of CITES. At COP 13 held in October 2004 in Bangkok Thailand, the Republic of Kenya submitted a proposal to amend the Appendix listing from Appendix II to I of CITES. Uplifting of lion to Appendix I of CITES would subject the species to the stringent provisions of Article III of the Convention text of CITES, which delimits commercial exploitation of the species. Despite the lack of accurate estimates of the lion population in the country, Zambia feels that the species does not qualify for an instantaneous uplifting to Appendix I. Un justified uplifting of lion to Appendix I would have serious ramifications on the Safari hunting industry in Zambia. As we all know, lion is an important component in the classical safari and its removal would distort the classical package/bag. This would present serious challenges and present areas of potential litigation by safari companies with valid concession agreements and would eventually lead to loss of revenue to ZAWA and the local communities.

In view of the foregoing, Zambia as a range state is required to collect reliable and systematic data on the status of lion in the country. This data will be used in the effective and efficient conservation of the species countrywide and to justify the lions' retention in Appendix II or ascension to Appendix I at COP 14 or other subsequent COPs.

We are all therefore required to participate in the collection of data using standard methods outlined in this field manual and other scientifically approved methods.

2.0 BACKGROUND

The African Lion (*Panthera leo,* Linnaeus 1758*)* is the largest cat in Africa only surpassed by the Tiger of Asia in size. Some authorities have recognized about 9 ssp with 7ssp in Africa (Haltenorth and Diller 1986). Of these, the most northern, the atlas or Barbary lion (*Panthera leo leo,* Linnaeus 1758) and the southern most the Cape lion *Panthera leo melanochaita,* Smith 1842*)* are extinct. Elsewhere the species is more or less threatened.

2.1 Taxonomic Notes

A number of races have been described. These remain debatable as there is a wide range of individual variation even within the same population (Dandelot and Dorst 1979). Hemmer (1974b), summarized 9 ssp as follows:
Panthera leo azandica (Allen 1924) Northern Congo DRC;
Panthera leo bleyenberghi (Lonnberg 1964) Shaba Kasai woodland Savannah regions of southern Congo DRC and presumably also neighbouring parts of Zambia and Angola;
Panthera leo krugeri (Roberts 1929) Kalahari region east of the Transvaal and Natal regions of the Republic of South Africa;

Panthera leo leo (Linnaeus 1758) Coastal woodlands of Morocco through Tunisia- Extinct;
Panthera leo melanochaita (Smith 1842) Cape region of South Africa- Extinct;
Panthera leo nubica (de Blainville 1843) North east and east Africa, includes *massaica* (Neumann, 1900); *somaliensis* (Noack 1871) and *roosevelti*, (Heller 1913);
Panthera leo persica (Meyer, 1826) From Iraq to central India in the 19th Century, now restricted to Gir Forest in India; and
Panthera leo senegalensis (Meyer 1826) West Africa east to the central African republic.

O'Brien *et al* (1987b) analysed samples from captive African lions and from wild lions of Tanzania's Serengeti National Park and South Africa's Kruger National Park and suggested that they were of sufficient genetic similarity to warrant sub summation into a single African race *Panthera leo leo*

2.2 Distribution

Lion was once widely distributed in Europe, Asia, and northern Holarctic to Mid and N.W. South America (Skinner and Smithers 1990; Haltenorth and Diller 1986). Currently, the species still occurs in all parts of Africa (apart from the rain forest belt).
In Asia it occurred in the following areas: Sinai, Arabia, Iraq, Asia minor, Greece, Iran, Baluchistan, N. and Mid India. Now extinct in Asia apart from a relict population in Gir Forest Reserve in Kathiawar in India. The current distribution in Africa is limited to Africa south of the Sahara as shown in Figure 1 below.



Figure 1 Lion Distribution in Africa (Source IUCN 1996)

9

2.2.1 Distribution in Zambia

Lion was previously distributed through out Zambia. In the last few decades the lion distribution has been greatly modified by shooting and snaring. As great wanderers and vagrants often occurring far from their areas of occurrence they end up being shot as pests. Important populations now remain in the following areas; Luangwa system, Kafue system, mid Zambezi system, west Zambezi system and Nsumbu – Mweru wa Ntipa system (ZAWA records 2005) see Figure 2 for details.

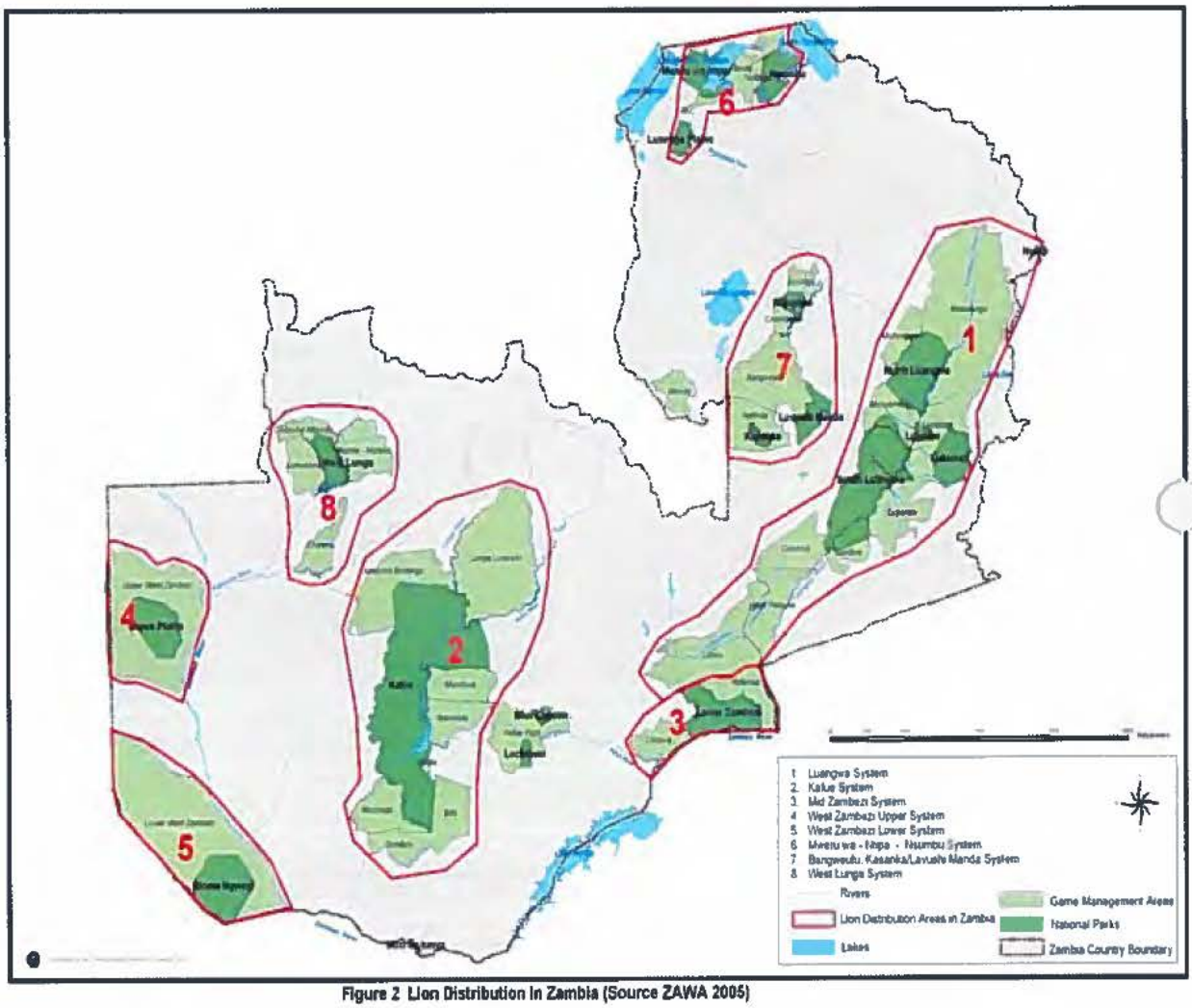


Figure 2 Lion Distribution in Zambia (Source ZAWA 2005)

3.0 POPULATION STATUS

3.1 Continental Estimates

There are no good estimates of the total number of lions in Africa. Guess estimates range from 30,000 to 100,000 (IUCN 1996).

A 2004 inventory of available information on *P. leo* provided a conservative estimate of 23,000 free-ranging lions, with a range of 16,000 to 30,000 (Bauer and Van Merwe 2004). This shows a significant departure from the IUCN's 1996 estimate of 30,000 to 100,000.

Many countries including Zambia have disputed the recent estimate of 23,000 free ranging lions. This is because no systematic studies or data collection was done in many countries.

3.1.1 Estimates for Zambia

The estimate for Zambia was put at 1,500 (1,000-2000) thus covering Kafue National Park, Luangwa valley and Lower Zambezi (CITES 2004). This was an off guard estimate as the figure cannot be authenticated, because it did not state the source of information and the methodology used in counting and does not cover the entire lion range. For instance, the report did not include GMAs and other areas of the country where the lion is found. This estimate therefore remains unacceptable.

3.1.2 Continental distribution by country

Countries in which lions still remain relatively widespread are: Botswana, Central African Republic, Ethiopia, Kenya, Tanzania, Congo DRC., Zimbabwe and Zambia. Angola, Mozambique, Sudan, and Somalia could have widespread populations but the long history of civil unrest has prevented scientists from gathering information. With the peace returning to these countries, it will soon be possible to complete the otherwise missing link.

Sparse distribution have been recorded in Benin, Burkina Faso, Cameroon, Chad, Congo, Ivory Coast, Ghana, Guinea, Guinea Bissau, Mali, Nigeria and Uganda.

Countries in which populations are essentially restricted to Protected Areas are: Burundi, Malawi, Niger, Rwanda, Senegal and the Republic of South Africa.

Countries in which lions are believed to be extinct are: Djibouti, Gabon, Lesotho, Mauritania, Swaziland and Togo (IUCN 1996).

4.0 PROTECTION STATUS

The species is currently in Appendix II of Cites. All international trade in the specimens of the species is conducted within the framework of Article IV of CITES. Trophy hunting is permitted in Botswana, Namibia, South Africa, Tanzania, Zambia and Zimbabwe. In other countries, hunting is either prohibited or restricted to control of problem/dangerous animals.

5.0 BIOLOGY OF THE SPECIES

5.1 Reproductive Season

Reproduction is not limited seasonally (Haltenorth and Diller 1986); The species breeds through out the year (but peak is about January in the Kafue and Luangwa areas of Zambia (Mitchell and Ansell, 1978); Bertram (1975a) noted seasonality, February-April-weak and March-July as strong.

5.2 Estrus

Females are polyoestrus with estrus lasting 4-16 days (Skinner and Smithers, 1990); 4-8days (Haltenorth and Diller 1986). Have postpartum oestrus and can conceive if litter dies but cannot if litter survives.

5.3 Gestation

Stuart and Stuart (2000), Skinner and Smithers (1990) recorded 110 days; 102-113 days (Haltenorth and Diller, 1986); 105 days (McCalaugh 1989, Smithers 1966); 100-114 days (Cooper 1942); 108 days (Mitchell and Ansell, 1978).

5.4 Litter size

Litter size usually 1-6 (Packer 1987, Haltenorth and Diller 1986); 1-4 (Skinner and Smithers 1990); 2-6 Dorst and Dandelot, 1979); 2-3 (Klevansky 2000); Usually six cubs are born (Stuart and Stuart, 2000). Our analysis is that there is a general agreement of 1-6 cubs.

5.5 Cub Mortality

Mortality rate is very high until two years of age (Dorst and Dandelot 1979); Mortality is high depending on how well the mother looks after her cubs (Klevansky, 2000); Cub mortality is high 50% survival rate recorded for Kruger, 40% survival rate for Mashatu Game Reserve in Botswana. If prey is plentiful, the cubs get enough to eat, if not they starve. Starvation and predation are the main causes. Leopard, hyaena, eagles and other non-pride lions take a heavy toll from 50-80% (McCalaugh 2000). Mortality of cubs is rather high in lions and is linked chiefly to periods of prey scarcity, infanticide, abandonment of cubs by mothers especially when food is scarce.

Across the range of habitats mortality rates ranges from 14 to 73% (Skinner and Smithers 1990).
There is a general agreement that infant mortality is high particularly when food is scarce. It is also documented that prides without males in constant attendance fail to rear any cubs (Skinner and Smithers 1990).

5.6 Interbirth interval

Eleven to twenty five months if previous litter survives to maturity; 4-6 months if previous litter is lost (Pusey and Packer1987). Average number of births per female is 5.

5.7 Age at Maturity

Lions become sexually mature at 18months though females may mature earlier. Become capable hunters at 2 years (McCalaugh 1989). Dorst and Dandelot (1979) recorded that lions mature at 18months but are not fully adult until 3years. Haltenorth and Diller (1986) recorded that the lions mature at 18 months but are only fully grown at 5-6yeras.

Males leave their natal pride at 2-4 years (Bertram 1975a) but they may be forced out much earlier 13-20 months when there is a pride take over (Hanby and Bygott 1987). Median age for dispersal of females is 2.5 years, though 75% of dispersers range 1.5 – 3.75 years of age (Nowell and Jackson 1996).

5.8 Age at first Reproduction

Onset of spermatogenesis begins at 30 months, but males generally establish pride tenure at 4-4.5 years (Pusey and Packer 1987). Females begin mating at 24 months, but successful first reproduction generally only happens when pride membership is established. Females, which remained in the pride in Serengeti, first gave birth at 5 years. Females, which dispersed from their natal pride, first successfully raised their litter at an average age of 8 years (Pusey and Packer 1978).

5.9 Age at last Reproduction

Female reproductive performance starts to decline at 11 years and probably virtually ceases at 15 years (Packer *et al* 1988). Sixteen (16) year old males can still produce viable sperm but reproduction probably completely ceases after pride tenure is lost.

5.10 Sex Ratio

Sex ratio at birth is parity 1:1 (Skinner and Smithers 1990). Prenatal 1 Male: 0.9 females, but adult (5years +) 1: 2.1 females. Adult sex ratios are typically heavily weighed in favour of females. The skew does not seem to be related to food supply or density, but rather to differential rates of maturation, mortality and emigration between sexes.

5.11 Size of Pride

Pride sizes (measured by number of adult females) are smallest in very arid environments mean 2.2 in South Africa's Kalahari Gemsbok National Park (Eloff 1973a); otherwise average between four to six (Stander 1991). In Luangwa and Kafue areas of Zambia, pride size rarely exceeds 8 to 10 (Mitchell and Ansell 1978). Pride size is positively correlated with lean season prey abundance. In Ngorongoro Crater where prey is abundant year round, groups of up to 20 or more adult females have been observed (IUCN 1996). Stuart and Stuart (2001) recorded that across the different types of habitat, pride sizes vary from 3 to 30.

5.12 Number of Males in a Pride

A single male or a coalition of males up to 7 or slightly more holds tenure over one or more prides. Average tenure is 2-3 years some times more (Packer 1988). A large coalition of males of 4-6 or more maintains tenure more than twice as long as 1-2 males (Bygott 1979).

5.13 Major Prey Species

Major prey species recorded in east and southern Africa are; buffalo, zebra, wildebeest, roan antelope, sable antelope, springbok, gemsbok, kob, impala, warthog, waterbuck, and hartebeest. While medium to large sized ungulates make up the bulk of their diet, lions like leopards are generalist hunters and will take a wide range of prey from rodents, young rhinos, giraffe, hippos and baby elephants.

5.14 Longevity

Lions can live from 25-30 years, but average is 13 years (Guggisberg 1961). Normally lions live between 13-15 years, in captivity up to 30 years (Haltenorth and Diller 1986, Dorst and Dandelot 1979).
Normally live an average of 13 years, longer for females, although up to 30 years has been recorded in captivity (McCalaugh 1989).

5.15 Lion Densities

Reported lion densities (measured according to number of adults and sub adults per $100KM^2$) range from 0.17 in Chobe National Park Botswana to 3-10 and up to 18 in east and southern African Protected Areas (Viljoen P.C. 1993; Makacha and Schaller 1969). Probably one of the highest known densities is in Masaai Mara National Reserve in Kenya estimated at 30/100km.^{2}

5.16 Home Range Size

Average pride home range size vary from 26 to 226km^2 (Viljoen 1993) and can be considerably larger as reported in Etosha National Park of 2,075km^2 (Stander 1991).

6.0 COUNTING LIONS

Generally there is no suitable single method for counting lions. The study requires a cocktail of approaches to achieve reliable results. Some methods are more reliable than others but each method has its own advantages and disadvantages.

6.1 Difficulties in Counting Lions

(a) Lions are generally not as abundant as prey species on which they depend. Their relative scarcity makes all the information on lions worth having even if collected in a nonsystematic manner (Bertram 1979).

(b) Lions are difficult to see. They are often well camouflaged and usually remain hidden. One needs experience or the knowledge and assistance of those familiar with the species to spot and areas to look for them.

(c) Lions are often nocturnal. Most of their activities being done at night making it difficult to observe them. Instruments for night vision are available but expensive for most African countries including Zambia.

(d) Lions are dangerous. An observer must be careful and study them with caution.

6.2 Common methods used to determine population size

As indicated above, lions are difficult to census and despite the various conventional methods, there are several drawbacks in each method. A combination of methods is recommended.

The following methods are commonly used:

6.2.1 Aerial Survey

Except in extremely open country, most lions are not visible from the air. By day they tend to be concealed in thick vegetation and can easily be overlooked if in the shade or when inactive. It is however recommended that lions seen during the aerial surveys should be noted, and GPS location taken.

6.2.2 Ground Counts

Ground counts for lions are better done from a vehicle. Fewer animals are probably missed as the observer can stop to investigate any suspicious object or movements.

Nonetheless, most animals are still missed particularly where vegetation is thick limiting visibility. This method is most suitable for areas with open country, such as the Liuwa Palain.

6.2.3 Counts of Calls, Faeces, Footprints, or Food remains

Here the observer looks for things associated with the animal such as; calls, droppings, footprints, for food remains.
The advantage for this method is that even if the animal hides in thick vegetation it will be unable to conceal its signs.
The disadvantage is that one does not obtain an absolute value for population size, but a minimum figure. Not all individuals call (at the time the observer is looking for them), not all droppings nor footprints are found. The method needs to be calibrated first in areas of known populations. This has not been done in Zambia.
The other disadvantage is that lion droppings are not as easy to see as hyaena faeces, which are white and visible.

6.2.4 Capture-Mark – Release- Recapture Method

Bertram (1979) recommended cutting of notches in the ears as being one of the most effective ways of marking lions. Freeze marking causing a small permanent patch of white hair is another effective method, which has been used on lions (Lecture notes 1986, 1992). In lions there is no need of recapturing as the mark can be seen on the free-living animal, which saves time and money.

This method yields reliable figures for population size provided that the animals move and intermingle and the sightings or recaptures are done randomly with respect to their movements.

The disadvantage is that this method is difficult and time consuming, particularly the component of capturing and marking. Lion prides may not mingle with neighbouring prides. Under such circumstances it is difficult or impossible to re-sight randomly with respect to the marked animals.

An intermediate method between the mark release recapture method and the individual recognition method has been used successfully with lions in the Kruger National Park.

6.2.5 Individual Recognition

This is probably one of the most accurate ways of determining population size by recognizing all animals in the population individually, where this is practicable.

Individual lions are recognized by scars on the face, missing teeth, arrangement of whisker spots, tears in the ears, size and colour of the mane if any, tail tuft missing, a blind eye and any other body marks.

Note that in a population containing a proportion of individually recognized animals, a recognize- re-recognise method can be applied whose principle is the same as for the Mark-Recapture Method.

7.0 STUDYING LION MOVEMENTS

There are three commonly used methods:

(a) plotting positions of known or marked animals when ever they are found;
(b) continuously following individual animals; and
(c) by radio tracking them so that they can be found at intervals decided by the observer.

All the three methods and others have relative advantages and disadvantages. The best way is to use a combination of methods.

8.0 LION STUDY PARTICIPANTS

- Regional Mangers
- Park Managers
- Ecologists
- Area wardens
- Park Rangers
- Wildlife Police Officers
- Tour operators
- Professional Hunters
- Tour Guides
- Park Visitors
- Safari Operators
- Community Resource Board Members
- Non Governmental Organisations
- Individuals with interest
- External Researchers
- Others not covered above

The staff indicated above will be required to fill in the sighting form provided in Appendix I. Safari Operators will also be required to fill in the trophy size form provided in Appendix II.

REFERENCES

Bauer, H. and Van Der Merwe, S. 2004 *Inventory of free ranging lions Panthera leo* in Africa. *Oryx 38: 26-31.*

Bertram, B.C.R. 1975a The social system of a lions. *Sci. Am. 232-: 54-65.*

Bertram, B.C.R. 1975b Social factors influencing reproduction in wild lions. *J. Zool. 177: 463-482.*

Bertram, B.C.R. 1979 *Studying predators.* African Wildlife Foundation, Nairobi.

Chapman, J.L. and Reiss, J.M. 2000 Ecology, Principles and Applications. Cambridge University Press, Cambridge.

CITES COP 13 2004 *Proposal to transfer Panthera leo from Appendix I to II.* Proposal presented by the Republic of Kenya at the 13th Conference of the Parties to CITES, Bangkok Thailand, October 2004.

Cooper, J. 1942 *An explanatory study of African lions.* Comp. Phychol. Monograph 17 (7): 1-48. IN: IUCN 1996 Status survey and Conservation Action Plan, Wild cats. IUCN/SSC Cat specialist group, Gland.

Dandelot, P. and Dorst, J. 1979 *A Field guide to the larger mammals of Africa.* Collins, London.

Elof, F.C. 1973a Lion predation in the Kalahari Gemsbok National Park. *J.Sth. Afr. Wildl. Mgt. Ass. 3 (2): 59-63.*

Guggisberg, C.A.W. 1961 *Simba: the life of a lion.* Howard Timmis, Cape Town.

Haltenorth, T. and Diller, H. 1986 *A field guide to the Mammals of Africa including Madagascar.* Collins, London.

Hanby, J.P. and Bygott, J.D. 1987 Emigration of subadult lions. *Anim. Behav. 35: 161-169.*

Hemmer, H. 174b *Studies of the phylogenic history of the pantherines.* In: Status survey and Conservation Action Plan, IUCN. Gland.

IUCN 1996 *Status survey and Conservation Action Plan,* Wild cats. IUCN/SSC Cat specialist group, Gland.

Klevansky, R. 2000 *Nature fact file, Big cats.* Southwater, London.

Makacha, S. and Schaller, G.B. 1969 Observations on lions in Lake Manyara National Park, Tanzania. *E. Afr. Wild. J. 7: 99-103.*

McCalaugh, W.D. 1989 *Wildlives, Profiles of east African Mammals.* African Wildlife Foundation, Nairobi.

Mithchell, B.L. and Ansell, W.F.H. 1978 *Wildlife of Kafue and Luangwa.* Zambia National Tourist Bureau, Lusaka.

Mweka lecture notes 1986 *Mammalogy Diploma Lecture notes.* College of African Wildlife Management, Mweka.

O'Brien, S.J., Joslin, V., Ott-Joslin, P. Wildt, D.E. and Bush, M. 1987b, Biochemical genetic variation in geographic isolates of African and Asian lions. *Nat. Geog. Res. 3 (1): 114-124.*

Packer, C. 1987 Intrasexual cooperation and sex ratio in African lion. *Am. Nat. 130: 636-642.*

Packer, C., herbst, L., Pusey, A.E., Bygott, J.D., Hanby, J.P., Cairns, S.J. and Borgerhoff-Mulder 1988 *Reproductive success of lions.* Pp. 363-383. In: Clutton-Brock, T.H. ed. Reproductive success. Univ. Chicago Press, Chicago.

Pusey, A.E., and Packer, C. 1987 The evolution of sex biased dispersal in lions. *Behaviour 101: 275-310.*

Skinner, D.J. and Smithers, R.H.N. *1990 The Mammals of the southern African region.* University of Pretoria, Pretoria.

Smithers, R.H.N. 1966 *The mammals of Rhodesia, Zambia and Malawi.* Collins, London.

Stander, P. 1991 Demography of lions in the Etosha National Park. *Madoqua 18: 1-9.*

Stuart, C. and Stuart, T. *2001 Field guide to Mammals of southern Africa.* Struik Publishers, Cape Town.

University of Dar es salaam lecture notes 1992.

Viljoen, P.C. 1993 *The effects of changes in prey availability on lion predation in a large natural ecosystem in northern Botswana.* In: Dunstone, N. and Gorman, M.L. eds. Mammals as predators. *Proc. Symp. Zool. Soc. Lond. 65*, Clarendon Oxford.

Appendix I Lion Sighting Form

National Park.....
Game Management Area.....
Open Area.....
Name and profession of recorder.....

Sighting Number	Date	Time	Pride Size and Structure					Pride Identity Code	Total Number of non pride males	General description of the area	GPS Location	Activity
			Total number	Number of adult males	Number of adult females	Number of sub adults	Number of cubs					

Pictures are also required where possible.

Notes

Age determination in the field

It is not possible to accurately determine the age of a lion in the field. However, lions can be classified into age groups or age categories based on size, and for adults on colour of teeth and tooth wear. The classification based on size is some how arbitrary.

Activities

These will include; resting, feeding, walking, chasing/hunting etc.

Pride Identity Code

Identity code can be by Name(s), Number or a combination of both.

Appendix II **Trophy size Record Form**

Name of Company.....
Game Management Area and Hunting Block.....
.....

Number of Years Company has operated in the GMA.....
Number of Years Company has operated in (a) Zambia.....(b) Africa.....
name country(ies) and years in which company has operated other than Zambia.....
.....
Name and Profession of recorder.....

Year	Specimen Number	Measurements (Inches and Centimetres)		Mean per year		Hunting Area		Remarks
		Body	Skull (Length and Width)	Body	Skull	GMA	Hunting Block	
2004	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
2003	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
2002	1							
	2							
	3							
	4							
	5							

	6							
	7							
	8							
	9							
	10							
2001	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
20000	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
1999	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
1998	1							
	2							
	3							
	4							
	5							
	6							

	7							
	8							
	9							
	10							
1997	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
1996	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
1995	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
1994	1							
	2							
	3							
	4							
	5							
	6							
	7							

	8							
	9							
	10							
1993	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
1992	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
1991	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
1990	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							

	9							
	10							
1989	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
1988	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
Total								
Mean								

The United Nations Development Programme, under the Environmental Protection and Natural Resources Management Programme provided financial support to print this document.

Cartographic and GIS: Zambia Wildlife Authority.

SHORT SUMMARY OF CONCLUSIONS OF THE 75TH MEETING OF THE SCIENTIFIC REVIEW GROUP ON TRADE IN WILD FAUNA AND FLORA[1]
7 MARCH 2016

The SRG took the following decisions2 under Articles 4.1(a)(i) and 4.2(a) of Council Regulation (EC) No. 338/97:

1) Negative opinions[3] for import of specimens from the following species / country combinations:

Brookesia minima	Madagascar
Brookesia nasus	Madagascar
* *Trioceros pfefferi*	Cameroon (agreed by written procedure on 18/02/16)
Zygosicyos pubescens	Madagascar
Euphorbia subpeltatophylla	Madagascar
Senna meridionalis	Madagascar

2) Negative opinions[3] for import of specimens from the following species / countries combinations confirmed / maintained – NOT to be formalised in the Regulation prohibiting the introduction in the EU:

Loxodonta africana	Tanzania (Hunting trophies)

3) CITES recommendations for trade suspensions to be formalised in the Regulation prohibiting the introduction in the EU based on:

Pandinus imperator	Ghana (R)

4) Confirmation of current prohibitions as listed in Commission Implementing Regulation (EU) 2015/736

Varanus beccarii	Indonesia
Morelia boeleni	Indonesia
Cuora amboinensis	Malaysia
Indotestudo forstenii	Indonesia
Tridacna crocea	Viet Nam

1 It is understood that the above opinions are also those of each Member State's Scientific Authority and will be reflected in any opinion given in relation to the application of Art. 4.1(a) and 4.2(a) of Regulation 338/97. These opinions will remain valid unless or until circumstances related to the trade or conservation status of the species change significantly

2 Unless specifically stated otherwise, all decisions relate to wild specimens.

3 Recommendation based on the following guidelines: The species is in trade or is likely to be in trade, and introduction to the Community from the country of origin at current or anticipated levels of trade is likely to have a harmful effect on the conservation status of the species or the extent of the territory occupied by the species.

Tridacna derasa	Palau
Tridacna squamosa	Viet Nam
Cypripedium japonicum	China
Cypripedium japonicum	South Korea
Cypripedium micranthum	China

5) No opinion for import of specimens of the following species / countries combinations

Rationale for the "no opinion":

i) No trade anticipated: The species is not currently (or is only rarely) in trade, and no significant trade in relation to the conservation status of the species is anticipated

ii) Decision deferred: There are insufficient data on the species.

iii) All applications to be referred to SRG: The species is not currently (or is only rarely) in trade, but significant trade in relation to the conservation status of the species could be anticipated.

Ovis ammon karelini	Kyrgyzstan [ii)]
Ovis ammon severtzovi (currently valid name *Ovis vignei severtzovi)*	Kyrgyzstan [ii)]
Falco cherrug	Bahrain [i) 4]
Hieraaetus spilogaster	Tanzania [iii)] All applications to be referred to the SRG
Balearica regulorum	Rwanda [i) 4]
Psittrichas fulgidus	Indonesia [i) 4]
Psittrichas fulgidus	Papua New Guinea [i) 4]
Brookesia brygooi	Madagascar [ii)]
Brookesia stumpffi	Madagascar [ii)]
Calumma ambreense	Madagascar [iii) 4] All applications to be referred to the SRG
Calumma capuroni	Madagascar [iii) 4] All applications to be referred to the SRG
Calumma cucullatum	Madagascar [iii) 4] All applications to be referred to the SRG
Calumma furcifer	Madagascar [iii) 4] All applications to be referred to the SRG
Calumma guibei	Madagascar [iii) 4] All applications to be referred to the SRG
Calumma hilleniusi	Madagascar [iii) 4] All applications to be referred to the SRG
Calumma linota	Madagascar [iii) 4] All applications to be referred to the SRG
Calumma peyrierasi	Madagascar [iii) 4] All applications to be referred to the SRG

[4] The decision will come into effect when this species / country combination will be removed from the Suspension Regulation.

Calumma tarzan	Madagascar [iii] [4] All applications to be referred to the SRG
Calumma tsaratananense	Madagascar [iii] [4] All applications to be referred to the SRG
Calumma vatosoa	Madagascar [iii] [4] All applications to be referred to the SRG
Furcifer balteatus	Madagascar [iii] [4] All applications to be referred to the SRG
Furcifer belalandaensis	Madagascar [iii] [4] All applications to be referred to the SRG
Furcifer monoceras	Madagascar [iii] [4] All applications to be referred to the SRG
Furcifer tuzetae	Madagascar [iii] [4] All applications to be referred to the SRG
Furcifer nicosiai	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma antanosy	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma barbouri	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma flavigularis	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma klemmeri	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma pronki	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma seippi	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma serraticauda	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma berghofi	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma hielscheri	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma malamakibo	Madagascar [iii] [4] All applications to be referred to the SRG
Phelsuma masohoala	Madagascar [iii] [4] All applications to be referred to the SRG
Varanus spp.	Malaysia [ii] (confirmed)
Batagur borneoensis	Brunei Darussalam [iii] [4] All applications to be referred to the SRG
Batagur borneoensis	Indonesia [iii] [4] All applications to be referred to the SRG
Batagur borneoensis	Malaysia [iii] [4] All applications to be referred to the SRG
Batagur borneoensis	Thailand [iii] [4] All applications to be referred to the SRG
Ornithoptera goliath	Indonesia [ii] (F)
Ornithoptera priamus	Indonesia [ii] (F)
Troides cuneifera	Indonesia [ii] (F)

3.

Huso huso	Iran [iii)] All applications to be referred to the SRG
Huso huso	Kazakhstan [iii)] All applications to be referred to the SRG
Huso huso	Russia [iii)] All applications to be referred to the SRG
Hippopus hippopus	New Caledonia [i) 4]
Tridacna derasa	New Caledonia [i) 4]
Tridacna derasa	Philippines [i) 4]
Tridacna maxima	New Caledonia [i) 4]
Tridacna squamosa	New Caledonia [i) 4]
Acropora spp.	Malaysia [ii)] (confirmed)
Montipora spp.	Malaysia [ii)] (confirmed)
Leptoseris spp.	Malaysia [ii)] (confirmed)
Pachyseris spp.	Malaysia [ii)] (confirmed)
Pavona spp.	Malaysia [ii)] (confirmed)
Euphyllia spp.	Malaysia [ii)] (confirmed)
Turbinaria spp.	Malaysia [ii)] (confirmed)
Diploastrea heliopora	Malaysia [ii)] (confirmed)
Echinopora spp.	Malaysia [ii)] (confirmed)
Favia spp.	Malaysia [ii)] (confirmed)
Favites spp.	Malaysia [ii)] (confirmed)
Platygyra spp.	Malaysia [ii)] (confirmed)
Hydnophora spp.	Malaysia [ii)] (confirmed)
Lobophyllia spp.	Malaysia [ii)] (confirmed)
Symphyllia spp.	Malaysia [ii)] (confirmed)
Galaxea spp.	Malaysia [ii)] (confirmed)
Echinophyllia spp.	Malaysia [ii)] (confirmed)
Pocillopora spp.	Malaysia [ii)] (confirmed)
Goniopora spp.	Malaysia [ii)] (confirmed)
Porites spp.	Malaysia [ii)] (confirmed)
Tubipora musica	Malaysia [ii)] (confirmed)
Anacropora spp.	Malaysia [ii)] (confirmed)
Astreopora spp.	Malaysia [ii)] (confirmed)
Cataluphyllia jardinei	Malaysia [ii)] (confirmed)
Physogyra spp.	Malaysia [ii)] (confirmed)
Plerogyra turbida	Malaysia [ii)] (confirmed)
Dendrophyllia spp.	Malaysia [ii)] (confirmed)
Tubastraea spp.	Malaysia [ii)] (confirmed)
Caulastraea spp.	Malaysia [ii)] (confirmed)
Cyphastrea spp.	Malaysia [ii)] (confirmed)
Goniastrea spp.	Malaysia [ii)] (confirmed)
Leptastrea spp.	Malaysia [ii)] (confirmed)
Montastrea spp.	Malaysia [ii)] (confirmed)
Ctenactis spp.	Malaysia [ii)] (confirmed)
Cycloseris spp.	Malaysia [ii)] (confirmed)
Fungia spp.	Malaysia [ii)] (confirmed)
Lithophyllon spp.	Malaysia [ii)] (confirmed)
Polyphyllia talpina	Malaysia [ii)] (confirmed)
Acanthastrea spp.	Malaysia [ii)] (confirmed)

4.

Blastomussa spp.	Malaysia [ii] (confirmed)
Cynarina lacrymalis	Malaysia [ii] (confirmed)
Scolymia spp.	Malaysia [ii] (confirmed)
Oxypora spp.	Malaysia [ii] (confirmed)
Seriatopora spp.	Malaysia [ii] (confirmed)
Stylophora spp.	Malaysia [ii] (confirmed)
Alveopora spp.	Malaysia [ii] (confirmed)
Coscinaraea spp.	Malaysia [ii] (confirmed)
Psammocora spp.	Malaysia [ii] (confirmed)
Siderastrea spp.	Malaysia [ii] (confirmed)
Trachyphyllia geoffroyi	Malaysia [ii] (confirmed)
Millepora spp.	Malaysia [ii] (confirmed)
Distichopora spp.	Malaysia [ii] (confirmed)
Pectinia spp.	Malaysia [ii] (confirmed)
Cyphostemma elephantopus	Madagascar [ii]
Cyphostemma montagnacii	Madagascar [ii]
Operculicarya decaryi	Madagascar [ii]
Operculicarya hyphaenoides	Madagascar [ii]
Operculicarya pachypus	Madagascar [ii]
Pachypodium brevicaule	Madagascar [ii]
Zygosicyos tripartitus	Madagascar [ii]
Euphorbia denisii	Madagascar [ii]
Euphorbia hedyotoides	Madagascar [ii]
Pericopsis elata	Democratic Republic of the Congo [ii] (17 451 m3 (round wood equivalent))
Cypripedium japonicum	North Korea [iii] [4] All applications to be referred to the SRG
Cypripedium japonicum	Japan [iii] [4] All applications to be referred to the SRG
Cypripedium macranthos	North Korea [i] [4]
Cypripedium macranthos	Russian Federation [i] [4]
Cypripedium margaritaceum	China [iii] [4] All applications to be referred to the SRG

6) Positive opinion for import of specimens of the following species / countries combinations:

Ovis ammon polii	Kyrgyzstan
Panthera leo	Tanzania (including hunting trophies) (confirmed)
Panthera leo	Zambia (including hunting trophies)
Pericopsis elata	Democratic Republic of the Congo (imports can only be accepted from the 12 forestry concessions for which management inventories were submitted by companies to the DRC forestry administration, corresponding to an overall quota of 31 905 m^3 (round wood equivalent)) (confirmed)

Prunus africana	Democratic Republic of the Congo (Total annual quota of 231 860 kg of dry bark divided between the following sub-quotas: Ibathama and Mwenda: 72 000 kg; Walikale: 30 000 kg; Lume: 85 190 kg; Mangurdjipa: 44 670 kg) (subject to clear indication of the origin in the export permit)

7) Import prohibitions for the following species / countries combinations recommended for removal:

Falco cherrug	Bahrain
Balearica regulorum	Rwanda
Psittrichas fulgidus	Indonesia
Psittrichas fulgidus	Papua New Guinea
Calumma ambreense	Madagascar
Calumma capuroni	Madagascar
Calumma cucullatum	Madagascar
Calumma furcifer	Madagascar
Calumma guibei	Madagascar
Calumma hilleniusi	Madagascar
Calumma linota	Madagascar
Calumma peyrierasi	Madagascar
Calumma tarzan	Madagascar
Calumma tsaratananense	Madagascar
Calumma vatosoa	Madagascar
Furcifer angeli	Madagascar
Furcifer balteatus	Madagascar
Furcifer belalandaensis	Madagascar
Furcifer monoceras	Madagascar
Furcifer tuzetae	Madagascar
Furcifer nicosiai	Madagascar
Phelsuma abbotti	Madagascar
Phelsuma antanosy	Madagascar
Phelsuma barbouri	Madagascar
Phelsuma dubia	Madagascar
Phelsuma flavigularis	Madagascar
Phelsuma guttata	Madagascar
Phelsuma klemmeri	Madagascar
Phelsuma pronki	Madagascar
Phelsuma seippi	Madagascar
Phelsuma serraticauda	Madagascar
Phelsuma berghofi	Madagascar
Phelsuma hielscheri	Madagascar
Phelsuma malamakibo	Madagascar
Phelsuma masohoala	Madagascar
Phelsuma modesta	Madagascar
Phelsuma mutabilis	Madagascar

Phelsuma pusilla	Madagascar
Batagur borneoensis	Brunei Darussalam
Batagur borneoensis	Indonesia
Batagur borneoensis	Malaysia
Batagur borneoensis	Thailand
Hippopus hippopus	New Caledonia
Tridacna derasa	New Caledonia
Tridacna derasa	Philippines
Tridacna maxima	New Caledonia
Tridacna squamosa	New Caledonia
Cypripedium japonicum	North Korea
Cypripedium japonicum	Japan
Cypripedium macranthos	North Korea
Cypripedium macranthos	Russian Federation
Cypripedium margaritaceum	China

IVORY SAFARIS LTD

PLOT 6980 KATANGA ROAD
HEAVY INDUSTRIAL AREA LUSAKA
CELL: 0977486547
TELEFAX: +260 211 252422

21ST March, 2015

The Director General
Department for National Parks and Wildlife
P O Box 1
Chilanga
Lusaka

Dear Sir

RE: **2015 IVORY SAFARIS LIMITED ANNUAL REPORT**

We refer to the above and would like to present to you the company's annual report for the year 2015

Please see attached bundle of documents presenting the information as per your request

Kindly contact us should you require any further information or clarifications

Yours faithfully

PAUL BWALYA
DIRECTOR

MVU Safaris – Table of Contents

1) Minutes of the negotiation meetings
2) Annual community obligations
3) Infrastructure development
4) Resource monitoring
5) Law enforcement
6) Fire management
7) Meat Distribution
8) Quota Utilisation
9) Conclusion

1. Minutes of the negotiation meeting

From the meeting which was held on the 13th March, 2015, below were the important and critical issues discussed;

a) Community obligations by the outfitter were adjusted to K145, 000 per annum with additional support to the community.

b) Law enforcement contribution was agreed at K90,000 per annum.

c) Fire management by the outfitter was decided at K15, 000.00 per annum.

d) On Infrastructure development, the outfitter agreed to pay K80, 000.00 per annum.

e) The Outfitter agreed to contribute K24, 000 per annum.
f) The outfitter will also donate a Landcruiser to the Community meant for Anti Poaching which will be supervised by ZAWA

ANNEXURE 4

NEGOTIATIONS FOR CHIKWA HUNTING BLOCK HELD ON 13TH MARCH 2015 IN THE ZAWA HUMAN RESOURCES BOARD ROOM IN CHILANGA

In Attendance

Mr. Matthews Mushimbalume Manager Operations	ZAWA (Chairperson)
Mr. Edward Chilufya Projects Coordinator	ZAWA
Mr. Mannas Simwanza Head – Procurement Unit	ZAWA
Mr. Collins Chilongoshi Procurement Officer	ZAWA
Felix R. Mbuzi (Chief Chikwa)	Chikwa
Mr. Julius Ngulube	Chikwa
Mr. Paul Bwalya	Ivory Safaris
Mr. Phillip Banda	Ivory Safaris
Mr. Steward Nchimunya	Office of the President (Observer)

The Chairperson called the meeting to order at 15:40 hours. The chairperson welcomed everyone present and informed the meeting that His Royal Highness had made consultations and was now ready to proceed with the negotiations. The Chairperson informed the meeting that Ivory Safaris was the highest bidder for Chikwa Hunting Block. He further stated that it was important to discuss the issues that were not clear in the Technical Proposal before the Hunting Concession Agreement could be signed.

The chairman informed the outfitter that:-

- There will be no subleasing of hunting blocks, because in the past some outfitters had subleased the hunting blocks without authorization from ZAWA
- The hunting quota will not be fixed. There is room for adjustments based on hunting returns.
- 60% of animal fees should be paid prior to commencement of hunting season.
- Distribution of carcasses of edible meat should be 50% to the community and Zambia Wildlife Authority staff in the area.
- The community pledge would now be called community obligation because some outfitters were not honoring the pledges in the past.

Concerns raised by His Royal Highness Chief Chikwa

His Royal Highness requested the Outfitter to work in harmony with the community and provide them with support. He further stated that the K5.00 allowance paid to the village scouts as escort fee per day by the previous outfitter was not enough. Hence he suggested that a minimum wage must be paid to the Village Scouts. He sought clarity on the sharing of the edible carcasses of meat.

In response, the chairperson clarified that the sharing of edible meat is 50% to the Community and Zambia Wildlife Authority.

Concerns and remarks by the Outfitter

The meeting agreed on the following:-

- Community Obligations by the outfitter was adjusted to pay K145,000.00 with additional support to the community.
- The outfitter adjusted to pay K15,000.00 towards Fire Management.
- On Infrastructure development, the Outfitter adjusted to pay K80,000.00.
- The outfitter committed to pay K90,000.00 towards Law Enforcement support in the first year of the Concession Agreement.
- The outfitter committed to pay K24,500.00 towards Resource Monitoring.
- The Outfitter will also donate a Landcruiser to the Community meant for Anti Poaching which will be supervised by ZAWA.

The figures above are per annum for the period of the Concession.

Closing Remarks

The chairperson thanked His Royal Highness Chief Chikwa, Ivory Safaris and ZAWA Staff for the fruitful negotiations. The meeting was closed at 16:10 hours.

.....

Matthews Mushimbalume

.....

Julius Ngulube

.....

Phillip Banda

.....

Felix R. Mbuzi (Chief Chikwa)

.....

Paul Bwalya

IVORY SAFARIS LTD
PLOT No. 4172/16
NANGWENYA ROAD,
RHODES PARK,
LUSAKA, ZAMBIA.
CELL: 0978 773948

4

2. Annual community obligations (K145, 000)

Below is the breakdown of the total cost incurred for community obligations:

The total expenses incurred on Pledges was K141, 900

The K141, 900 was paid through Bank Transfer and K3, 100.00 was paid to facilitate opening of the Bank Account..

The outfitter also donated a 4x4 Land cruiser to be used for Anti-Poaching in the GMA.

We managed to pay in full our community pledges as can be evidenced by the Transfer Letter attached.

We have also inserted the picture of the Handover for the Landcruser and acknowledgement Letter.

(See attached transfer letter and letters from the CRB)



IVORY SAFARIS LTD

PLOT NO. 4172/16 NAGWENYA ROAD,
RHODES PARK, LUSAKA ZAMBIA
CELL: 0978 773948

14th October 2015

Attn Chunga
Stanbic Bank Zambia
Woodgate House
Lusaka, Zambia

RE TRANSFER OF ZMW 141 900

We hereby refer to the above caption and would like to transfer the amount of Zambian Kwacha One Hundred Forty One Thousand Nine Hundred (ZMW141,900) only to the following account details

Account Name	CHIKWA CRB
Account Number	**1064637400197**
Bank Name	ZANACO
Branch	Lundazi Branch
Reason For Payment	This is for 2015 Pledges

Kindly debit our Kwacha account number 0140006467701 (IVORY SAFARIS LIMITED)

Authorized Signatory

CHIKWA CRB
P.O BOX 53000,
LUSAKA
17/09/2015

THE DIRECTOR
[illegible] SARACHI

AT MR KHALID DALALA

DEAR SIR

- REF REQUEST FOR K3,100 TO FACILITATE THE OPENING OF CRB ACCOUNT.

The above subject matter refers.

The Chikwa CRB is requesting for cash amounting to three thousand one hundred kwacha (K3,100) only to enable the officer, facilitate the opening of Chikwa CRB bank account.

Your assistance in the request will be highly appreciated.

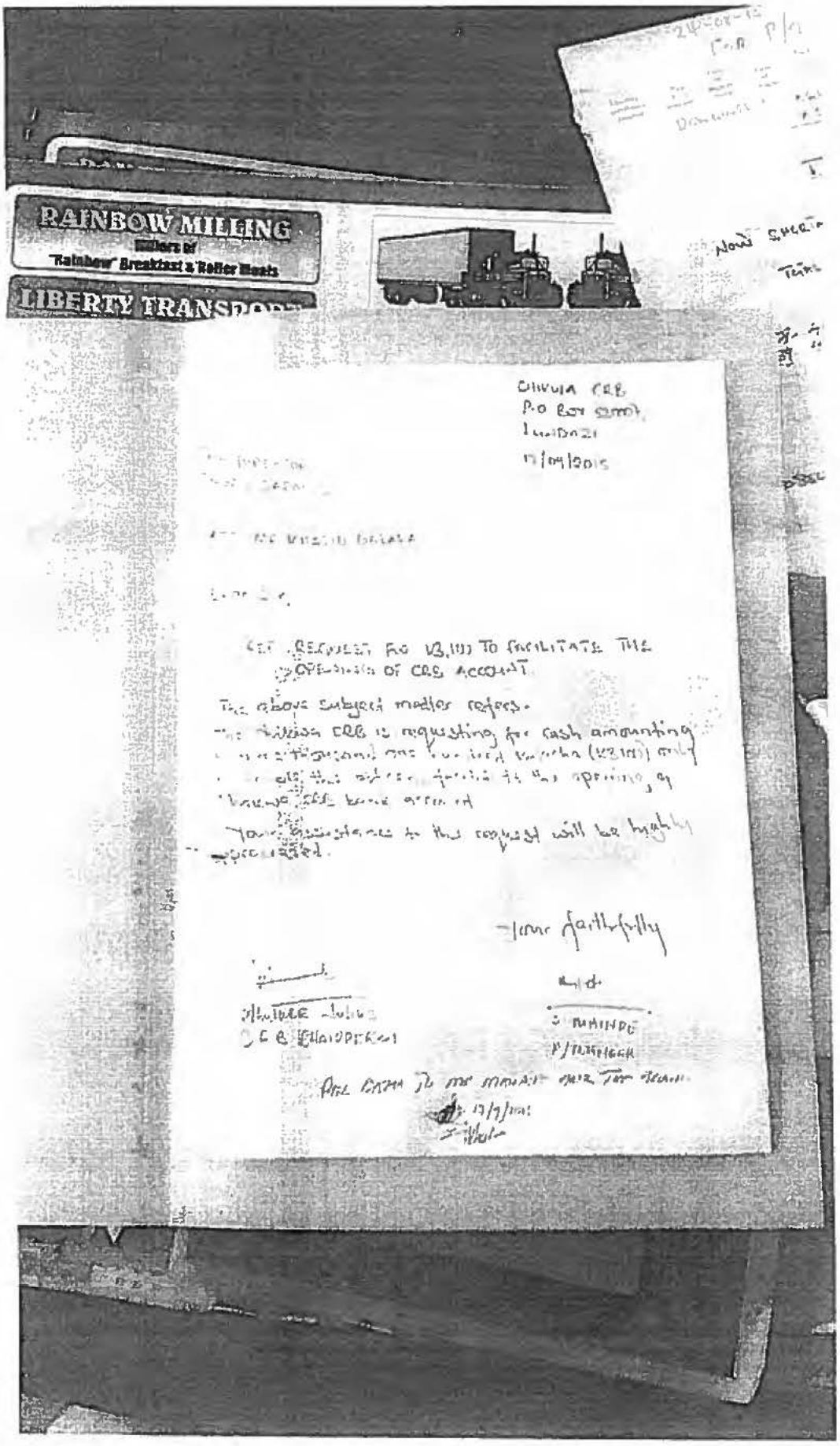
Yours faithfully

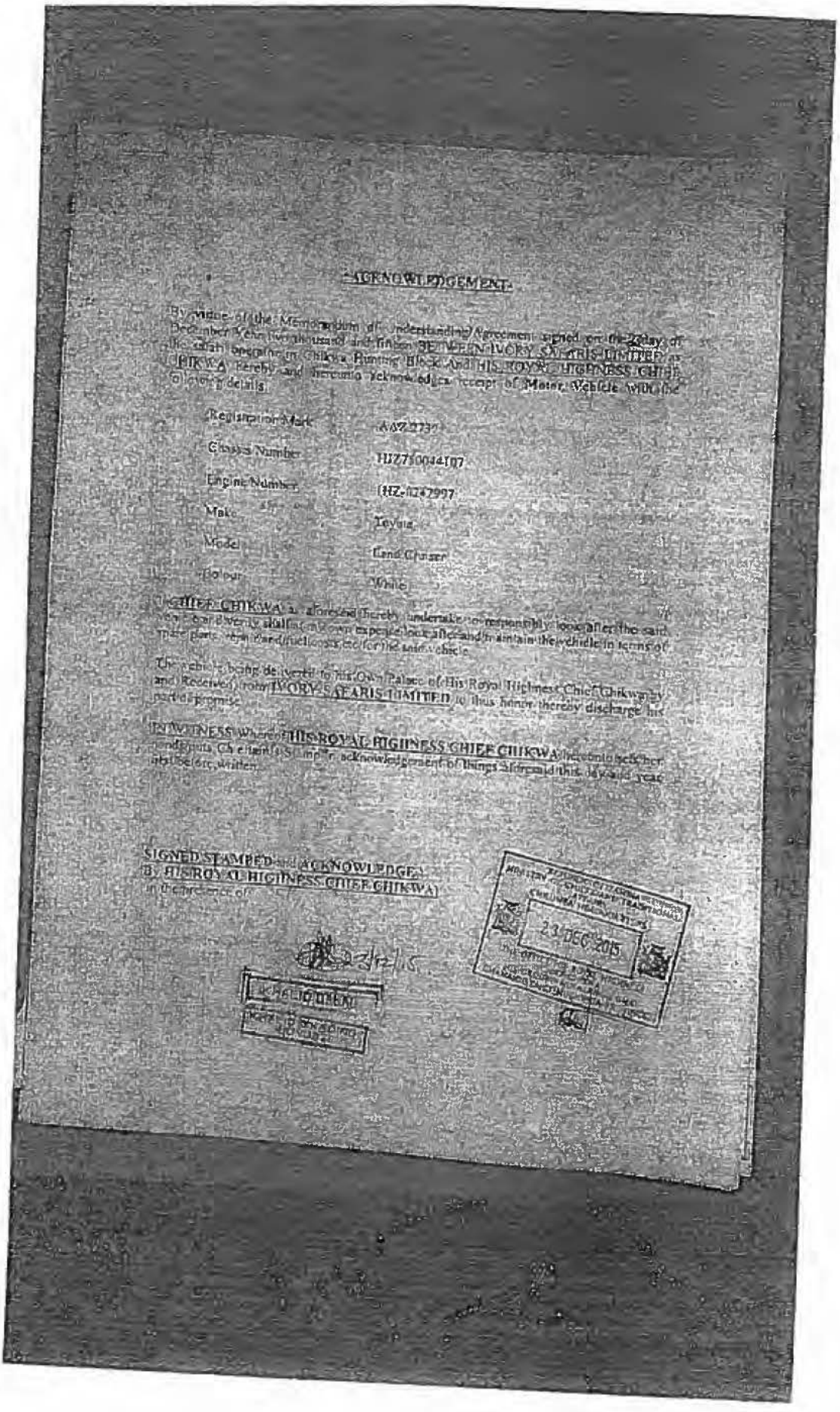
[illegible]

[illegible]
CRB [illegible]

[illegible]
P/[illegible]

[illegible]
17/9/2015


RAINBOW MILLING
Millers of
"Rainbow" Breakfast & Roller Meals
LIBERTY TRANSPORT



ACKNOWLEDGEMENT

By virtue of the Memorandum of Understanding Agreement signed on the 2 day of December Year two thousand and fifteen BETWEEN IVORY SAFARIS LIMITED as the safari operator in Chikwa Hunting Block And HIS ROYAL HIGHNESS CHIEF CHIKWA hereby and hereunto acknowledges receipt of Motor Vehicle with the following details

Registration Mark	AAZ 2739
Chassis Number	HJZ750044107
Engine Number	HZ-0242997
Make	Toyota
Model	Land Cruiser
Colour	White

I CHIEF CHIKWA as aforesaid hereby undertake to responsibly look after the said vehicle and verily shall at my own expense look after and maintain the vehicle in terms of spare parts, repair and fuel costs etc for the said vehicle.

The vehicle being delivered to his Own Palace of His Royal Highness Chief Chikwa by and Received from IVORY SAFARIS LIMITED to thus honor thereby discharge his part of promise.

IN WITNESS Whereof HIS ROYAL HIGHNESS CHIEF CHIKWA hereunto sets her hands puts Chieftain's Stamp in acknowledgement of things aforesaid this day and year first before written.

SIGNED STAMPED and ACKNOWLEDGED
By HIS ROYAL HIGHNESS CHIEF CHIKWA
in the presence of

23/12/15

KHALID DHEN

23 DEC 2015


AAZ 368T
AAZ 2737

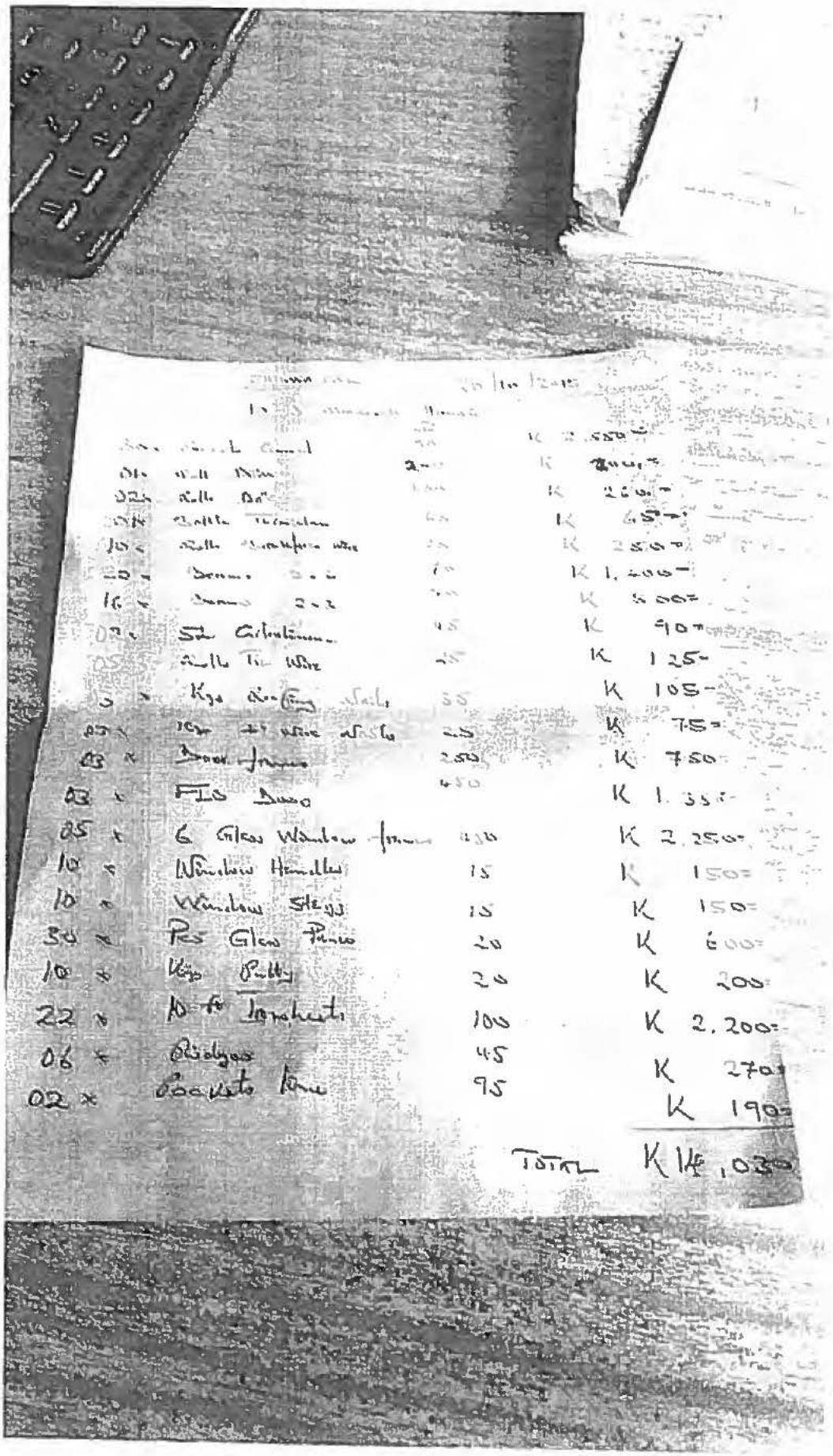
3. Infrastructure development (K 80,000)

The Company paid K80, 000.00 towards Infrastructure as per attached support documentation.

The Company further incurred K14, 030.00 for infrastructure

Please see attached supporting documents for your reference.

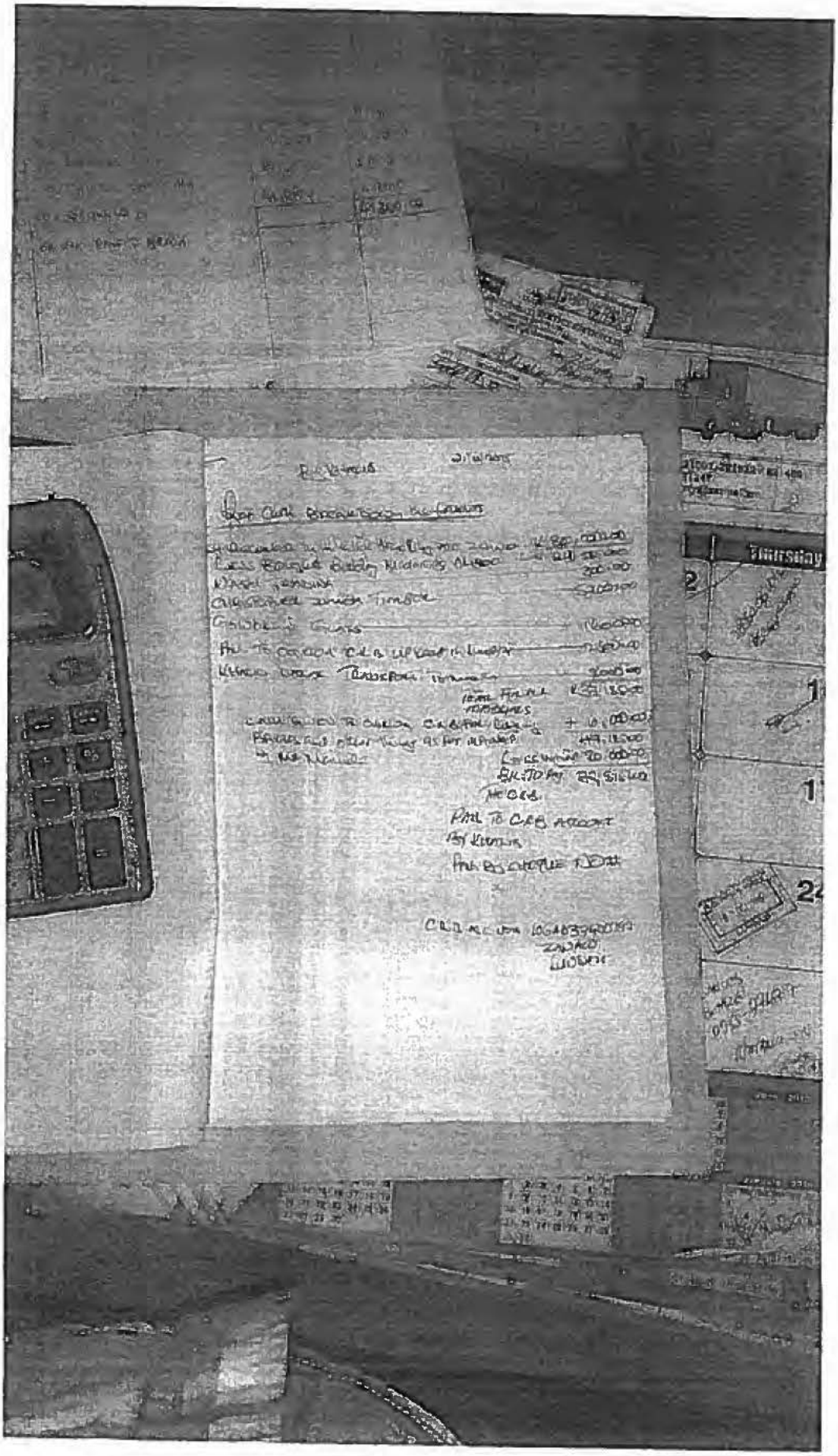
Total expenses incurred for Infrastructure development was K94,030.00

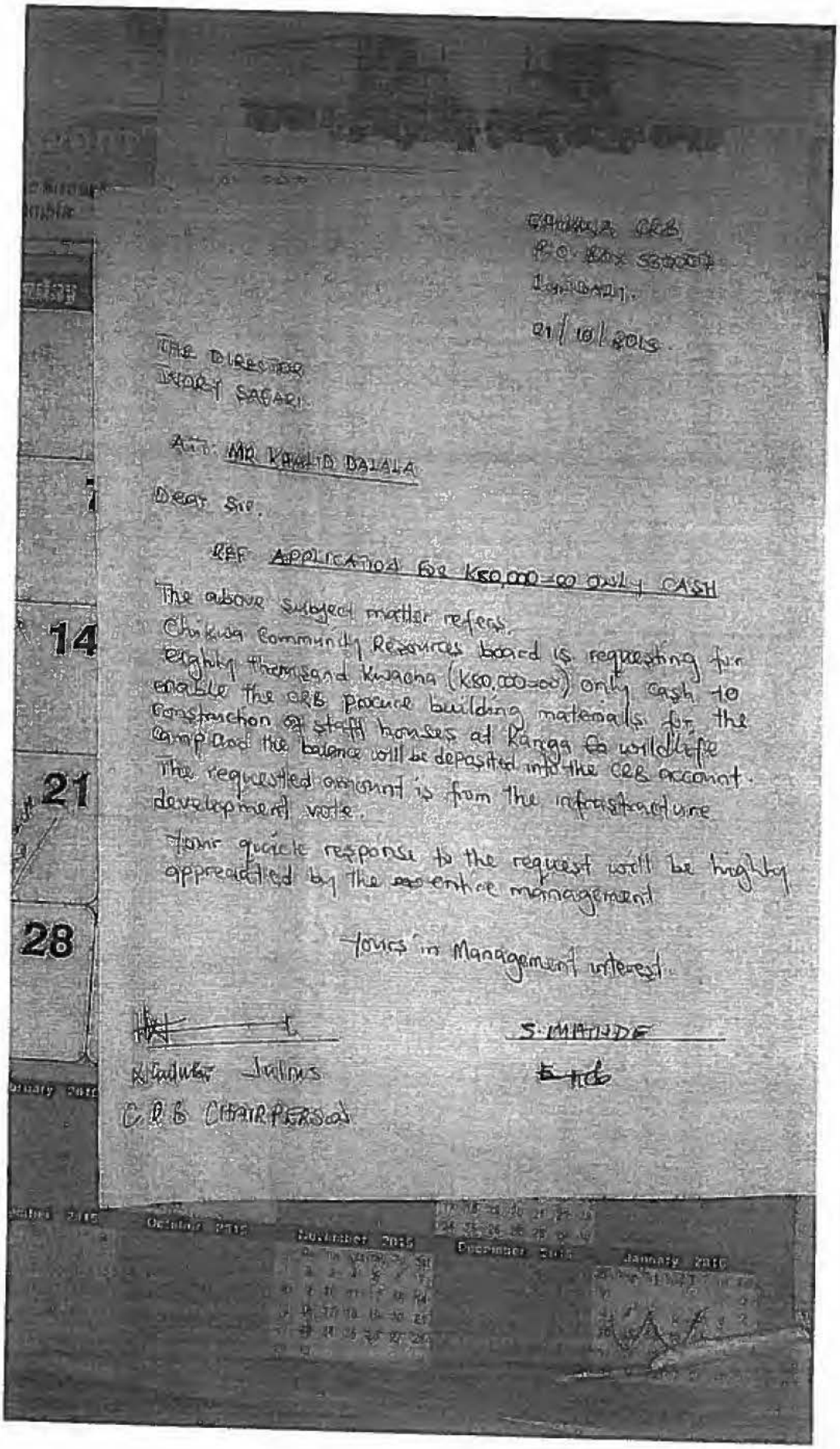


[illegible] 20/10/2015

[illegible]

[illegible]	[illegible]	[illegible]	K 2,550=
01	[illegible]	2[illegible]	K [illegible]
02	[illegible]	[illegible]	K 260=
01	[illegible]	[illegible]	K 65=
10	[illegible]	[illegible]	K 250=
20	[illegible]	[illegible]	K 1,200=
16	[illegible]	[illegible]	K 500=
02	[illegible]	45	K 90=
05	[illegible]	25	K 125=
3	Kgs [illegible]	35	K 105=
03	[illegible]	25	K 75=
03	Door frames	250	K 750=
03	FIS Door	450	K 1,350=
05	6 Glass Window frames	450	K 2,250=
10	Window Handles	15	K 150=
10	Window Stays	15	K 150=
30	Pcs Glass Panes	20	K 600=
10	Kgs Putty	20	K 200=
22	10 ft Ironsheets	100	K 2,200=
06	Ridges	45	K 270=
02	Pockets [illegible]	95	K 190=
		TOTAL	K 14,030


Thursday



CHIKWA CRB
P.O. BOX 530007
LUNDAZI.

21/10/2015.

THE DIRECTOR
IVORY SAFARI.

ATT: MR KHALID DALALA

Dear Sir,

REF: APPLICATION FOR K80,000=00 ONLY CASH

The above subject matter refers.
Chikwa Community Resources board is requesting for eighty thousand Kwacha (K80,000=00) only cash to enable the CRB procure building materials for the construction of staff houses at Ranga Co wildlife camp and the balance will be deposited into the CRB account. The requested amount is from the infrastructure development vote.

Your quick response to the request will be highly appreciated by the entire management

Yours in Management interest.

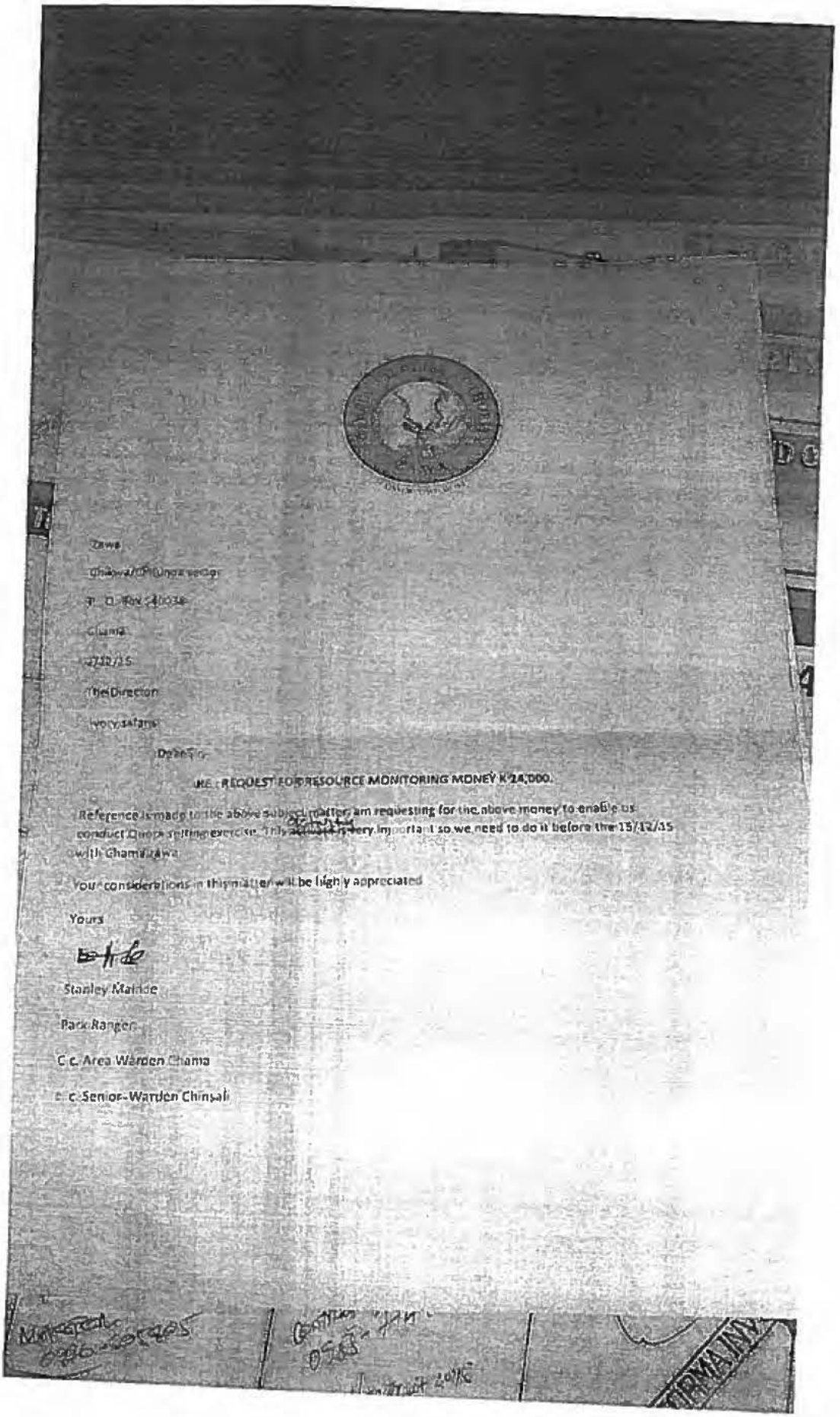
S. MATINDE

Kalwa Julius
C.R.B CHAIRPERSON

4. Resource monitoring (K24,500)

The company paid K24, 000.00 towards resource monitoring.

Please see attached supporting documents for your reference.



Zawa

Chawa/Chilunga sector

P. O. Box 240038

Chama

2/12/15

The Director

Ivory safaris

Dear Sir,

RE: REQUEST FOR RESOURCE MONITORING MONEY K 24,000.

Reference is made to the above subject matter, am requesting for the above money to enable us conduct Quota setting exercise. This ~~activity~~ activity is very important so we need to do it before the 15/12/15 with Chama Zawa.

Your considerations in this matter will be highly appreciated

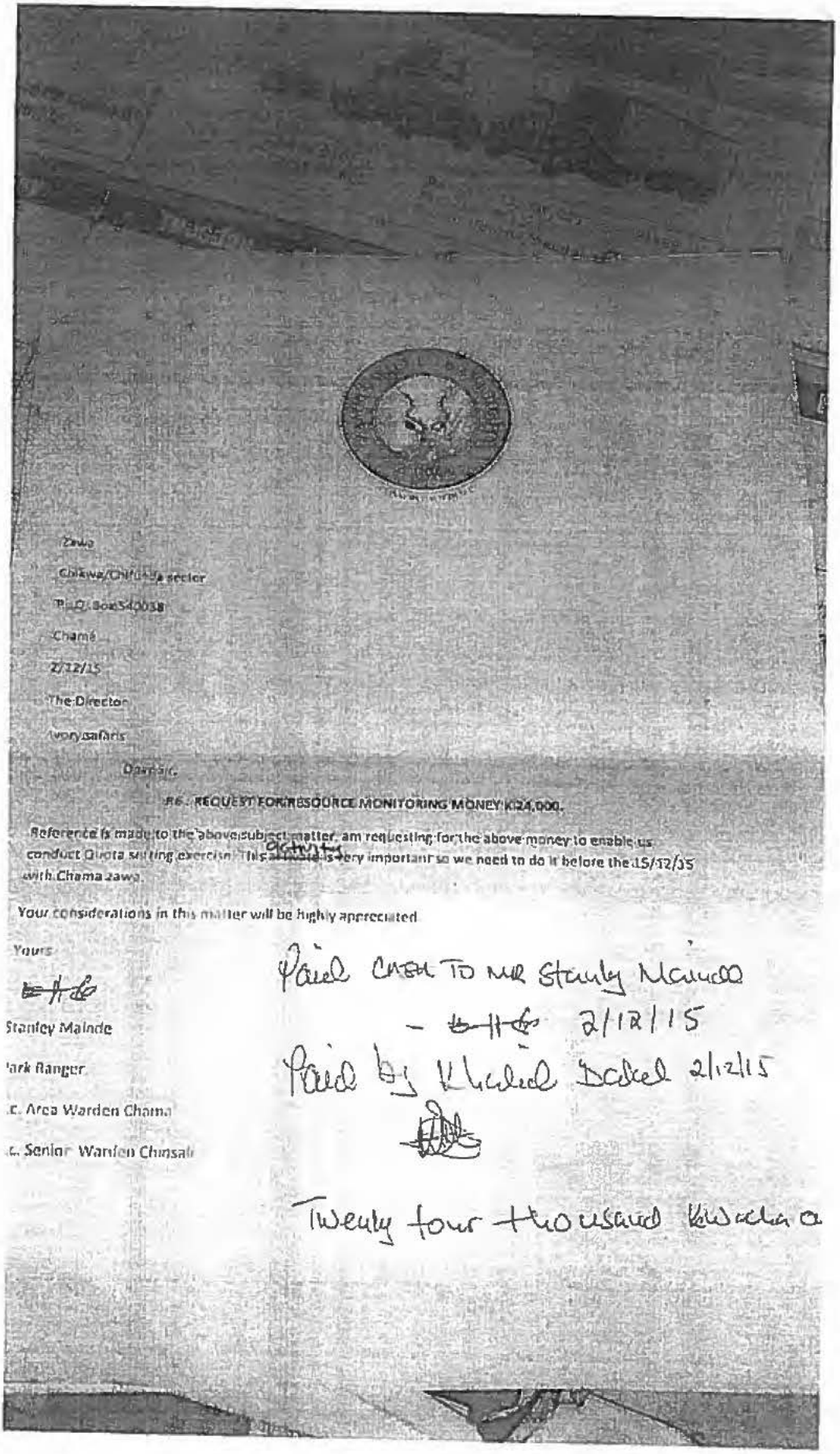
Yours

Stanley Mainde

Park Ranger

C.c. Area Warden Chama

c.c. Senior-Warden Chinsali



Zawa

Chikwa/Chifunda sector

P.O. Box 540038

Chama

2/12/15

The Director

Ivory safaris

Dear sir,

RE: REQUEST FOR RESOURCE MONITORING MONEY K24,000.

Reference is made to the above subject matter, am requesting for the above money to enable us conduct Quota setting exercise. This activities is very important so we need to do it before the LS/12/15 with Chama zawa.

Your considerations in this matter will be highly appreciated

Yours

Stanley Mainde

Park Ranger

c. Area Warden Chama

c. Senior Warden Chinsali

Paid CASH TO MR Stanley Mainde

- 2/12/15

Paid by Khalid Dated 2/12/15

Twenty four thousand Kwacha

5. Law enforcement (K90,000)

In order to enhance Law enforcement in Chikwa Management Area the Company supplied Diesel amounting to K9, 436.00 and cash to the CRB totaling K6, 000.00

The company then supplied food rations for six months totaling k48, 621.00

The company incurred a further K40, 715.00 for staff rations and diesel to enhance Law enforcement

Please see attached documents for your reference

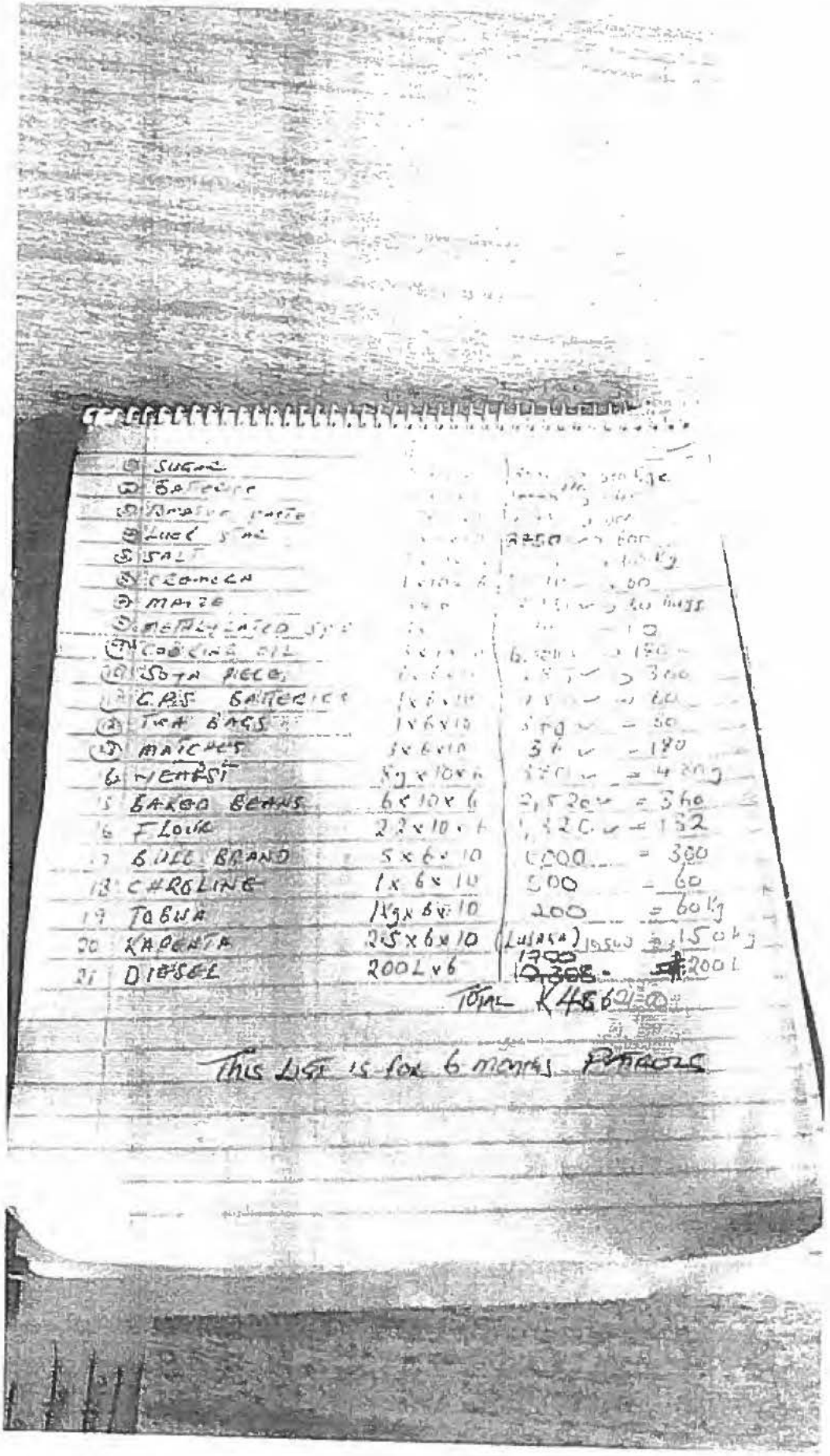
The total expense for Law enforcement was K101, 872.00

10110
ambia
Tel: 216 - 221097, 221532 / 221489
Fax: 216 - 221247
E-mail: liberty@zamtel.zm

HOME AND

FOR IVORY SAFARIS
CHIKWA 6/06/2015 № 19

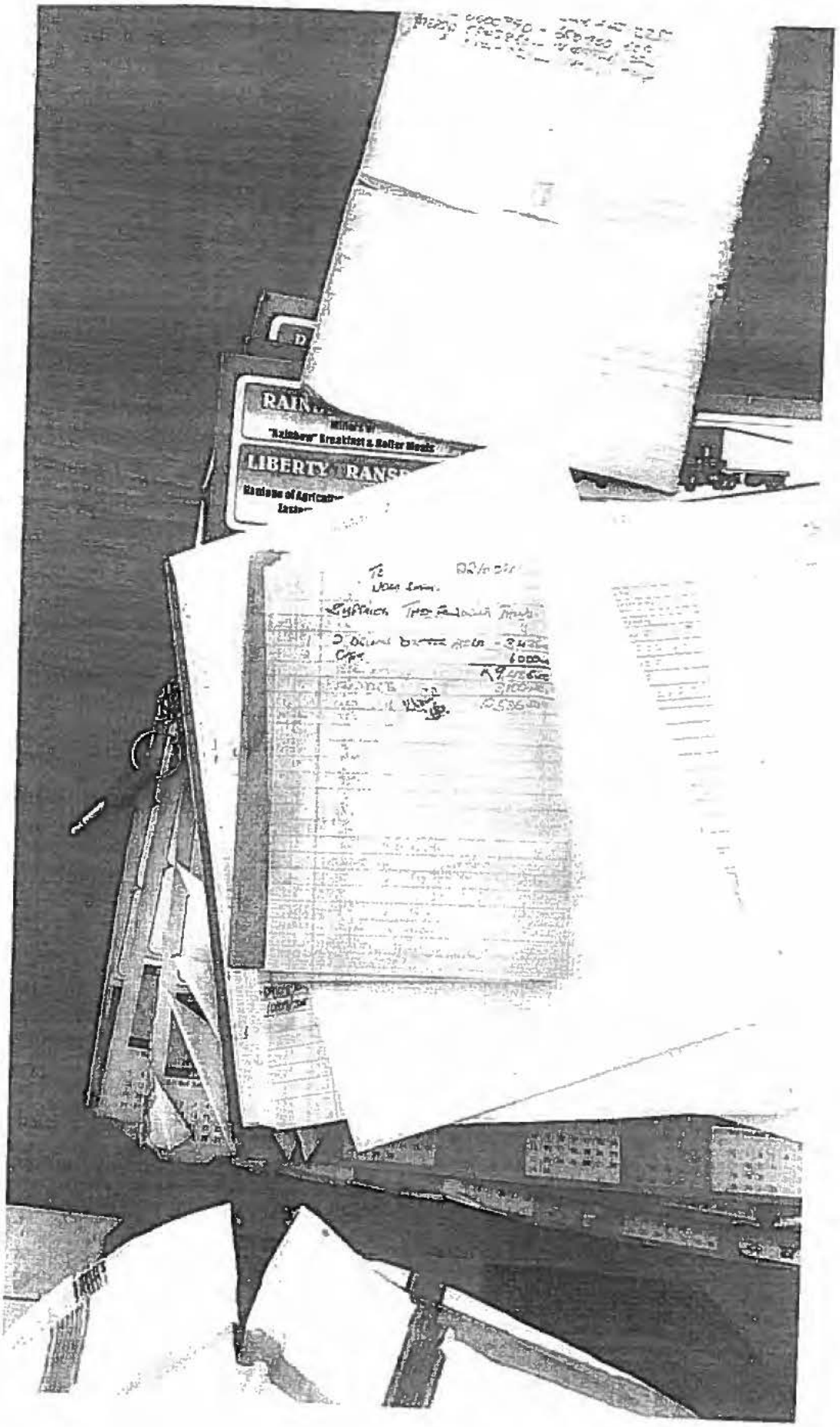
1 -	40 cls Mineral Water - K30 = Per cls =	K1200=00
2 -	5 Bags B/Fast Meal K85 - =	K425=00
3 -	Kapenta for =	K 500=00
4 -	Beans for =	K 470=00
5 -	2x 20 Litres C/oil	K 480=00
6 -	200 Litres Diesel	K 1520=00
7 -	1x Empty Drum	K 250=00
8 -	5 Bags Soya Pieces	K 360=00
9 -	Cash	K35000=00
10 -	80 Litres Diesel for Delivery	610=00
		K40,715=00

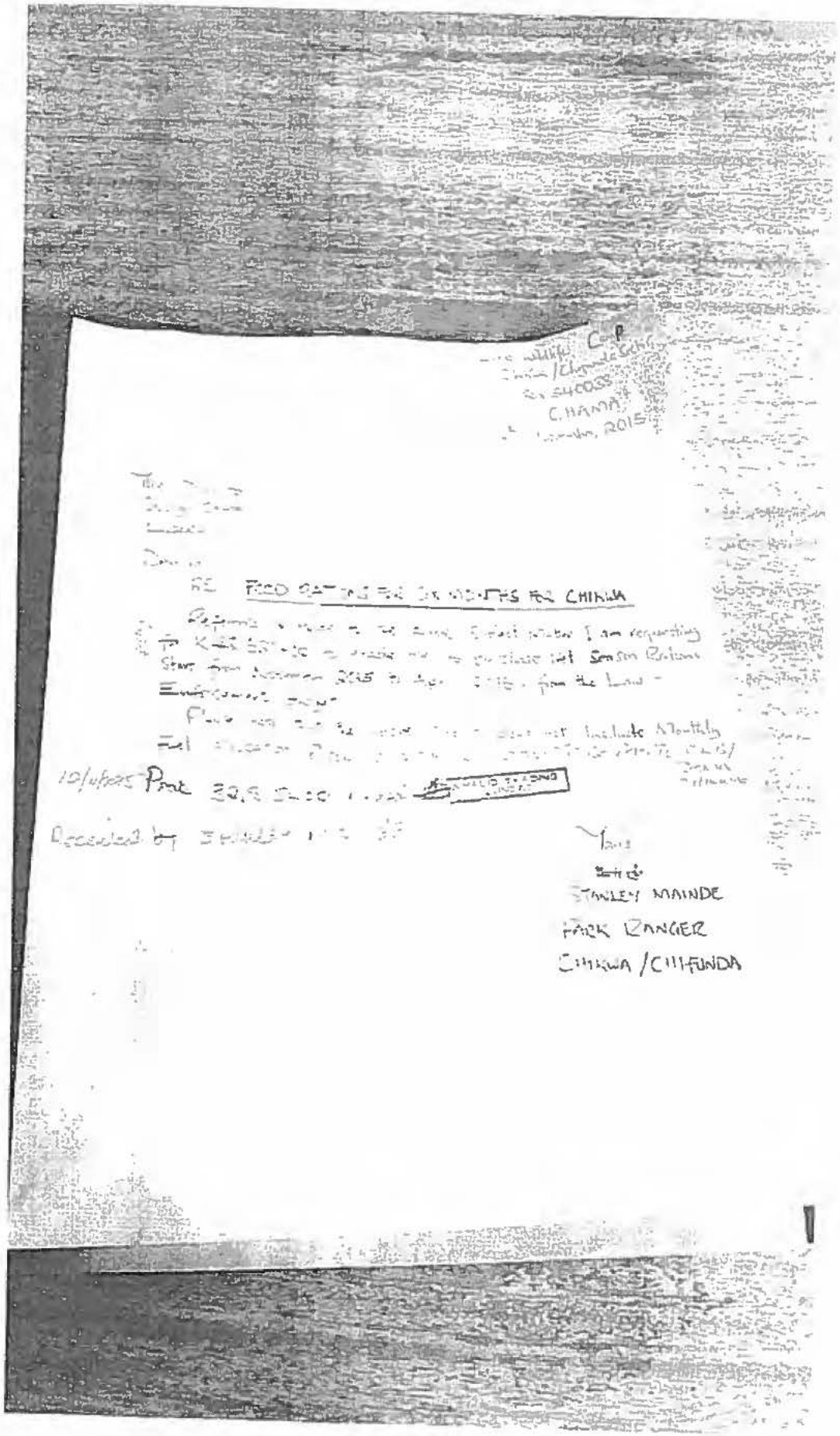


1	SUGAR	[illegible]	[illegible] kg
2	BATTERIES	[illegible]	[illegible]
3	[illegible] PASTE	[illegible]	[illegible]
4	LUCK STAR	[illegible]	2750 [illegible] 600
5	SALT	[illegible]	[illegible] kg
6	CREMORA	1 x 10 x 6	[illegible] 60
7	MAIZE	[illegible]	[illegible] 60 bags
8	METHYLATED SPIRIT	[illegible]	[illegible] 10
9	COOKING OIL	[illegible]	6,[illegible] 180
10	SOYA PIECE	[illegible]	[illegible] 300
11	C.P.S. BATTERIES	1 x 6 x 10	[illegible] 60
12	TEA BAGS	1 x 6 x 10	[illegible] 60
13	MATCHES	3 x 6 x 10	36 [illegible] 180
14	WEARST	8 kg x 10 x 6	[illegible] 480 kg
15	BAKED BEANS	6 x 10 x 6	2,520 [illegible] 360
16	FLOUR	22 x 10 x 6	1,320 [illegible] 132
17	BULL BRAND	5 x 6 x 10	6000 = 300
18	CHROLINE	1 x 6 x 10	500 = 60
19	TOBWA	1 kg x 6 x 10	200 = 60 kg
20	KAPENTA	25 x 6 x 10	(LUSAKA) 10500 = 150 kg
21	DIESEL	200 L x 6	1700 ~~10,308~~ = 200 L

TOTAL K486 21=00

This LIST is for 6 months PATROLS


LIBERTY



6. Fire Management (15,000)

The company spent a total of K10, 970.00 for rations during Fire Management.
The company further spent a sum of K8, 698.00 for fuel and Groceries during Fire Management.

Please see attached documents for your reference

The total expense for Fire Management was K19,668.00

BERTY WHOLESALE
- Household Items
- Cement

ME AND OFFICE FURNISHERS
- Stationery
- Computer Accessories

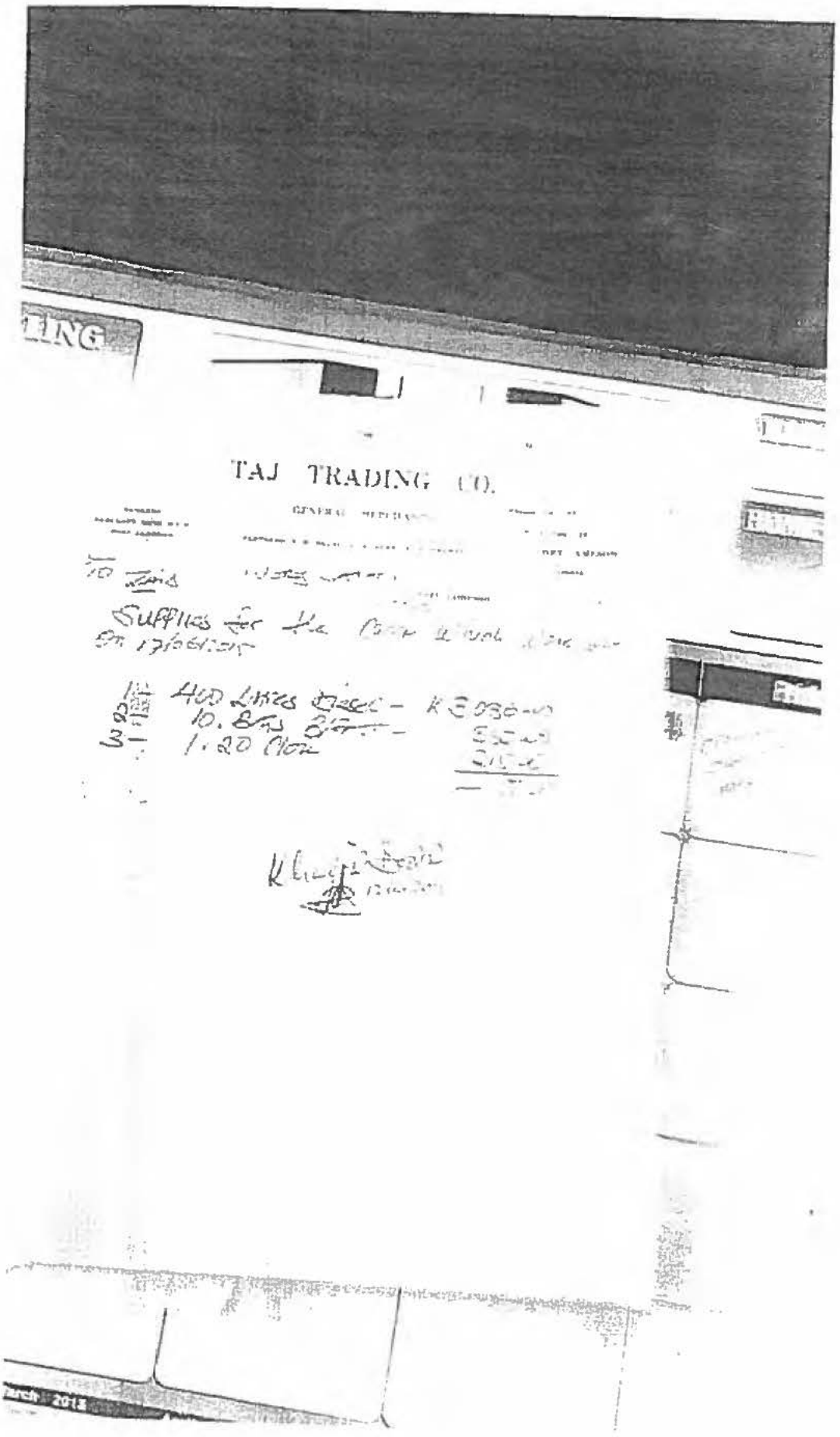
07 | JUL

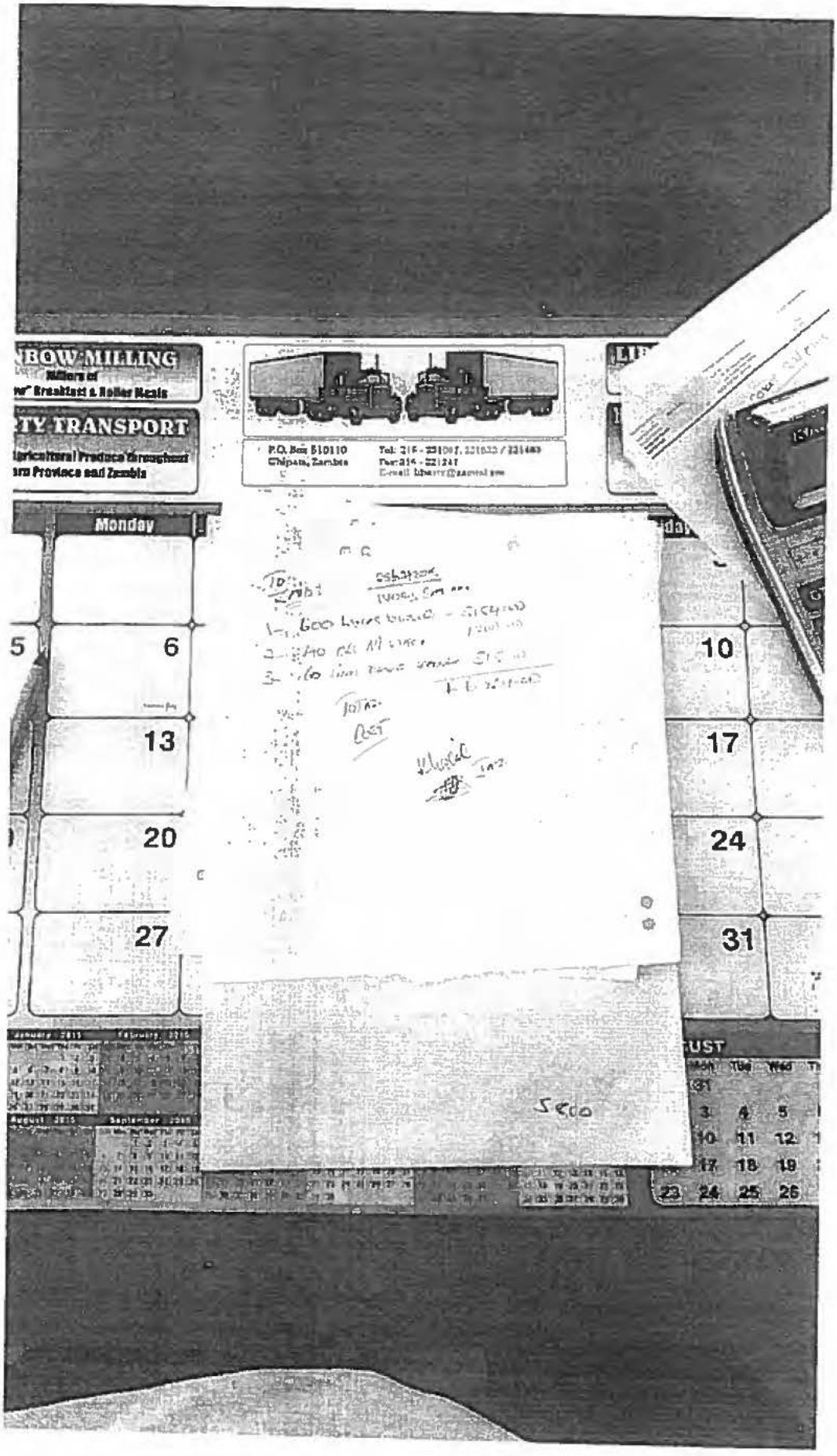
IVORY SAFARI 29/09/2015

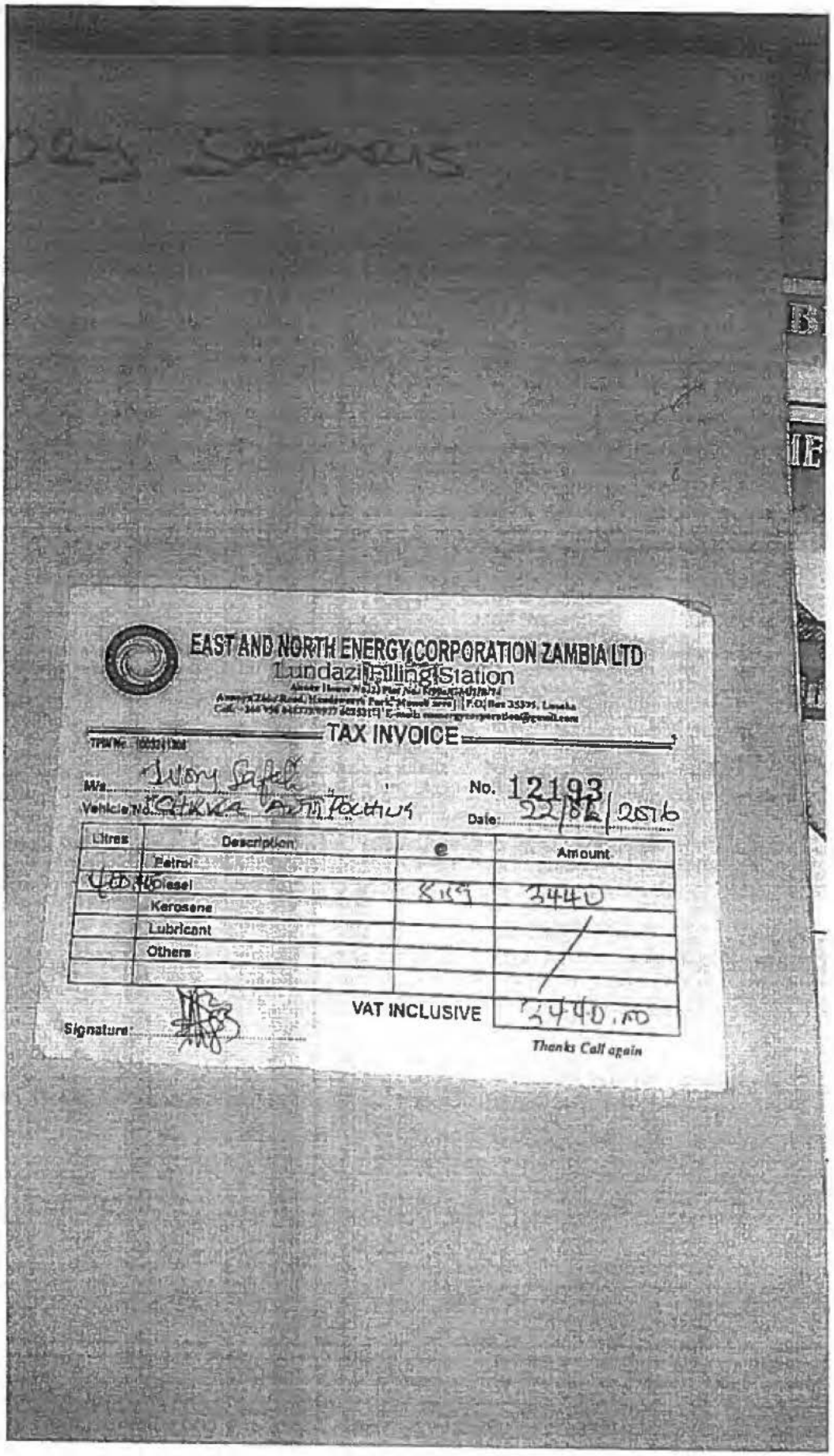
3x Soda Pieces	K225:00
2x 10 Litres Cloak	280:00
2x 2½ Bottles	45:00
10x Bars Bifatt	850:00
1 Bar K-Plasta	450:00
1x 50 Kgs Beans	500:00
5 Torches	75:00
TOTAL	2,425:00
3x 275 Metre Roll Wire	700:00
	K3,125:00

Khalid


OF MILLING
BERTY TRANSPORT
Sunday
Monday


TAJ TRADING CO.


BOW-MILLING
TY TRANSPORT
Monday
5
6
10
13
17
20
24
27
31
5600



EAST AND NORTH ENERGY CORPORATION ZAMBIA LTD

Lundazi Filling Station

Annex House No. 2 Plot No. [illegible]

Annex Zaka Road, Handsworth Park, Munali area | P.O. Box 35375, Lusaka

Cell: [illegible] E-mail: [illegible]@gmail.com

TAX INVOICE

TPIN No. [illegible]

M/s. Ivory Safeli

No. 12193

Vehicle No. CHKKA ANTI POCHING

Date: 22/02/2016

Litres	Description	@	Amount
	Petrol		
400.00	Diesel	8.59	3440
	Kerosene		
	Lubricant		
	Others		
		VAT INCLUSIVE	3440.00

Signature:

Thanks Call again

7. Meat Distribution

More than 50% of the hunted game was distributed to the Chikwa Community. In most instances the whole carcass was distributed to the community. See attached supporting documents.

Meat allocation During 2015 - 2016 season.
<CHIKWA (IVORY SAFERI)>

1. Buffallo Carcass distributed to Chikwa chiefdom
2. Buffallo Carcass distributed to chikwa chiefdom
3. Buffallo Carcass distributed to chikwa chiefdom
4. Buffallo Carcass distributed to Chikwa chiefdom
5. Buffallo Carcass distributed to chikwa chiefdom
6. Buffallo Carcass distributed to chikwa chiefdom
7. Buffallo Carcass distributed to chikwa chiefdom
8. Hippopotamus Carcass distributed to chikwa chiefdom
9. Hippopotamus Carcass distributed to chikwa chiefdom

8. Quota Utilization

The company achieved a 38% quota despite being given the Area late and not having done enough marketing. The Company will endeavor to reach its full potential on quota Utilization in the coming years and do a lot of conservation so as to harvest quality trophies.

2015 Non Resident Hunting Quota Utilisation

Safari Company ..... CHIKWA

CHIKWA

Species	Allocation	2016 PROPOSED QUOTA	Bought	BALANCE ZAWA RECORDS	UTILISED QUOTA	BALANCE
Baboon	4	5	2	2	1	1
Buffalo	12	20	7	5	7	0
Bushbuck	4	8	4	0	4	0
Bushpig	4	2		4	0	0
Crocodile	10	8		10	0	0
Elephant	1	1		1	0	0
Duicker.C	2	2		2	0	0
Eland	2	2	1	1	1	0
Grysbok	1	1		1	0	0
Hartebeast	3	4	2	1	2	0
Hippopotamus	8	8	2	6	2	0
Hyeana	2	3	1	1	0	1
Impala	12	12	5	7	5	0
Kudu	5	5	5	0	5	0
Leopard	3	5	3	0	3	0
Puku	8	8	5	3	4	1
Roan	3	2	1	2	0	1
Warthog	8	6	2	6	1	1
Waterbuck Common	2	2	1	1	1	0
Wilbeest Common	8	8	5	3	5	0
Zebra	5	4		5	0	0
Lion		2				
CIVET		1				
REEDBUCK		2				
Totals	107	121	46	61	41	5

38%

113/21/20165:39 PMZ \rasheed\transfer of system files\2015 SEASON\IVORY\2015 ZAWA Recon2015 ZAWA ReconQUOTA USE Update

9. CONCLUSION

IVORY Safaris Limited is ready to help and support the Chikwa Community in terms of infrastructure development, fire management and other related services in the long run. The company is also ready to work with the Department of National Parks and Wildlife (DNPW) scouts to help stop poaching.

Mammal Review

Mammal Review ISSN 0305-1838

PERSPECTIVE

Lions, trophy hunting and beyond: knowledge gaps and why they matter

David W. MACDONALD* *Wildlife Conservation Research Unit, Department of Zoology, The Recanati-Kaplan Centre, University of Oxford, Tubney House, Tubney, Oxon OX13 5QL, UK.*
Email: david.macdonald@zoo.ox.ac.uk
Andrew J. LOVERIDGE *Wildlife Conservation Research Unit, Department of Zoology, The Recanati-Kaplan Centre, University of Oxford, Tubney House, Tubney, Oxon OX13 5QL, UK.*
Email: Andrew.loveridge@zoo.ox.ac.uk
Amy DICKMAN *Wildlife Conservation Research Unit, Department of Zoology, The Recanati-Kaplan Centre, University of Oxford, Tubney House, Tubney, Oxon OX13 5QL, UK.*
Email: Amy.dickman@zoo.ox.ac.uk
Paul J. JOHNSON *Wildlife Conservation Research Unit, Department of Zoology, The Recanati-Kaplan Centre, University of Oxford, Tubney House, Tubney, Oxon OX13 5QL, UK.*
Email: Paul.johnson@zoo.ox.ac.uk
Kim S. JACOBSEN *Wildlife Conservation Research Unit, Department of Zoology, The Recanati-Kaplan Centre, University of Oxford, Tubney House, Tubney, Oxon OX13 5QL, UK.*
Email: kimsjacobsen@gmail.com
Byron DU PREEZ *Wildlife Conservation Research Unit, Department of Zoology, The Recanati-Kaplan Centre, University of Oxford, Tubney House, Tubney, Oxon OX13 5QL, UK.*
Email: byron.d.dupreez@gmail.com

Keywords
Africa, economics, ethics, lions, trophy hunting

*Correspondence author.

Submitted: 3 April 2017
Returned for revision: 15 May 2017
Revision accepted: 12 June 2017
Editor: DR

doi: 10.1111/mam.12096

ABSTRACT

What does trophy hunting (selective hunting for recreation) contribute to wild lion conservation? Macdonald (Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting. WildCRU, Oxford, UK, 2016) summarises what we know. We identify unknowns, gaps in the knowledge that inhibit conservation planning, including: the causes of lion mortality, the amount of land used for lion trophy hunting, the extent to which trophy hunting depends on lions for financial viability, and the vulnerability of areas used for hunting to conversion to land not used for wildlife, if trophy hunting ceased. The cost of reversing biodiversity loss exceeds income from tourism, including hunting. New financial models are needed, particularly in view of the expanding human population in Africa.

BACKGROUND

Lions *Panthera leo*, iconic symbols of the African wilderness, are in trouble. The latest International Union for Conservation of Nature (IUCN) estimates suggest a population of 23000–39000 (probably closer to the lower estimate), a decline of at least 43% between 1993 and 2014, approximately three lion generations (Bauer et al. 2015). Lions have been extirpated from at least 92% of their historic range. According to the 2016 IUCN Red List Assessment, in Africa, lions are almost certainly extinct in 15 countries, possibly extinct in another seven, and now occur in only 25 countries (Bauer et al. 2016). Lion decline may be even more severe than estimated by the IUCN (Anonymous 2006a, b) based on well-known populations which tend to be in a better state. Only six populations have more than 1000 lions (Selous-Niassa, Serengeti-Mara, Kavango-Zambezi, Greater Limpopo,

Katavi-Ruaha and Kgalagadi). About half of the remaining wild populations comprise fewer than 100 individuals (Dickman et al. submitted). Lion populations are in crisis, due primarily to the loss and degradation of habitat, loss of prey, and conflict with people (Anonymous 2016a), pressures exacerbated when they are small, isolated, and poorly managed (Anonymous 2006a, b, Henschel et al. 2014).

Public interest in lion conservation was stimulated in July 2015 with the killing of a well-known lion nicknamed 'Cecil' (Macdonald et al. 2016a). Fierce debate has since raged over whether trophy hunting is good or bad for lion conservation. To be clear, trophy hunting 'generally involves the payment of a fee by a foreign or local hunter for a hunting experience, usually guided, for one or more individuals of a particular species with specific desired characteristics (such as large size or antlers). The trophy is usually retained by the hunter and taken home' (Anonymous 2016a).

This debate would be informed by identifying the conditions where trophy hunting contributes to lion conservation, if indeed such conditions prevail anywhere. Whether trophy hunting lions is ethically acceptable is a distinct debate, which we enlarge on below. Some hold trophy hunting in such moral repugnance that any benefit to conservation is insufficient to justify it. This view may come to prevail, and perhaps a majority of the Western public already holds it (although the balance of opinion probably varies from place to place, notably between the West and lion range countries). Until the part played by trophy hunting is known and, as necessary, alternative means of financing lion conservation are in place, we have defended a more utilitarian population-based perspective, arguing that the cost of implementing such a moral imperative may be too high if no better alternative for lion conservation is available (Macdonald et al. 2016b). We support the cessation of trophy hunting where it is clearly inimical to conservation, and its reform where it is better for conservation than any viable alternative land use. While lion hunting exists, it should, at least, be sustainable. An account of the evidence base for assessing its sustainability is presented by Macdonald (2016). In compiling that evidence base, we were, however, thwarted by a surprising lack of information on several important issues. In the much, but perhaps unfairly, mocked words of the former US politician Donald Rumsfeld, there are knowns, known unknowns, and unknown unknowns.

We identified a conspicuous knowledge gap concerning the causes of lion mortality. At both national and regional scales, trophy hunting of wild lions has been ranked relatively low as a threat (Anonymous 2006a, b; we do not consider 'canned' hunting, in which captive-bred lions are hunted, as it has little relevance to wild lion conservation). However, there is evidence that over-hunting has reduced lion numbers at national scales – such an effect was particularly clear in Tanzania (Packer et al. 2011). In unfenced reserves, large-scale population growth rates are lower in the presence of trophy hunting (Packer et al. 2013). It is also clear that badly regulated hunting can be locally damaging (Caro et al. 2009, Packer 2015, Creel et al. 2016).

Trophy hunting is not the only reason lions are killed. How the number of lions killed by trophy hunting compares with those killed by snaring or human-lion conflict is known only for a few localities (e.g. Loveridge et al. (2016), and conventional ecological methods for estimating mortality have been found to underestimate rates of illegal killings, such as poaching, relative to legal killings, for example trophy hunting (Treves et al. 2017). Mortality due to conflict with local people may be orders of magnitude greater than that due to international trophy hunters: in Tanzania's Ruaha landscape, at least 37 lions were killed in 2011 due to conflict, in an area of less than 500 km^2, making the offtake over 100 times higher than the recommended maximum offtake for a trophy hunting area (Dickman in prep.). Recently, concern over lions being poisoned as an incidental outcome of attempts to disguise elephant poaching has gained prominence (Sandhu 2016). There are other places (e.g. Hwange; Loveridge et al. 2016) where trophy hunting is the main cause of mortality for adult male lions. However, in many places the balance of these factors remains unknown, although it is suspected that throughout Africa many more lions die due to conflict than are killed by trophy hunters (Anonymous 2016a).

Where trophy hunting occurs, its mortality is probably additive. It can also lead to a cascade of indirect mortality through social perturbation (the perturbation effects of other sources of mortality have not been studied). But even where other sources of mortality predominate, it is theoretically possible for a small amount of additive mortality to tip the balance from a scenario where a population is stable or increasing to one where the population growth rate is negative. Creel et al. (2016) concluded that for trophy hunting to be sustainable under the conditions that most lions experience, total mortality needs to be reduced. Where other sources of mortality dominate, tackling them is likely to be the priority. It is clear that there will be many places where focussing on a single threat to lions, whether trophy hunting or any other cause, will be inadequate for effective conservation. A holistic approach, considering all the threats and their interconnections, is most likely to succeed.

As with photo-tourism, trophy hunting can protect wildlife by providing an economic reason for land being maintained under a wildlife-based land use. Income

from trophy hunting can be significant for government bodies responsible for managing wildlife – the Wildlife Division in Tanzania, for example makes 60% of its income from trophy hunting licence fees (Estes 2015). Major unknowns therefore include the likely, but inconclusively demonstrated, positive roles of trophy hunting in creating economic incentives for wildlife-based land use, whether on private, state or communal land. It may also provide an anti-poaching presence in wildlife areas, together with general management such as maintenance of boreholes. How widely land managed for hunting is well managed for non-hunted species is also poorly understood.

The continued availability of land for lions is clearly crucial for their conservation. Our review of the evidence led to the conclusion that trophy hunting's greatest contribution to lion (and wider) conservation lay in providing an incentive to retain wildlife habitat that might otherwise be lost to agriculture or pastoralism (Macdonald 2016). It is vital, therefore, to know how much lion habitat there is, where it is, how many lions it supports and how it is managed. Large areas of wilderness are used for lion hunting, but there are few recent estimates of precisely how much. Lindsey et al. (2013) estimated that lions were hunted in around 558000 km^2, which comprised 27–32% of the lion range in countries where they were hunted. There have been no published updates since Botswana banned lion hunting in 2008 (and all hunting in public areas in 2014), or since Zambia imposed a lion hunting moratorium between 2013 and 2016. Also, since Lindsey et al.'s estimate, human encroachment has caused losses of hunting land: Packer (2015) estimates that 40% of hunting blocks in Tanzania have been abandoned in the last decade. Hunting blocks elsewhere have also been abandoned after becoming depleted and unviable (Lindsey et al. 2016). If not used for hunting, a lot of that land would be likely to be lost to wildlife, by for example being converted to agriculture or livestock grazing. In some areas, where economic forces did not prompt conversion, lions and their prey might recover when hunting stopped, leading to restoration of hunting at some point.

We make two interim conclusions: first, trophy hunting should be strictly regulated to ensure that it does contribute to lion conservation, including by the maintenance of habitat (Macdonald 2016 makes clear how this can be achieved). Second, where lion hunting is disallowed by national law or rendered financially unviable (by import bans for example), alternatives must be found to ensure that its contribution to habitat preservation is replaced – this is the difficult bit, and the one worst bedeviled by unknowns. The substituted institutions will need to effect more than habitat protection, by preventing poaching, for example. It is crucial to distinguish between scenarios where trophy hunting of lions alone is stopped and those where there is a general cessation of trophy hunting. Many hunting areas may not be financially dependent on lions, but a further unknown is whether a cessation of lion hunting would be followed by extended restrictions on the hunting of other charismatic and threatened species. Lindsey et al. (2017) demonstrate that, with or without hunting, many areas have insufficient funds for effective management.

HOW HUNTING AFFECTS LION POPULATIONS

An understanding of the mechanisms whereby trophy hunting affects lion populations requires monitoring, and knowledge not just of population size, but also of the density of individuals eligible for hunting. Appropriate methodologies are available (e.g. Funston et al. 2010, Broekhuis & Gopalaswamy 2016, Elliot & Gopalaswamy 2016). Macdonald (2016) shows how an adaptive management system can ensure that departures from sustainable offtakes can be rectified. Thus, while there is scope for refining methods of counting carnivores (Gopalaswamy et al. 2015), useful methods exist – the dangerous unknown is ignorance of the numbers of lions, largely due to the practicalities of who is going to pay for such monitoring.

In principle, calculating the mortality lion populations can withstand, from trophy hunting or any other source, is straightforward. There are area-based and density-based harvesting models of sustainable offtake. These could be refined to account for intra-specific variation in lion density, and other threats. For example the figure recommended by Packer et al. (2011) for offtake of 0.5 lions per 1000 km^2, while intended to be precautionary, does not account for variation in lion population density. Furthermore, it would be useful to quantify the interactions between mortality factors (e.g. trophy hunting, snaring, and conflict) some of which (e.g. snaring) are non-specific. Perturbation effects (Tuyttens & Macdonald 2000) on lion demography resulting from trophy hunting are well documented (Loveridge et al. 2007), and there is evidence that such effects exacerbate human-lion conflict (Loveridge et al. in prep).

WHAT WOULD HAPPEN TO LION POPULATIONS IF THEY WERE NO LONGER HUNTED FOR TROPHIES?

It is difficult to predict what would happen to hunted lion populations if hunting was stopped. Would phototourism substitute, or some other regime that was not wildlife-friendly? Hunting may, in general, be less beneficial

than photo-tourism for lion populations, but may nonetheless be better than nothing (Lindsey et al. 2017). There are crucial unknowns from the viewpoints of both land managers and governments. These include the extent to which photo-tourism (itself vulnerable to insecurity and global economic forces), or other non-consumptive uses can substitute for trophy hunting, and crucially, how lion populations would fare following conversion. How much current trophy hunting land is suitable for conversion to photo-tourism is uncertain. Lindsey et al. (2006) argue that certainly not all of it is, and question whether there is sufficient demand to supply visitors to these areas.

Under what conditions is trophy hunting land converted to less wildlife-friendly uses such as agriculture, settlement, mining, or pastoralism? The regulation and enforcement of land ownership and land-use zoning are likely to be influential. The key unknown here is how important lions are for the profitability of trophy hunting operations relative to their value under different land uses. It is also important to whom the different values of lions accrue under different land-use systems. Progress is hampered by inadequate political, legal, and governance instruments, such that local people have no incentive to value wildlife (Muposhi et al. 2016).

Amongst the most serious unknowns, then, are the extents to which trophy hunting (and photo-tourism) does or could provide sufficient financial incentive to retain land under wildlife-based uses and under alternative uses, and what factors influence this (and how the answers are likely to change in the rapidly changing socio-economic landscape of Africa and beyond). From the viewpoint of governments, the associated expenditure and value-added estimates of the economic contribution of trophy hunting and the alternative land-uses should be compared, not just the economic revenue directly attributable to each activity, which is most commonly the practice in both the academic literature and advocacy documents. Questions of land-use transitions will also be affected by unknowns such as the likely sequence in which measures against lion hunting would be extended to other species, most obviously elephants *Loxodonta africana* to whom, *de facto*, it has already extended through the ban of imports in important consumer countries, whereas the process of uplisting leopards *Panthera pardus* already began under the Endangered Species Act of the USA (Anonymous 2016a, b).

In 2012, before the restrictions on elephant hunting and reduced lion quotas, Lindsey et al. (2012) made a tentative prediction that a lion hunting ban would make trophy hunting financially unviable in substantial areas of the lion's geographic range, with potential wider negative impacts. Banning the hunting of species like leopards would be likely to reduce viability in a wider area. Those authors did not account for the cost of conservation in their perspective on sustainability. Questions about the proportion of park and wildlife management budgets provided by trophy hunting operators are generally unanswered (and might usefully be posed of photo-tourist operators too). Most National Parks in Africa would not be financially viable without support from government, which often comes at least in part from hunting revenues. It would also be helpful to know how important trophy hunting is for the financial viability of wildlife authorities. Considering that in most African countries conservation is underfunded (Lindsey et al. 2017), it would be useful to know more about the comparative economics of trophy hunting and photo-tourism.

A linked unknown is how lions would be tolerated if they could not be hunted, but land was managed for other wildlife uses, such as trophy hunting of their prey. Lions could then impose a substantial cost – it has been said that 'game farming is incompatible with predators' (Schneider 1990). The fate of lion populations, even under non-consumptive land uses, is also uncertain, although insights may soon be gleaned from Botswana where hunting was banned in 2015 (Macdonald 2016); there may also be lessons, although certainly not simple cause and effect, to be gleaned from Kenya, where trophy hunting was banned in 1977 and where wildlife numbers declined on average by 68% between 1977 and 2016, alongside increases in human and livestock numbers that further confound simple interpretations (Macdonald 2016, Ogutu et al. 2016). Banning trophy hunting does not necessarily lead to less killing of lions: Richard Leakey observes that: 'Carnivores are being decimated… hunting has never been stopped in Kenya, and there is more hunting in Kenya today than at any time since independence. (Thousands) of animals are being killed annually with no control…' (Martin 2015).

Of 38 lion populations in non-hunting areas examined for the latest IUCN Red List assessment, 58% were declining, whereas of the seven populations examined in hunting areas, potentially self-selecting and mainly fenced, one (14%) was declining (Bauer et al. 2015). Comparing trends is not straightforward. For example, hunted populations are likely to be depleted already, whereas well-protected populations are generally closer to carrying capacity and are therefore more likely to decline if protection wavers.

THE CURRENT STATUS OF TROPHY HUNTING

It is clear that evaluating how trophy hunting contributes to lion conservation is compromised by lack of data. Here, we turn to the current state of lion trophy hunting.

Macdonald (2016) sets out criteria under which lion hunting could be deemed sustainable. How many hunted populations meet these criteria is unknown, as are the conditions where trophy hunting is a conservation tool. Although we know which populations are currently hunted, we do not know how many of these depend on lion hunting for their viability (the only estimate, from 2012 and before heavy quota reductions in Tanzania and several other countries, is about 11%; Lindsey et al. 2012). Indeed, for many management units, how many lions are hunted annually is unknown. Monitoring of both populations and hunting offtake is often poor; Macdonald (2016) concludes that under these circumstances, precaution demands the use of conservative age-based and area-based criteria when allocating quotas.

Amongst the knowledge gaps that impair a comprehensive analysis of lion trophy hunting is the inadequacy of statistics on exports. Improving the collection and organisation of data by the Convention on International Trade in Endangered Species of Wild Fauna and Flora was amongst several recommendations made by Macdonald (2016). Others included a move to open auctions for concession leases and to longer leases to discourage short-termist mining of the natural resources (Brink et al. 2016).

ETHICS AND HINDSIGHT

Thus far we have focused on empirical data. However, the evidence of these disciplines will be judged within a wider set of societal ethics. There is no consensus, even among conservationists, that a utilitarian perspective on trophy hunting is the right one. Even the concept of 'sustainability', used above as a criterion of good management, would be viewed by some as ethically questionable when applied to lion hunting (or to any killing of animals for 'sport'). Also, we are mindful that while emotional responses affect moral judgements (Nelson et al. 2016), policies based principally on emotion could have perverse consequences. Where an intention to improve lion conservation worsens it, perhaps even those implacably opposed to lion hunting on ethical grounds might favour a 'journey' towards its cessation rather than a 'jump'. As Macdonald (2016) concluded 'if society judged trophy hunting lions unacceptable, but also concluded that it benefited lion conservation, then this dilemma might be approached via a journey to find ways of replacing the benefits of hunting before jumping to end them'.

The day may not be far off, if it is not here already, when much of society (at least outside lion range countries) regards lion hunting as being as unacceptable as, for example bear baiting or child labour (Macdonald et al. 2016a). However, views widely held in the wealthy West are often at odds with views within lion range countries, where lions often impose severe costs (including man-eating) on the people who live alongside them. Who has the right to make decisions about trophy hunting? How should the weight of opinions held on lion hunting in countries without lions, such as the USA (which has a thriving domestic hunting market), be ranked against the opinions held in African countries where lions occur (and where the financial consequences of a cessation of trophy hunting might bite hardest)? These are all difficult issues. It is clear, though, that if lion hunters aspire to be tolerated, they must demonstrate radical reform (and that may not be enough). It is also clear that those who seek to eliminate trophy hunting have either to acknowledge that the possible subsequent loss of lions is a cost they are prepared to pay, or to demonstrate an economically valid alternative wildlife-based land use.

CONCLUSION

Trophy hunting, like almost everything else affecting conservation, is a moving target (and moving, like all aspects of African conservation, heavily at the mercy of external factors). Having reviewed what we know about lion trophy hunting (Macdonald 2016), we thought it helpful to highlight the unknowns here and why they matter. Our understanding of trophy hunting's potential global significance for the species is compromised by not knowing over how much of the species' range it occurs. Where trophy hunting does occur, the implications for lion conservation of any change to the current system vary from place to place. Where lion trophy hunting is run with sustainable quotas, and where no viable wildlife-friendly alternative exists, its removal seems likely to be negative for lion conservation. But there are extensive areas where the implications of the removal of trophy hunting for lion conservation are uncertain, because we do not know the answer to questions like how much the industry's viability depends on lions, or if lions could persist after an alternative land use was substituted.

Unknown threats to lions will surely change. The next clutch will be spawned by changing societal, global economic, demographic, and environmental factors. Trophy hunting, and the prudence of relying on tourism to support conservation in Africa, might be considered minor issues compared to the others jeopardising biodiversity. The money needed to reverse biodiversity loss dwarfs that likely to flow from any variant of tourism, including hunting, so new financial models to encourage coexistence with nature must be found. Dickman et al. (2011) speculate that mechanisms for converting global value to local benefits provide one promising option. Beyond that, we cannot predict how emerging markets and economies such as Russia and China will influence the status quo. The most

perilous unknowns of all include the consequences of an estimated tripling by the year 2100 of the human population of Africa. Whatever plan is put in place for the conservation of lions and the rest of Africa's wildlife, it must accommodate the reality of nature living alongside two billion people.

ACKNOWLEDGEMENTS

We thank H. Bauer, J. Vucetich, and D. Burnham for comments, and gratefully acknowledge discussion with G. Chapron, P. Lindsey, C. Packer, together with T. Hodgetts and K. Somerville, and all those who commented on our original report.

REFERENCES

Anonymous (2006a) *Conservation strategy for the lion in West and Central Africa*. IUCN, Gland, Switzerland.

Anonymous (2006b) *Regional Conservation Strategy for the lion Panthera leo in Eastern and Southern Africa*. IUCN, Gland, Switzerland.

Anonymous (2016a) *Beyond Cecil: Africa's Lions in Crisis*. Panthera, WildAid, WildCRU, New York, USA.

Anonymous (2016b) Endangered and Threatened Wildlife and Plants; 90-Day Findings on Three Petitions. https://www.federalregister.gov/documents/2016/11/30/2016-28513/endangered-and-threatened-wildlife-and-plants-90-day-findings-on-three-petitions

Bauer H, Chapron G, Nowell K, Henschel P, Funston P, Hunter LTB, Macdonald DW, Packer C (2015) Lion (*Panthera leo*) populations are declining repidly across Africa, except in intensively managed areas. *Proceedings of the National Academy of Sciences of the United States of America* 112: 14894–14899. https://doi.org/10.1073/pnas.1500664112.

Bauer H, Packer C, Funston PF, Henshel P, Nowell K (2016) Panthera leo. The IUCN Red List of Threatened Species.

Brink H, Smith RJ, Skinner K, Leader-Williams N (2016) Sustainability and long term-tenure: lion trophy hunting in Tanzania. *PLoS ONE* 11: https://doi.org/ARTN e0162610 10.1371/journal.pone.0162610.

Broekhuis F, Gopalaswamy AM (2016) Counting cats: spatially explicit population estimates of cheetah (*Acinonyx jubatus*) using unstructured sampling data. *PLoS ONE* 11: e0153875. https://doi.org/10.1371/journal.pone.0153875.

Caro TM, Young CR, Cauldwell AE, Brown DDE (2009) Animal breeding systems and big game hunting: models and application. *Biological Conservation* 142: 909–929.

Creel S, M'soka J, Droge E, Rosenblatt E, Becker MS, Matandiko W, Simpamba T (2016) Assessing the sustainability of African lion trophy hunting, with recommendations for policy. *Ecological Applications* 26: 2347–2357.

Dickman AJ, Macdonald EA, Macdonald DW (2011) A review of financial instruments to pay for predator conservation and encourage human-carnivore coexistence. *Proceedings of the National Academy of Sciences of the United States of America* 108: 13937–13944. https://doi.org/10.1073/pnas.1012972108.

Dickman AJ, Riggio J, Jacobsen K, Loveridge AJ, Burnham D, Bauer H et al. (submitted) Determining the ecological and socio-political fragility of free-ranging African lion populations.

Elliot N, Gopalaswamy AM (2016) Towards accurate and precise estimates of lion density. *Conservation Biology* 31: 934–943.

Estes R (2015) Hunting helps conserve African wildlife habitat. *African Indaba* 13: http://www.africanindaba.com/2015/09/hunting-helps-conserve-african-wildlife-habitat-september-2015-volume-13-4/

Funston PJ, Frank L, Stephens T, Davidson Z, Loveridge A, Macdonald DM, Durant S, Packer C, Mosser A, Ferreira SM (2010) Substrate and species constraints on the use of track incidences to estimate African large carnivore abundance. *Journal of Zoology* 281: 56–65. https://doi.org/10.1111/j.1469-7998.2009.00682.x.

Gopalaswamy AM, Mohan D, Karanth KU, Kumar NS, Macdonald DW (2015) An examination of index-calibration experiments: counting tigers at macroecological scales. *Methods in Ecology and Evolution* 6: 1055–1066. https://doi.org/10.1111/2041-210X.12351.

Henschel P, Coad L, Burton C, Chataigner B, Dunn A, Macdonald DW, Saidu Y, Hunter LTB (2014) The lion in West Africa is Critically Endangered. *PLoS ONE* 9: e83500.

Lindsey PA, Alexander R, Frank LG, Mathieson A, Romanach SS (2006) Potential of trophy hunting to create incentives for wildlife conservation in Africa where alternative wildlife-based land uses may not be viable. *Animal Conservation* 9: 283–291. https://doi.org/10.1111/j.1469-1795.2006.00034.x.

Lindsey PA, Balme GA, Booth VR, Midlane N (2012) The significance of African lions for the financial viability of trophy hunting and the maintenance of wild land. *PLoS ONE* 7: e29332. https://doi.org/10.1371/journal.pone.0029332.

Lindsey PA, Balme GA, Funston P, Henschel P, Hunter L, Madzikanda H, Midlane N, Nyirenda V. (2013) The trophy hunting of African lions: scale, current management practices and factors undermining sustainability. *PLoS ONE* 8: e73808. https://doi.org/10.1371/journal.pone.0073808.

Lindsey PA, Balme GA, Funston PJ, Henschel PH, Hunter LTB (2016) Life after Cecil: channelling global outrage into funding for conservation in Africa. *Conservation Letters* 9: 296–301. https://doi.org/10.1111/conl.12224.

Lindsey PA, Petracca LS, Funston PJ, Bauer H, Dickman A, Everatt K et al. (2017) The performance of African protected areas for lions and their prey. *Biological Conservation* 209: 137–149. https://doi.org/doi: 10.1016/j.biocon.2017.01.011.

Loveridge AJ, Searle AW, Murindagomo F, Macdonald DW (2007) The impact of sport-hunting on the population dynamics of an African lion population in a protected area. *Biological Conservation* 134: 548–558.

Loveridge AJ, Valeix M, Chapron G, Davidson Z, Mtare G, Macdonald DW (2016) Conservation of large predator populations: demographic and spatial responses of African lions to the intensity of trophy hunting. *Biological Conservation* 204(Part B): 247–254. https://doi.org/10.1016/j.biocon.2016.10.024

Loveridge AJ, Calderon-Quiñónez AP, Macdonald DW, (in prep) Effect of anthropogenic male mortality on social and territorial stability of lions (Panthera leo).

Macdonald DW (2016) *Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting*. WildCRU, Oxford, UK. https://www.wildcru.org/wp-content/uploads/2016/12/Report_on_lion_conservation.pdf

Macdonald DW, Jacobsen KS, Burnham D, Johnson PJ, Loveridge AJ (2016a) Cecil: a moment or a movement? Analysis of media coverage of the death of a lion, *Panthera leo*. *Animals* 6: https://doi.org/10.3390/ani6050026.

Macdonald DW, Johnson PJ, Loveridge AJ, Burnham D, Dickman AJ (2016b) Conservation or the moral high ground: siding with Bentham or Kant. *Conservation Letters* 9: 307–308. https://doi.org/10.1111/conl.12254.

Martin G (2015) *Lionizing Cecil Makes us Feel Good, but a Trophy Hunting Ban will Accelerate Slaughter*. UC Berkeley, Berkeley, California, USA.

Muposhi VK, Gandiwa E, Bartels P, Makuza SM (2016) Trophy hunting, conservation and rural development in Zimbabwe: issues, options and implications. *International Journal of Biodiversity* 2016: 1–16. https://doi.org/10.1155/2016/8763980.

Nelson MP, Bruskotter JT, Vucetich JA, Chapron G (2016) Emotions and the ethics of consequence in conservation decisions: lessons from Cecil the lion. *Conservation Letters* 9: 302–306. https://doi.org/10.1111/conl.12232.

Ogutu JO, Piepho HP, Said MY, Ojwang GO, Njino LW, Kifugo SC, Wargute PW (2016) Extreme wildlife declines and concurrent increase in livestock numbers in Kenya: what are the causes? *PLoS ONE* 11: e0163249. https://doi.org/10.1371/journal.pone.0163249.

Packer C (2015) *Lions in the Balance: Man-eaters, Manes, and Men with Guns*. Chicago University Press, Chicago and New York, USA.

Packer C, Brink H, Kissui BM, Maliti H, Kushnir H, Caro T (2011) Effects of trophy hunting on lion and leopard populations in Tanzania. *Conservation Biology* 25: 142–153. https://doi.org/10.1111/j.1523-1739.2010.01576.x.

Packer C, Loveridge A, Canney S, Caro T, Garnett ST, Pfeifer M et al. (2013) Conserving large carnivores: dollars and fence. *Ecology Letters* 16: 635–641. https://doi.org/10.1111/ele.12091.

Sandhu S (2016) *Elephant Poisoned by Poachers in Kruger National Park Leads to Death of 110 Vultures*. The Independent, London, UK.

Schneider R (1990) Concerns about game ranching. *Canadian Veterinary Journal-Revue Veterinaire Canadienne* 31: 479–480.

Treves A, Artelle KA, Darimont CT, Parsons DR (2017) Mismeasured mortality: correcting estimates of wolf poaching in the United States. *Journal of Mammology*. https://doi.org/10.1093/jmammal/gyx052

Tuyttens FAM, Macdonald DW (2000) Consequences of social perturbation for wildlife management and conservation. In: Gosling LM & Sutherland WJ (eds) *Behaviour and Conservation* 315–329. Cambridge University Press, Cambridge, UK.

Fwd: PDFs of your two new lion papers please!

Gadd, Michelle <michelle_gadd@fws.gov> Wed, Aug 10, 2016 at 2:05 PM
To: Darcy Vargas <darcy_vargas@fws.gov>, Anna Barry <anna_barry@fws.gov>, Mike Moore <mike_moore@fws.gov>, Tim Vannorman <tim_vannorman@fws.gov>, Sandra Farkas <sandra_farkas@fws.gov>, Kathleen Moore <kathleen_moore@fws.gov>, Emma Nelson <emma_nelson@fws.gov>

Please find attached some great new papers co-authored by our colleague Matt Becker from Montana, working in Zambia. Please let me know if you would like an email introduction to Matt directly - he runs the Zambia Carnivore Project which has done impressive research on large felids, canids and hyaenids in various land uses in Zambia and he also has mentored a number of Zambian carnivore biologists who are now going for their doctorates and veterinary degrees. This project also shares an airplane with an AFE-sponsored elephant project in South Luangwa. thanks, mg

——— Forwarded message ———
From: **Matthew S. Becker** <matt@zambiacarnivores.org>
Date: Tue, Jul 26, 2016 at 11:07 AM
Subject: RE: PDFs of your two new lion papers please!
To: Michelle Gadd <michelle_gadd@fws.gov>

Hi Michelle, Please find attached! All the best, M

Creel et al 2016
Miller et al 2016

–
Michelle Gadd, Ph.D.
Program Officer, African Elephant and African Rhino Programs
Division of International Conservation
U.S. Fish and Wildlife Service
5275 Leesburg Pike, MS: IA
Falls Church, VA 22041-3803
michelle_gadd@fws.gov

2 attachments

Creel_et_al-2016-Ecological_Applications.pdf
710K

Miller et al 2016 - Biol Cons - Aging traits and sustainable trophy hunting of African lions.pdf
1067K

Received Date : 04-Mar-2016

Revised Date : 02-May-2016

Accepted Date : 12-May-2016

Article type : Articles

Assessing the sustainability of African lion trophy hunting, with recommendations for policy.

Scott Creel[1,2,*], Jassiel M'soka[3], Egil Dröge[1,2], Eli Rosenblatt[1,2], Matt Becker[1,2], Wigganson Matandiko[1,2] & Twakundine Simpamba[4]

1: Zambian Carnivore Programme, P.O. Box 80 Mfuwe, Eastern Province, ZAMBIA

2: Department of Ecology, Montana State University, Bozeman, Montana 59717 USA

3: Department of National Parks and Wildlife, South Luangwa National Park, P.O. Box 18, Mfuwe, ZAMBIA

4: Department of National Parks and Wildlife, Private Bag 1, Kafue Road, Chilanga, ZAMBIA

***Corresponding author**: screel@montana.edu, 406-994-7033

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1002/eap.1377
This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

ABSTRACT: While trophy hunting provides revenue for conservation, it must be carefully managed to avoid negative population impacts, particularly for long-lived species with low natural mortality rates. Trophy hunting has had negative effects on lion populations throughout Africa, and the species serves as an important case study to consider the balance of costs and benefits, and to consider the effectiveness of alternative strategies to conserve exploited species. Age-restricted harvesting is widely recommended to mitigate negative effects of lion hunting, but this recommendation was based on a population model parameterized with data from a well-protected and growing lion population. Here, we used demographic data from lions subject to more typical conditions, including source-sink dynamics between a protected National Park and adjacent hunting areas in Zambia's Luangwa Valley, to develop a stochastic population projection model and evaluate alternative harvest scenarios. Hunting resulted in population declines over a 25-year period for all continuous harvest strategies, with large declines for quotas greater than 1 lion/concession (~0.5 lion/1000 km^2) and hunting of males younger than 7 years. A strategy that combined periods of recovery, an age limit of ≥ 7 years and a maximum quota of ~0.5 lions shot per 1000 km^2 yielded a risk of extirpation < 10%. Our analysis incorporated the effects of human encroachment, poaching and prey depletion on survival, but assumed that these problems will not increase, which is unlikely. These results suggest conservative management of lion trophy hunting with a combination of regulations. To implement sustainable trophy hunting while maintaining revenue for conservation of hunting areas, our results suggest that hunting fees must increase as a consequence of diminished supply. These findings are broadly applicable to hunted lion populations throughout Africa, and to inform global efforts to conserve exploited carnivore populations.

Keywords: trophy hunting, extinction risk, population dynamics, carnivore, *Panthera leo*

This article is protected by copyright. All rights reserved.

Accepted Article

Large carnivores are declining globally (Estes et al. 2011), with important consequences for ecosystem structure and function (Pace et al. 1999; Scheffer et al. 2001; Terborgh & Estes 2013). These declines are well-exemplified by the lion (*Panthera leo*), Africa's largest carnivore, for which suitable habitat has declined by approximately 75% in recent decades (Riggio et al. 2013). Lion numbers have decreased in parallel with their habitat, and only 10 'stronghold' populations – stable, protected populations of more than 500 individuals – currently persist (Bauer & Van Der Merwe 2004; Packer et al. 2013; Riggio et al. 2013; Bauer et al. 2015; Riggio et al. 2016). As with many other apex carnivores, most large, free-ranging lion populations are limited by a combination of habitat loss, prey depletion, direct conflict and retaliatory killing, wire-snare poaching and trophy hunting (Yamazaki 1996; Ogada et al. 2003; Bauer & Van Der Merwe 2004; Loveridge et al. 2007; Packer et al. 2009; Packer et al. 2011; Becker et al. 2013; Becker et al. 2013; Rosenblatt et al. 2014).

For lions and all other exploited species, trophy hunting is unique because it is intentional and legal, and thus more easily controlled than other limiting factors (Creel et al. 2015). In 2015, the US Fish and Wildlife Service listed lions in Western and Central Africa as endangered and those in Eastern and Southern Africa as threatened under the Endangered Species Act. This listing decision found evidence for "practices that experts have identified as undermining the sustainability of trophy hunting" and included an explicit rule that body parts from lions killed in trophy hunts can only be imported from nations with "a scientifically sound management program that benefits the subspecies in the wild" (U.S.Fish and Wildlife Service 2015). Due to concern over population decline, poor recruitment and a decrease in the age of lions being shot in Game Management Areas adjacent to South Luangwa National Park, the Zambia Wildlife Authority implemented a moratorium on lion hunting for 2013-2015 (Rosenblatt et al. 2014). It

This article is protected by copyright. All rights reserved.

is unusual that a limiting factor can be switched off so directly (Rutledge et al. 2010; Creel et al. 2015), but hunting is also unusual because it provides revenue that can contribute to conservation, and from this economic perspective, lions are one the most important of Africa's hunted species (Creel & Creel 1997; Packer et al. 2011; Lindsey et al. 2013; U.S.Fish and Wildlife Service 2015). Well-regulated hunting has the potential to contribute to lion conservation, but data show that overharvesting has contributed to their current decline (Packer et al. 2011; Lindsey et al. 2013; Rosenblatt et al. 2014), and the ecological, cultural and economic importance of lions mandates careful attention to these issues (Creel et al. 2015).

Empirical Studies of Trophy Hunting Effects on Lions

Lions, like most large carnivores, have low adult mortality rates in the absence of human effects, making it unlikely that hunting simply substitutes for other causes of death (Rosenblatt et al. 2014; Creel et al. 2015), and data confirm that some lion populations are affected by overhunting. Loveridge et al. (2007) examined lions in Hwange National Park (Zimbabwe) in an area of 7129 km^2, of which 83% was within the National Park where hunting is not allowed, and 17% was within adjacent communal lands, safari areas and hunting concessions. Of 62 individuals marked on this site, trophy hunting accounted for 63% of 38 individuals who died or disappeared. The proportion of the population comprised of adults males declined from 26.3% to 13.7% during a period of 4 years over which the offtake of males doubled. Of marked, territorial males in this population, 72% were killed by trophy hunters, at a mean distance of 1.5 km from the park boundary. Thus in the Hwange region, sport hunting is largely based on source-sink harvesting of lions from the national park, and not on sustainable offtake of lions residing within the hunting areas themselves (a phenomenon that Loveridge termed the 'vacuum effect').

This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

Rosenblatt et al (2014) found similar results for lions on a 2775 km^2 study site centered on the Luangwa River (Zambia), including portions of South Luangwa National Park (SLNP, which does not allow hunting) and the adjacent Lupande and Lumimba Game Management Areas (GMAs, which allow hunting). Lupanda and Lumimba are considered 'prime' hunting areas by the Department of National Parks and Wildlife. This classification is currently applied to a small number of GMAs, all adjacent to the large, protected lion populations of SLNP and Kafue National Park. Using mark-recapture models fit to data from intensive monitoring of 210 individual lions in 18 prides and 14 male coalitions over 5 years, they found that trophy hunting was the most common cause of death, with 46 males harvested from a population showing indications of overharvest that included population decline, low recruitment, low sub-adult and adult male survival, depletion of adult males (prime-aged and old adult males never exceeded 6% of the population) and a senescing adult female population. The median age of harvested males was 4.86 years old, substantially below the minimum age of 6 suggested by Whitman et al (2004), and annual harvest rates ranged from 1.86 to 2.56 lions/1000 km^2, much higher than the baseline recommendation of 0.5 lions/1000 km^2 (Packer et al. 2011) and well above the higher value of 1 lion/1000 km^2 recently suggested for Tanzania's Selous Game Reserve (Packer et al. 2011). As in Hwange, harvest was heavily concentrated along the national park boundary (Rosenblatt et al. 2014) (see Results, Fig. 1).

In Tanzania's Selous Game Reserve, which holds the largest lion population on the continent (Creel & Creel 1997; Bauer & Van Der Merwe 2004; Creel et al. 2013), lions attained densities between 8 and 13 per 100 km^2, and on a focal study area of 2,600 km^2 in the Northern Sector of Selous, lions were killed at a rate of 2·7–4·3% of adult males annually between 1989 and 1994. This mortality was thought to be sustainable, while noting that lion quotas were substantially

This article is protected by copyright. All rights reserved.

higher, equal to 10—16% of the adult male population. Offtake of the full quota was thought to be unsustainable, and the percentage of quotas filled (both in Selous and nationwide) began declining in 1988 as quotas increased (Creel & Creel 1997). Packer et al. (2011) analyzed harvest records for all of Tanzania's hunting blocks, which cover more than 300,000 km^2 (approximately 100,000 km^2 in Game Reserves and 200,000 km^2 in less-protected Game Controlled Areas) and found that lion harvests declined by 50% between 1996 and 2008, with the greatest declines in the areas of heaviest harvest. Thus in Tanzania, estimated catch-per-unit-effort has been declining for several decades (Creel & Creel 1997; Packer et al. 2011).

In Zimbabwe's Gonarezhou National Park and Tuli Safari area, lion densities (as estimated from call-up surveys) were between 0% and 16% of those predicted on the basis of prey biomass, a pattern that was not observed for other large carnivores (Groom et al. 2014). Data on offtake of lions by trophy hunting and other potential limiting factors suggested that population collapse was due to direct human effects including "unsustainably high trophy hunting quotas" in conjunction high levels of legal control killing and illegal killing (Groom et al. 2014).

In the Bénoué Complex of Cameroon, track surveys conducted in three national parks and three hunting zones suggested that lion densities in hunting zones were only 31% of those in national parks (Croes et al. 2011). Lions attained only 27% of their estimated carrying capacity (based on prey density) in hunted areas, compared to 53% in national parks. In contrast, densities of leopards (*Panthera pardus*) and spotted hyenas (*Crocuta crocuta*) did not detectably differ between hunted areas and national parks. Relating these patterns to data on the number of lions shot and permits issued, Croes et al. (2011) concluded that in addition to other problems, "lions living in the hunting zones are strongly impacted through excessive trophy off-takes".

This article is protected by copyright. All rights reserved.

Accepted Article

In summary, empirical studies have detected low lion density and population declines associated with excessive trophy hunting, using a broad range of methods, at sites widely distributed across the lion's range.

Modelling Trophy Hunting Effects on Lions

A population model applied to data from lions in Serengeti National Park suggested that "hunting can be sustained simply by hunting males above a minimum age threshold" (Whitman et al. 2004; Whitman et al. 2007). Following this suggestion, age-limited harvesting has been implemented in several nations (e.g. Tanzania, Zambia and Mozambique) in an effort to make lion hunting more sustainable. Also based on this model, a minimum permitted age of 6 years has been widely adopted. When considering the generality of this strategy, one must recognize that the model was parameterized with data from a well-protected population experiencing strong, sustained growth as its prey base increased (Hanby et al. 1995; Packer et al. 1988): this limitation was carefully acknowledged by the original authors (Whitman et al. 2004). In contrast to patterns in Serengeti for the period modelled, the ungulate prey base supporting lions and other large carnivores is declining in most ecosystems (Bolger et al. 2008; Caro & Kerley 2008; Western et al. 2009), and many lion populations are thought to be declining as a result of prey depletion and related problems (Bauer et al. 2015; Riggio et al. 2016). Moreover, the structure of the underlying population model (Quadling & Starfield 2002; Whitman et al. 2004) was highly complex and process-based, requiring detailed data such as the likelihood of death in territorial disputes between males of specific ages and resident/nomad status, the likelihood of females locating open territories as a function of distance, and differences in the likelihood that dispersing males will join single males, groups of nomads or pride-holding males. The lack of such data has limited application since the model's development (by Starfield more than 30 years

This article is protected by copyright. All rights reserved.

Accepted Article

ago) to a single population in Serengeti National Park (Whitman et al. 2004), with some important parameters roughly estimated even in that application (for examples, see the supplementary data of Whitman et al. 2004). To address uncertainty about the sustainability of current lion hunting policies and to evaluate age restrictions in areas more representative of harvested lion populations, we developed a simpler model to assess the sustainability of lion hunting, using Leslie matrix projection. We then applied the model to data typical of current conditions for many lion populations, with exposure to effects of human encroachment, snaring and prey depletion, and source-sink dynamics in which lions moving from a fully protected area are regularly exposed to mortality from hunting (Loveridge et al. 2007; Becker et al. 2013; Watson et al. 2013; Rosenblatt et al. 2014; Watson et al. 2015). We used population and harvest projections over 25 years to examine the sustainability of a range of potential policies including age-restricted harvest, quotas and recovery periods, separately and in combination. Our results strongly suggest that a combination of all of these strategies will be needed to avoid population declines due to overharvest, with appreciable risk of local extirpation.

A similar model parameterized with data from Serengeti was recently used to examine regulation of hunting with data only on the number of days required to kill a lion (Edwards et al. 2014). As Edwards et al. (2014) note, the value of this approach is that it can be applied even if data on population size, structure and growth rate are limited. On the other hand, indirect approaches depend on a strong and constant relationship between population size and the indirect measure of choice. In this case, the model assumed that the number of days required to shoot a lion (μ) relates inversely to population size in a constant manner, $\mu = {}^{1}/_{cN}$, where N is population size and c is a constant describing hunting effort and effectiveness. Thus, the model's results depend on an assumption that hunting effort and methods do not change as the targeted population

This article is protected by copyright. All rights reserved.

Accepted Article

decreases, which we do not consider realistic for lions. Even if constant effort and methods could be mandated and enforced, this approach relies on the additional assumption that μ has a strong relationship with population density, which to our knowledge is not supported by data from lions (see Results, Fig. 2), perhaps because a 'day of hunting' can mean many different things. For example, the use of baits (ungulate carcasses) to attract lions is still common practice. If multiple baits are dragged and hung in areas of known use (for example, watering points with good stalking cover), the likelihood of attracting a lion is likely to be decoupled from changes in population size until they become extreme. Similar concerns arise for the regulation of hunting with most large carnivores, for which population monitoring is generally difficult, limiting direct data on population size and trends.

METHODS

We modelled lion dynamics without harvest and with a range of harvest scenarios. The online supplement describes the model's structure, parameterization and validation in detail. Our basic approach was to begin with a population of defined size (180 individuals), with a sex ratio and age-distribution based on SLNP and the adjacent Lupande and Lumimba GMAs. These starting conditions are typical of many of Africa's most important lion hunting areas, with a single population that occupies a National Park in which lions cannot be hunted and adjacent areas in which hunting is allowed (see Results, Fig. 1). Recent population trends for lions in SLNP have included a decrease in population size and age-sex trends indicative of excessive trophy hunting (Rosenblatt et al. 2014). Many lion populations now show trends and constraints comparable to those of Luangwa valley lions. With these starting conditions, we projected population dynamics 25 years into the future, without hunting and with a range of hunting scenarios described just below. For all cases, we used stochastic Leslie matrix projection, with linear

This article is protected by copyright. All rights reserved.

density dependence and separate projection matrices for males and females (because they differ in patterns of age-specific survival and reproduction).

Effects of Trophy Hunting

We modelled the effects of three methods that are currently proposed or used to regulate lion hunting, separately and in combination: (a) block quotas, (b) age-restriction, and (c) recovery periods with no hunting. SLNP is bordered by four hunting blocks (Upper and Lower Lupande GMA, Lumimba GMA and Nyampala GMA), ranging in size from 1,296 km^2 to 4,392 km^2. Recent and proposed regulations allow either one or two males to be harvested in each of these blocks, so we modelled block quotas of one or two. SLNP is the primary source for lions shot in Upper and Lower Lupande and Lumimba (see Results, Fig. 1), but the ranging patterns of lions shot in Nyampala have not been described. Lions shot in Nyampala are likely to originate from SLNP, but if they do not, then results midway between those shown for block quotas of 1 and 2 would best represent block quotas of 2 for the other three blocks (see Results, Figs. 3 & 4). Current or proposed policies in Zambia, Tanzania, Mozambique and elsewhere incorporate a minimum age for males that can be shot, though there is currently little direct guidance about the appropriate age threshold for a population facing the conditions typical for most lions. Simulations based on data from the well-protected and growing lion population in Serengeti N.P. suggested a threshold of six years, but applicability of this threshold to other populations has not been tested. Thus, we modelled scenarios that varied the minimum allowable age from 4 to 8 years. Finally, the Zambian government recently closed trophy hunting for three years to allow a period of recovery in both population size and age structure. Thus, we modelled scenarios with continuous harvest, with 2 year recovery periods between hunted periods of 4 years ('4 on/2 off') and with alternating 3 year periods of hunting and population recovery ('3 on/3 off'). We

This article is protected by copyright. All rights reserved.

Accepted Article

present results for combinations of block quota (one or two), recovery periods (continuous harvest, 4 on/2 off, 3 on/3 off) and minimum age (4 – 8 years).

Direct hunting mortality. We incorporated direct mortality of males due to trophy hunting by checking within each group at each time step for males above the minimum allowable age, and removing them until the quota was filled. For scenarios other than continuous harvest, no males were removed by hunting in years designated for recovery.

Super-additive effects of hunting mortality on recruitment of cubs. The social disruption created by increased mortality due to hunting often reduces reproduction in social carnivores (Whitman et al. 2007; Rutledge et al. 2010; Creel et al. 2015). For lions, an increase in male turnover increases the frequency of infanticide by males that inherit prides, reducing recruitment (Whitman et al. 2004; Whitman et al. 2007). To incorporate super-additive effects on recruitment in a simple manner that is amenable to comparison with empirical data, we assumed that effects on recruitment will be stronger when the minimum age of males that can be shot is lower, because increased social disruption should increase the frequency of turnover. We then defined the reduction in fecundity due to hunting within the age classes exposed to this effect. As described in detail in the online supplemental materials, we examined three cases: one with no effect on fecundity due to male losses, one with strong effects on fecundity (reduction of 32% - 55% with stronger effects when a wider age range is hunted) and one intermediate case. These cases span the plausible range for the strength of super-additive effects in lions (Fig. S4), and we show results for all three cases for each harvest regulation scenario that we modelled.

This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

Model Outputs

For each scenario, we ran 500 stochastic simulations over 25 years, from which we report mean population size, the proportion of populations that were extirpated, and the total number of lions taken by trophy hunters. These data allow comparison of risks for different scenarios, and allow comparison of risks to financial benefit from license sales in a manner that could readily be used to adjust license fees.

RESULTS AND DISCUSSION

Lions are often hunted in areas adjacent to a fully-protected source population (Loveridge et al. 2007; Rosenblatt et al. 2014), so a population model parameterized with data from such conditions if of general interest. From 2008 to 2012 in the Luangwa valley, 22 kill sites recorded by the Department of National Parks and Wildlife show that lions were killed a median of 997 meters (SE = 463 meters) from SLNP, well within the normal ranges of lions that occupy the primary photo-tourism area of SLNP along the Luangwa River (Fig. 1, lion locations from Rosenblatt et al. 2014). The observed distribution of distances between kill sites and the National Park boundary did not overlap with a distribution of random locations within the GMA ($P < 0.001$, bootstrap randomization test). In short, the Luangwa valley holds a single lion population with individuals regularly moving between SLNP (where they are fully protected and support photo-tourism) and the adjacent GMAs where they are exposed to hunting.

We did not model the sustainability of hunting regulations based on indirect measures such as the number of days required to kill a lion. Data from the Luangwa valley (2003 - 2012) show that these indirect measures provide a weak signal-to-noise ratio (Fig. 2). Neither the number of days hunted nor reported measures of trophy quality showed any tendency to decline over a

This article is protected by copyright. All rights reserved.

Accepted Article

period for which capture-recapture estimates of population size revealed a significant decline, which (together with changes in age-structure) was deemed serious enough to provoke a complete hunting closure in 2013 (Rosenblatt et al. 2014). More specifically, a GLM (family = poisson, link = log) relating the number of days required to kill a lion to time had a slope indistinguishable from zero ($b = 0.005 \pm 0.018$ SE, $z = 0.28$, $P = 0.78$).

The baseline model (a scenario with no hunting and other limiting effects at 2008-2012 levels), yielded a deterministic growth rate (λ) of 1.022, stable stochastic dynamics and no risk of extirpation over 25 years (Fig. S3). Because the initial conditions were for a population well below carrying capacity with $\lambda > 1$, populations in the baseline model increased over roughly 6-7 until reaching equilibrium. All scenarios with hunting produced some degree of population decline and local extirpation probabilities greater than zero, though some combinations of strategies yielded relatively stable dynamics and low probability of extirpation over 25 years.

Age-Restricted Harvesting

Our results (Fig. 3) strongly support the prior inference that restricting harvest to males above a certain age increases the sustainability of lion hunting (Whitman et al. 2004; Whitman et al. 2007a; Whitman and Packer 2007). However, our results do not support the suggestion that restriction of hunting to males of age six or older will reliably yield sustainable offtake in the absence of other restrictions, with the conditions typified by Luangwa valley lions. As Figure 3 shows, with age restriction and no other limits on offtake, the probability of extirpation was essentially certain if males as young as 4 years were allowed to be hunted (as has recently been the case in SLNP, where the median age of 12 known individuals shot by hunters between 2008 and 2012 was 4.86 years) (Rosenblatt et al. 2014). The probability of extirpation dropped

This article is protected by copyright. All rights reserved.

monotonically as the minimum age was raised, but fell consistently below 50% only with a minimum age of 7, and remained at 5% - 11% with a minimum age of 8. The results suggest that: (*a*) age-restriction is an important element of sustainable hunting for lions, (*b*) a minimum age of 7-8 is necessary to yield a reasonably low risk of extirpation even in the near future, and (*c*) age-restrictions must be combined with other regulations to assure sustainability. Like the baseline model (Fig. S3), all of the scenarios with hunting simulated an initial population well below carrying capacity with $\lambda = 1.022$, which allowed population growth for the first few years of simulation (Fig. 3), but this transient period of growth would not be expected with less favorable starting conditions for the simulation.

Lions can be aged using characteristics such as nose pigmentation, mane development and tooth condition (Whitman et al. 2007), but even careful application of these methods will yield some errors in age estimates. Our results can be used to examine the consequences of errors in aging, by recognizing that true age is being modelled. For example, if errors in age estimation cause half of the lions shot to be 5, even though regulations stipulate a minimum age of 6, then results intermediate to those for ages 5 and 6 would describe the predicted effect on population dynamics. We note that errors in aging are likely to be reduced by application of a minimum age of 7 or 8, because age-specific variation is greater at younger ages, when traits are changing more rapidly (Whitman and Packer 2007).

Block Quotas and Recovery Periods

Given the relatively high risk of extirpation from age restricted harvesting, particularly with the commonly-used threshold of six years, we examined scenarios with two restrictions applied in conjunction with age limits: maximum block quotas and recovery periods. A block quota of 2

This article is protected by copyright. All rights reserved.

examines a situation in which total harvest (maximum of 8 individuals killed/year) is slightly lower than reported harvests ($\bar{\bar{X}} = 8.8$ individuals killed/year) from 2008-2012 and a block quota of 1 examines the consequences of halving this rate. Recent observations suggest that South Luangwa lion dynamics have responded to a moratorium on hunting that began in 2013, so we also modelled recovery periods of 2 or 3 years out of each 6 year period. Results for these scenarios (Figs. 4 & 5) show that block quotas and recovery periods both considerably increased the sustainability of hunting, and that combining a block quota of one with a recovery period was the only scenario that consistently yielded a risk of extirpation below 20%. This scenario yields maximum annual mortality due to hunting of substantially less than 0.5 lions/1000 km^2 (see 'Number of Males Shot', below), which has been proposed as a reasonable threshold for sustainability (Packer et al. 2011). The value of 0.5 lions/1000 km^2 is a valuable general guideline, but it was based on estimates of population growth rates taken from coarse estimates of population size, which is notoriously difficult to estimate for lions without intensive monitoring (Creel et al. 2013; Rosenblatt et al. 2014; Riggio et al. 2016).

As expected, scenarios that included recovery periods and block quotas were less sensitive to effects of minimum hunted age than more liberal scenarios (Figs. 4 & 5). This result provides potentially useful guidance by identifying regulations that are expected to be sustainable in the face of uncertainty in the aging of lions or difficulty in enforcing age restrictions. Strategies that incorporate recovery periods and block quotas can promote sustainability despite problems with accurate aging or enforcement of age restriction. This combination of strategies is also inherently safer than harvesting solely on the basis of age with a 'points system' that reduces quotas if under-aged lions are shot, because such systems adjust quotas after the effects of killing under-aged males have already occurred.

This article is protected by copyright. All rights reserved.

Accepted Article

Finally, because very few males reach old age classes under most harvest scenarios (as in empirical data for SLNP), differences in outcomes for age thresholds of 7 and 8 years were somewhat unpredictable unless aggregated across a very large number of model iterations. This result is logically realistic: a change in policy that affects a small number of individuals in a stochastic process will have rather stochastic outcomes.

Number of Males Shot

Figure 6 shows the number of males legally shot in each year for each of the harvest scenarios described above. These data reinforce the conclusion that a combination of strategies is needed to promote sustainability, because a clear decline over time in the number of harvestable males is apparent for most scenarios. This decrease in the availability of prime-aged males is minimized by the combination of a block quota of one, a 3 on/3 off cycle of hunting and recovery, and a minimum hunted age of 7 or 8 years. While this scenario yields the lowest risk of extirpation, even this combination is predicted to produce a decline in harvestable males with the baseline conditions of this model, even with no super-additive effects on reproduction. Moreover, the survival rates in our base simulations include effects from poaching and human encroachment at their current levels, and then assume that these problems will not worsen, which is not necessarily correct (Becker et al. 2013; Watson et al. 2013; Rosenblatt et al. 2014; Watson et al. 2015). If other negative effects on lions are not controlled, it is unlikely that trophy hunting at any level will be sustainable.

Implications for Sustainable License Fees

Figure 7 shows the mean number of males killed by trophy hunters over 25 years for each of the policy scenarios discussed above. The number of harvested males ranged from a maximum of

This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

37 to a minimum of 7. As Figure 7 shows, many scenarios yield similar total offtake over a span of 25 years, parallel to results above showing that many scenarios yield similar risks of extirpation. This result is important because it implies that, among alternatives with similar expected outcomes, the one that is most easily and effectively enforced should be favored. Figure 7 can also be used to assess what changes might reasonably be made to lion hunting fees to promote sustainability, while maintaining current revenue for conservation. Forty-four males, or a mean of 8.8 males/year, were taken from this population by trophy hunters between 2008 and 2012, which yielded population decline, poor recruitment, a population with few old males, and a decrease in the age of harvested males (Rosenblatt et al. 2014). Figure 7 suggests that scenarios yielding sustainable offtake would require offtake to decline by roughly an order of magnitude. Thus, a clear policy recommendation is that the fee for lion hunting should be increased comparably, if it is expected to yield ecologically and economically sustainable trophy hunting. Such changes might usefully be paired with longer leases on hunting concessions (so that hunting operators could plan for required periods of recovery) and staged fees so that the full amount is only charged if a lion is shot.

The economics of supply and demand imply that any scarce and declining resource will become more expensive. If treated simply as a commodity (an approach that is questionable on many fronts), lions have declined dramatically over recent decades (Bauer & Van Der Merwe 2004; Packer et al. 2011; Riggio et al. 2013). Declines have been larger in the areas with heavier hunting, and hunting was the strongest predictor of population declines for lions in Tanzanian protected areas (Packer et al. 2011). Our results strongly suggest that lion hunting fees have been too low to promote truly sustainable hunting. Throughout their range, the conservation of free-ranging lion populations has been demonstrably constrained by budgets that do not provide

This article is protected by copyright. All rights reserved.

sufficient protection (Packer et al. 2011; Creel et al. 2013). Thus, any policy change that reduced funding for necessary conservation actions such as patrolling and snare removal would be expected to have negative effects on lion populations, by exacerbating widespread and accelerating problems such as wildlife depletion due to snaring and encroachment by local people (Watson et al. 2013; Watson et al. 2015). At the same time, substantial recent data demonstrate that trophy hunting at unsustainable levels has contributed to lion population declines (Loveridge et al. 2007; Packer et al. 2009, 2011; Rosenblatt et al. 2014). Collectively, these results suggest the following:

1. For trophy hunting to be sustainable under the conditions that most lions now experience, modifications to policy must reduce total mortality.

2. Age-restricted harvesting is effective to increase the sustainability of trophy hunting, but is probably not sufficient to yield sustainability by itself. The widely-suggested minimum huntable age of 6 years (Whitman et al. 2004; Whitman et al. 2007) was based on data from a growing lion population in Serengeti, with more favorable conditions for lions than now exist for most populations that support trophy hunting. Our results suggest that a minimum age of 7 - 8 is substantially more effective for the conditions typified by Luangwa lions, and should be combined with other policies to limit total mortality.

3. The acceptable risk of local extirpation will have to be confronted. Our results show that a risk of extirpation that might be considered acceptable (e.g. <10%) is likely to be accomplished only with a combination of methods. This inference is generalizable to other exploited species.

4. Policies that combine age-restriction, conservative block quotas and recovery periods are more likely to promote sustainable harvest, particularly with uncertainty about field estimates of age or

This article is protected by copyright. All rights reserved.

difficulties with enforcement of regulations. A general lesson from this result is that policies that incorporate a combination of strategies to limit negative effects of hunting on population dynamics provide a margin of safety.

5. As lion populations (and particularly prime aged males) decrease, the price of licenses must increase to halt declines linked to overharvesting, to accurately reflect a decrease of supply (in the economic sense), and to ensure that hunting contributes to effective conservation of areas in which hunting is allowed. The values of lions that are not directly linked to short-term economics (e.g. ecological and cultural importance as well as value to non-consumptive tourism) should not be ignored and where lion are hunted in protected area complexes, efforts should focus on restoring and increasing lion populations and habitat for GMAs now classified as secondary or understocked, rather than finding means to increase offtake on prime hunting blocks. More broadly, low hunting license fees for carnivores promote aggressive offtake of these rare and ecologically important species (Creel et al. 2015: *e.g.*, a wolf license for out-of-state hunters in Idaho costs only $32, with individuals allowed to take up to five, while licenses for deer and elk, which outnumber wolves by several orders of magnitude, cost $302 and $417).

6. The data used to parameterize our model includes impacts on survival from poaching and human encroachment at their current levels, thus assuming these activities will not worsen, which is unlikely given burgeoning human pressures across Africa's remaining lion populations. If the current acceleration of other negative effects on lions is not addressed and controlled, then it is unlikely that trophy hunting at any level will be sustainable. These conclusions are likely to generalize to other African large carnivores, particularly the leopard.

This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

Acknowledgements: We thank the Zambia Department of National Parks and Wildlife for permission to conduct this research, and for their support and cooperation. This work was supported by grants from the National Science Foundation (IOS 1145749), WWF-Netherlands, Mfuwe Lodge/Bushcamp Company, Painted Dog Conservation Inc., and the National Geographic Society Big Cats Initiative.

SUPPORTING INFORMATION

Supplemental online material includes a detailed description of the lion population model's structure, parameterization and validation.

DATA AVAILABILITY

Data associated with this paper have been deposited in Dryad: http://dx.doi.org/10.5061/dryad.mc2p8.

LITERATURE CITED

Bauer H, Van Der Merwe S. 2004. Inventory of free-ranging lions Panthera leo in Africa. Oryx **38**: 26-31.

Bauer H Chapron G, Nowell K, Henschel P, Funston P, Hunter LT, Macdonald DW, Packer C. 2015. Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas. Proceedings of the National Academy of Sciences **112**: 14894-14899.

This article is protected by copyright. All rights reserved.

Accepted Article

Becker MS, McRobb R, Watson F, Droge E, Kanyembo B, Murdoch J, Kakumbi C. 2013a. Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. Biological Conservation **158**: 26-36.

Becker MS, Watson FG, Droge E, Leigh K, Carlson RS, Carlson AA. 2013. Estimating past and future male loss in three Zambian lion populations. Journal of Wildlife Management **77**: 128-142.

Bolger DT, Newmark WD, Morrison TA, Doak DF. 2008. The need for integrative approaches to understand and conserve migratory ungulates. Ecology Letters **11**: 63-77.

Caro T, Kerley GIH. 2008. Decline of large mammals in the Katavi-Rukwa ecosystem of western Tanzania. African Zoology **43**: 99-116.

Creel S, et al. 2013. Conserving large populations of lions: the argument for fences has holes. Ecology Letters **16**: 1413-1414e3.

Creel S, Creel NM. 1997. Lion density and population structure in the Selous Game Reserve: Evaluation of hunting quotas and offtake. African Journal of Ecology **35**: 83-93.

Creel S et al. 2015. Questionable policy for large carnivore hunting. Science **350**: 1473-1475.

Croes BM, Funston PJ, Rasmussen G, Buij R, Saleh A, Tumenta PN, De Iongh HH. The impact of trophy hunting on lions (*Panthera leo*) and other large carnivores in the Bénoué Complex, northern Cameroon. Biological Conservation. **144**: 3064-3072.

This article is protected by copyright. All rights reserved.

Accepted Article

Edwards CT, Bunnefeld N, Balme GA, Milner-Gulland EJ. 2014. Data-poor management of African lion hunting using a relative index of abundance. Proceedings of the National Academy of Sciences **111**: 539-543.

Estes JA et al. 2011.Trophic downgrading of planet earth. Science **333**: 301-306.

Groom RJ, Funston PJ, Mandisodza R. Surveys of lions Panthera leo in protected areas in Zimbabwe yield disturbing results: what is driving the population collapse?. Oryx **48**:385-393.

Hanby JP, Bygott JD, Packer C. 1995. Ecology, demography and behavior of lions in two contrasting habitats: Ngorongoro Crater and the Serengeti Plains. Pages 315-331 in Sinclair ARE, Arcese P, editors. Serengeti II. University of Chicago Press, Chicago.

Lindsey PA, Balme GA, Funston P, Henschel P, Hunter L, et al. (2013) The trophy hunting of African lions: Scale, current management practices and factors undermining sustainability. PLoS ONE 8(9): e73808. doi:10.1371/journal.pone.0073808

Loveridge AJ, Searle AW, Murindagomo F, Macdonald DW. 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation **134**: 548-558.

Midlane, N. 2014. The Conservation Status and Dynamics of a Protected African Lion Panthera Leo Population in Kafue National Park, Zambia. Ph. D. thesis, University of Cape Town, Cape Town.

Ogada MO, Woodroffe R, Oguge NO, Frank LG. 2003. Limiting depredation by African carnivores: the role of livestock husbandry. Conservation Biology **17**: 1521-1530.

This article is protected by copyright. All rights reserved.

Pace ML, Cole JJ, Carpenter SR, Kitchell JF. 1999. Trophic cascades revealed in diverse ecosystems. Trends in Ecology and Evolultion **14**: 483-488.

Packer C, Herbst L, Pusey AE, Bygott JD, Hanby JP, Cairns SJ, Borgerhoff Mulder M. 1988. Reproductive success in lions. Pages 363-383 in Clutton-Brock TH, editor. Reproductive Success. University of Chicago Press, Chicago.

Packer C, Brink H, Kissui BM, Maliti H, Kushnir H, Caro T. 2011. Effects of trophy hunting on lion and leopard populations in Tanzania. Conservation Biology **25**: 142-153.

Packer C, Kosmala M, Cooley HS, Brink H, Pintea L, Garshelis D, Purchase G, Strauss M, Swanson A, Balme G, Hunter L. 2009. Sport hunting, predator control and conservation of large carnivores. PloS One **4**: e5941.

Packer C et al. 2013. Conserving large carnivores: dollars and fence. Ecology Letters, **16**: 635-641.

Quadling HS, Starfield AM. 2002. Exploiting object-orientated programming structures in the quest for an individual-based lion population model with an attractive user interface: Starfield Festschrift. South African Journal of Science **98**: 449-454.

Riggio J Caro T, Dollar L, Durant SM, Jacobson AP, Kiffner C, Pimm SL, van Aarde RJ. 2016. Lion populations may be declining in Africa but not as Bauer et al. suggest. Proceedings of the National Academy of Sciences **113**: E107-E108

Riggio J et al. 2013. The size of savannah Africa: a lion's (Panthera leo) view. Biodiversity and Conservation **22**: 17-35.

This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

Rosenblatt E, Becker MS, Creel S, Droge E, Mweetwa T, Schuette PA, Watson F, Merkle J, Mwape H. 2014. Detecting declines of apex carnivores and evaluating their causes: An example with Zambian lions. Biological Conservation **180**: 176-186.

Rutledge LY, Patterson BR, Mills KJ, Loveless KM, Murray DL, White BN. 2010. Protection from harvesting restores the natural social structure of eastern wolf packs. Biological Conservation **143**: 332-339.

Scheffer M, Carpenter S, Foley JA, Folke C, Walker B. 2001. Catastrophic shifts in ecosystems. Nature **413**: 591-596.

Terborgh J, Estes JA. 2013. Trophic Cascades: Predators, Prey, and the Changing Dynamics of Nature. Island Press, Washington.

U.S.Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Listing Two Lion Subspecies. Federal Register **80**: 80000-80056.

Watson F, Becker MS, McRobb R, Kanyembo B. 2013. Spatial patterns of wire-snare poaching: Implications for community conservation in buffer zones around National Parks. Biological Conservation **168**: 1-9.

Watson FG, Becker MS, Milanzi J, Nyirenda M. 2015. Human encroachment into protected area networks in Zambia: Implications for large carnivore conservation. Regional Environmental Change **15**: 415-429.

Western D, Russell S, Cuthill I. 2009. The status of wildlife in protected areas compared to non-protected areas of Kenya. PloS One **4**: e6140.

This article is protected by copyright. All rights reserved.

Whitman K, Starfield AM, Quadling HS, Packer C. 2004. Sustainable trophy hunting of African lions. Nature **428**: 175-178.

Whitman KL, Packer C. 2007. A Hunter's Guide to Aging Lions in Eastern and Southern Africa. Safari Press, Huntington Beach.

Whitman KL, Starfield AM, Quadling HS, Packer C. 2007. Modeling the effects of trophy selection and environmental disturbance on a simulated population of African lions. Conservation Biology **21**: 591-601.

Yamazaki K. 1996. Social variation of lions in a male-depopulated area in Zambia. Journal of Wildlife Management **60**: 490-497.

FIGURE LEGENDS

Figure 1. Ranging patterns of lions in the Luangwa Valley from 2008 to 2012 and the reported locations of 21 lions shot by trophy hunters in the same years. One recorded kill site (not shown) in the western portion South Luangwa National Park was probably recorded incorrectly. No location was reported for 22 of 44 lions shot in this period. Lion kill sites are from Department of National Parks and Wildlife records, and lion ranging patterns are shown by radio-locations of resident females (Rosenblatt et al. 2014).

Figure 2. Indirect measures of population status showed high variability and no tendency to decline over a period of 10 years for which direct data revealed population decline, depletion of males in prime age-classes, poor recruitment and a decrease in the median age of harvested males to less than 5 years (Rosenblatt et al. 2014). Data are from Department of National Parks

This article is protected by copyright. All rights reserved.

Accepted Article

and Wildlife records; recorded measurements that are not plausible were not deleted, because our intention was to evaluate the signal-to-noise ratio of such data. Error bands show 95% confidence intervals.

Figure 3. With harvesting in every year, (***top***) population size is expected to decline appreciably, so that (***bottom***) the probability of local extinction within 25 years is also appreciable. For each minimum permitted age, the three curves show models with no effect on cub recruitment, moderate effects, and strong effects.

Figure 4. Mean population size for population projections over 25 years with variation in the minimum male age permitted for hunting. For each minimum age, population means are shown for three scenarios: no effect of male loss on reproduction, moderate effects and strong effects. (***Left***) Maximum block quota of one male shot per year. (***Right***) Maximum block quota of 2 males shot per year. (***Top***) Hunting cycle of 4 years on and 2 years off. (***Bottom***) Hunting cycle of 3 years on and 3 years off.

Figure 5. The proportion of simulated populations that went to local extinction over 25 years with variation in the minimum male age permitted for hunting. For each minimum age, extinction probabilities are shown three scenarios: no effect of male loss on reproduction, moderate effects and strong effects. (***Left***) Maximum block quota of one male shot per year. (***Right***) Maximum block quota of 2 males shot per year. (***Top***) Hunting cycle of 4 years on and 2 years off. (***Bottom***) Hunting cycle of 3 years on and 3 years off.

This article is protected by copyright. All rights reserved.

Accepted Article

Figure 6. Differences between hunting scenarios in the number of males legally harvested in each year. As population size and age structure changed through time, harvest rates declined for all scenarios, with the smallest decline for a maximum block quota of one, minimum permitted age of 7 or 8, and recovery periods of 3 years between 3 year periods of hunting.

Figure 7. The total number of adult males shot over 25 years, for scenarios varying the minimum age permitted, the duration of cycles between hunting and population recovery, and block quotas of one or two.

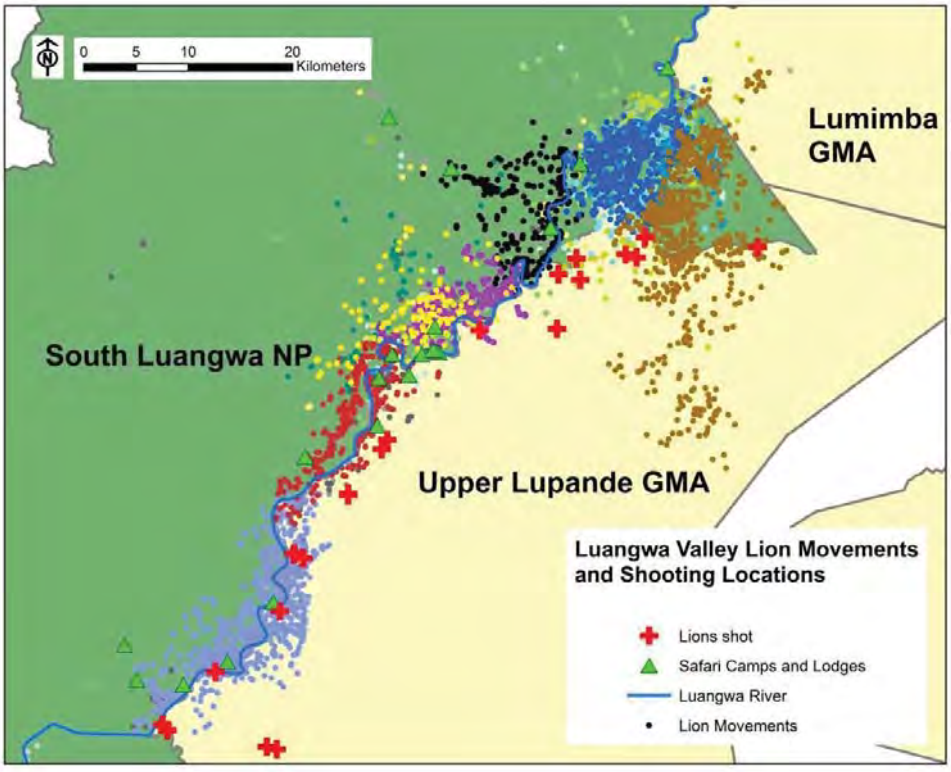


Figure 1.

This article is protected by copyright. All rights reserved.

Accepted Article

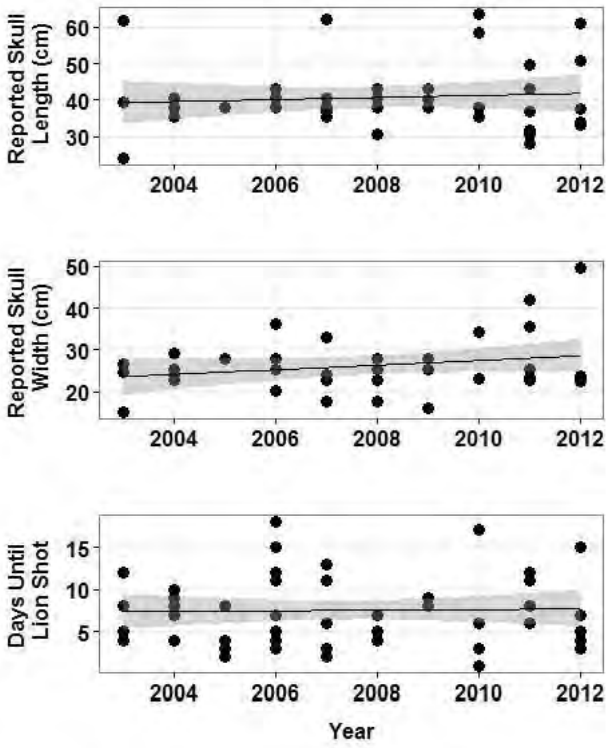


Figure 2.

Accepted Article

This article is protected by copyright. All rights reserved.

Accepted Article

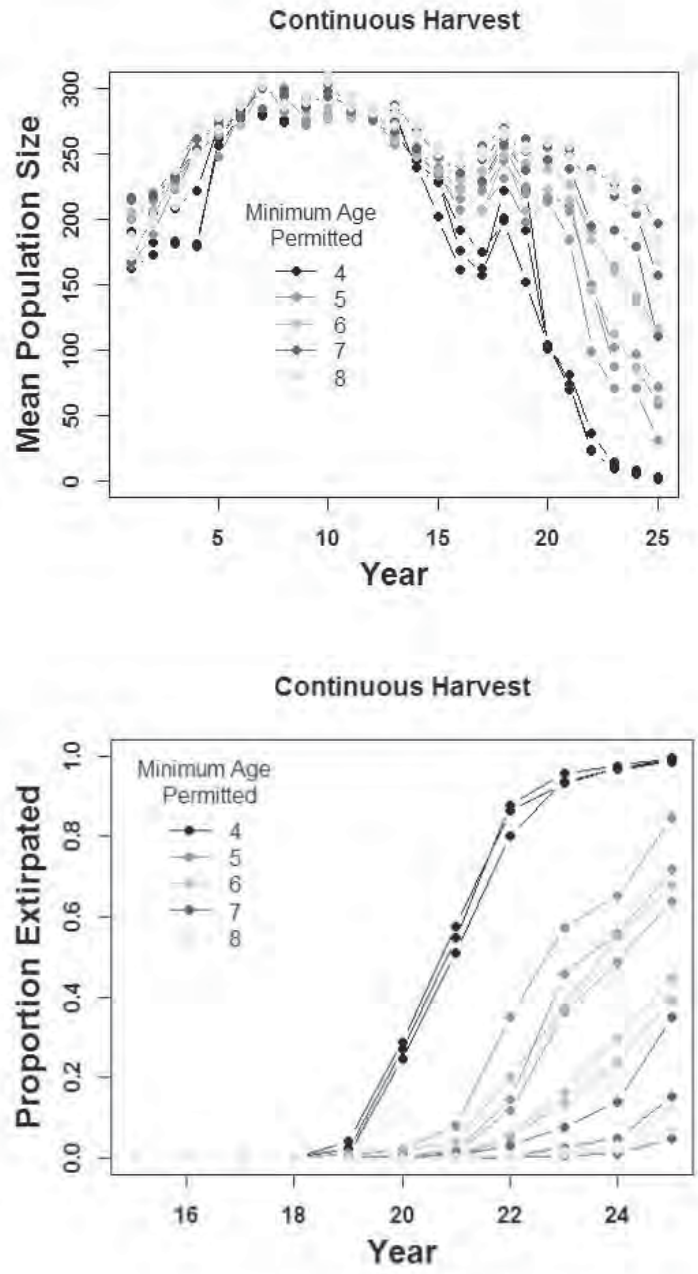


Figure 3.

This article is protected by copyright. All rights reserved.

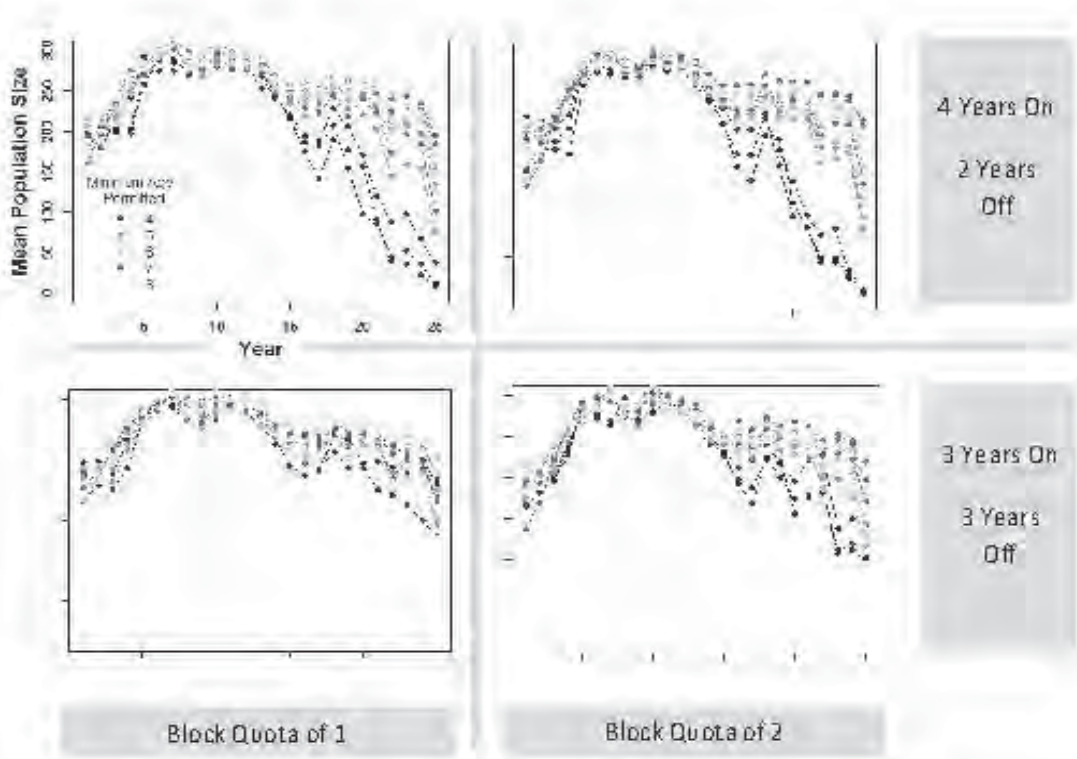


Figure 4.

Accepted Article

This article is protected by copyright. All rights reserved.

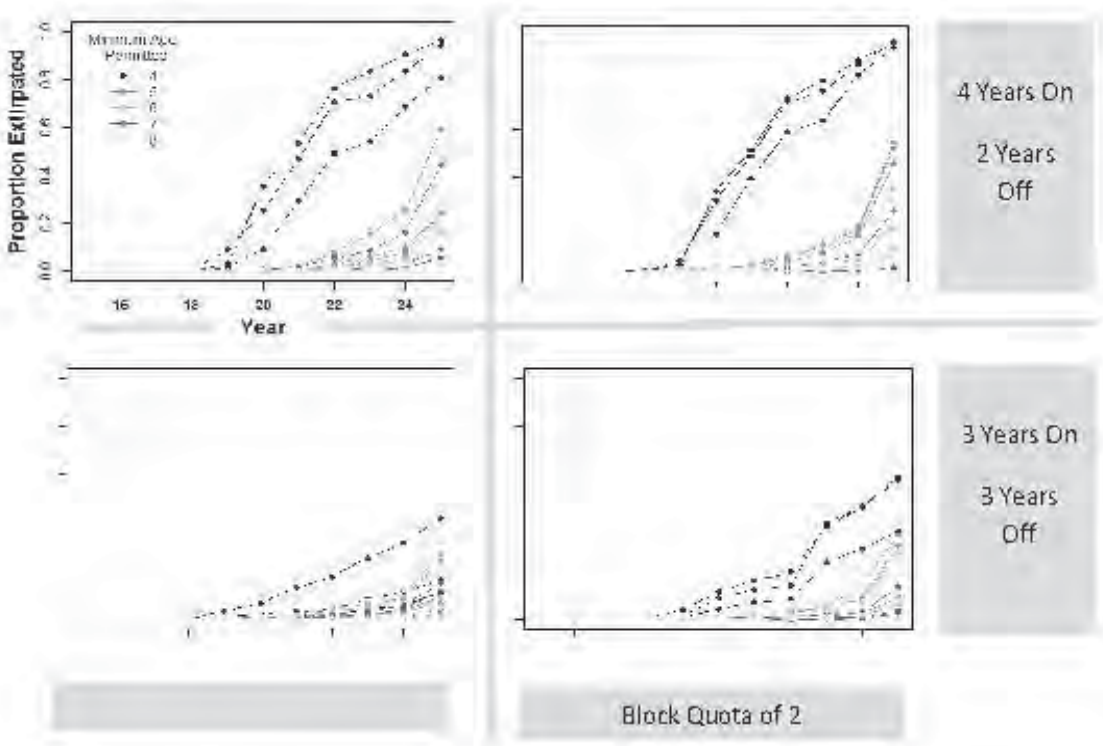


Figure 5.

Accepted Article

This article is protected by copyright. All rights reserved.

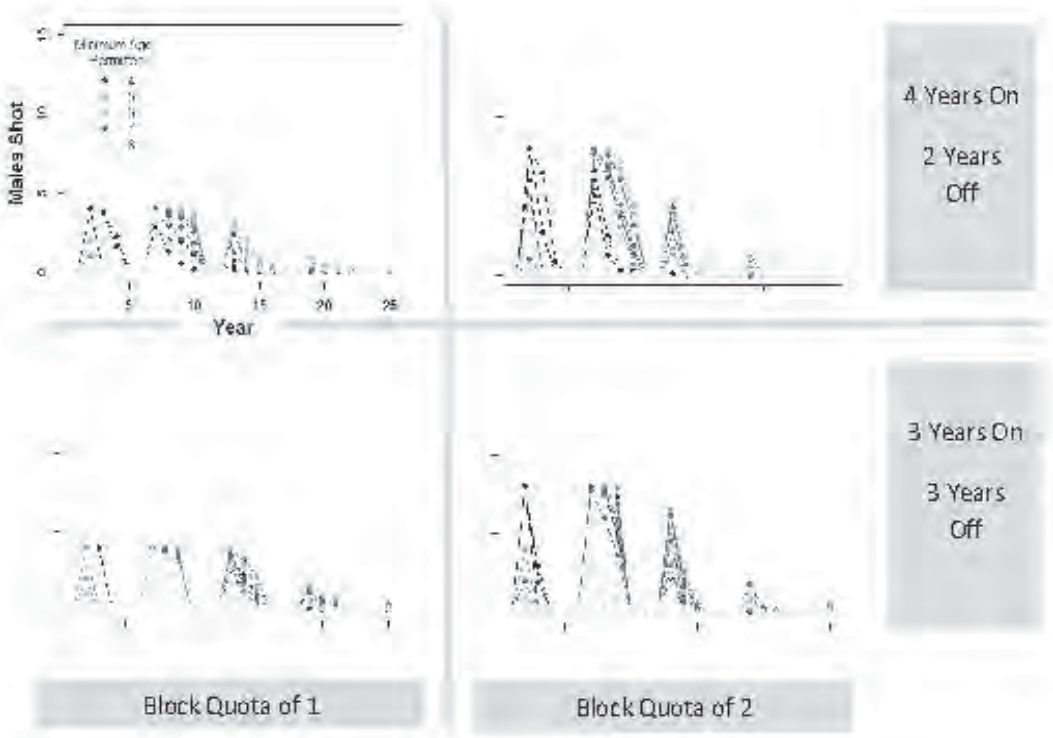


Figure 6.

Accepted Article

This article is protected by copyright. All rights reserved.

Accepted Article

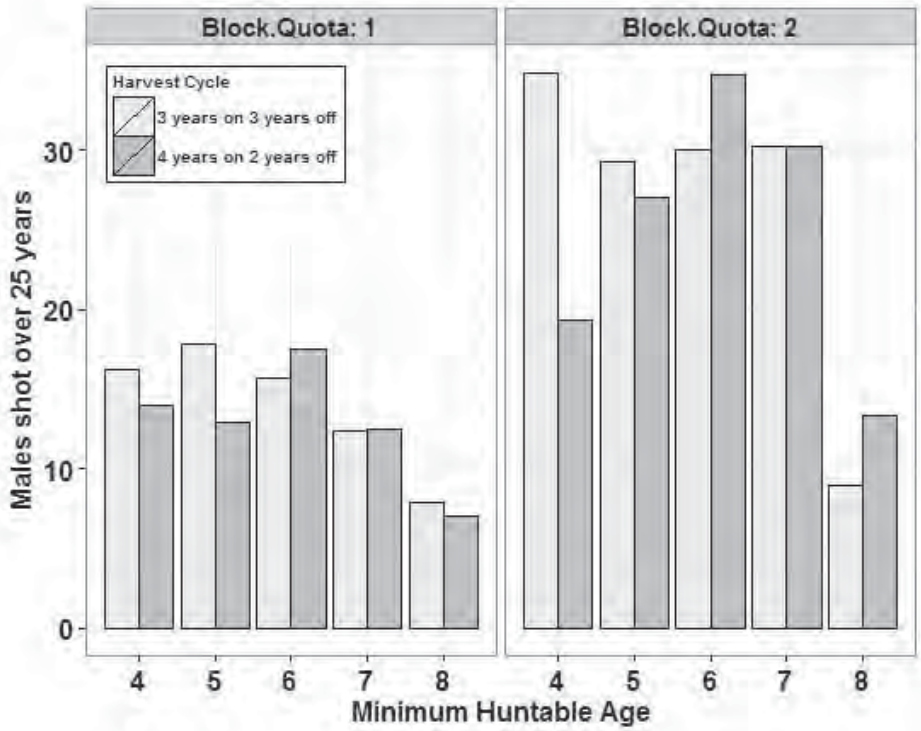


Figure 7.

This article is protected by copyright. All rights reserved.

Biological Conservation 201 (2016) 160–168

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/bioc

Aging traits and sustainable trophy hunting of African lions

Jennifer R.B. Miller [a,*], Guy Balme [a], Peter A. Lindsey [a,b], Andrew J. Loveridge [c], Matthew S. Becker [d,e], Colleen Begg [f], Henry Brink [g], Stephanie Dolrenry [h], Jane E. Hunt [c], Ingela Jansson [i], David W. Macdonald [c], Roseline L. Mandisodza-Chikerema [j], Alayne Oriol Cotterill [k], Craig Packer [l], Daniel Rosengren [m], Ken Stratford [n], Martina Trinkel [o], Paula A. White [p], Christiaan Winterbach [q], Hanlie E.K. Winterbach [q], Paul J. Funston [a]

[a] Panthera, 8 West 40th Street, 18th Floor, New York, NY 10018, USA
[b] Mammal Research Institute, Department of Zoology and Entomology, University of Pretoria, Pretoria, South Africa
[c] Wildlife Conservation Research Unit, Zoology Department, Oxford University, Tubney House, Abingdon OX135QL, UK
[d] Zambian Carnivore Programme, Box 80, Mfuwe, Eastern Province, Zambia
[e] Conservation Biology and Ecology Program, Department of Ecology, Montana State University, 310 Lewis Hall, Bozeman, MT 59717, USA
[f] Niassa Carnivore Project, The Ratel Trust, Cape Town, South Africa
[g] Selous Lion Project, PO Box 34514, Dar es Salaam, Tanzania
[h] Department of Biological Sciences, Conservation Conflict Research Institute, University of Cape Town, Rondebosch 7701, South Africa
[i] Department of Wildlife, Fish, and Environmental Studies, Swedish University of Agricultural Sciences, SE- 901 83 Umeå, Sweden
[j] Zimbabwe Parks and Wildlife Management Authority, PO Box CY140, Causeway, Harare, Zimbabwe
[k] Ewaso Lions, PO Box 14996, Nairobi 00800, Kenya
[l] Department of Ecology, Evolution & Behavior, University of Minnesota, 100 Ecology Building, 1987 Upper Buford Circle, St. Paul, MN 55108, USA
[m] Frankfurt Zoological Society, Bernhard-Grzimek-Allee 1, 60316 Frankfurt am Main, Germany
[n] Ongava Research Centre, Ongava Game Reserve, PO Box 58, Okaukeujo, Namibia
[o] School of Biological and Conservation Sciences, University of KwaZulu-Natal, Westville Campus, Private Bag 54001, Durban 4000, South Africa
[p] Center for Tropical Research, Institute of the Environment and Sustainability, University of California Los Angeles, 619 Charles E. Young Drive East, Los Angeles, CA 90095, USA
[q] Centre for Wildlife Management, University of Pretoria, Pretoria, South Africa

ARTICLE INFO

Article history:
Received 14 March 2016
Received in revised form 17 June 2016
Accepted 3 July 2016
Available online xxxx

Keywords:
Age-based hunting quota
Age determination
Minimum age threshold
Panthera leo
Pre-mortem aging
Sustainable harvest

ABSTRACT

Trophy hunting plays a significant role in wildlife conservation in some contexts in various parts of the world. Yet excessive hunting is contributing to species declines, especially for large carnivores. Simulation models suggest that sustainable hunting of African lions may be achieved by restricting offtakes to males old enough to have reared a cohort of offspring. We tested and expanded criteria for an age based approach for sustainably regulat ing lion hunting. Using photos of 228 known age males from ten sites across Africa, we measured change in ten phenotypic traits with age and found four age classes with distinct characteristics: 1 2.9 years, 3 4.9 years, 5 6.9 years, and ≥7 years. We tested the aging accuracy of professional hunters and inexperienced observers before and after training on aging. Before training, hunters accurately aged more lion photos (63%) than inexperienced observers (48%); after training, both groups improved (67 69%). Hunters overestimated 22% of lions <5 years as 5 6.9 years (unsustainable) but only 4% of lions <5 years as ≥7 years (sustainable). Due to the lower aging error for males ≥7 years, we recommend 7 years as a practical minimum age for hunting male lions. Results indicate that age based hunting is feasible for sustainably managing threatened and economically significant species such as the lion, but must be guided by rigorous training, strict monitoring of compliance and error, and conser vative quotas. Our study furthermore demonstrates methods for identifying traits to age individuals, information that is critical for estimating demographic parameters underlying management and conservation of age struc tured species.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

Trophy hunting can play a significant role in wildlife conservation by incentivising the conservation of animals and land in exchange for rec reational use. In Africa, hunting motivates the retention of vast blocks of state property for wildlife, generates over US$200 million annually across >20 countries, and encourages wildlife based land uses on large areas of community and private lands (Di Minin et al., 2015; Lindsey et al., 2007; Naidoo et al., 2016). However, poorly managed hunting can negatively affect animal populations by reducing genetic variation, increasing stress levels, changing animal behavior, and driv ing species decline (Aryal et al., 2015; Burke et al., 2008; Keehner et al., 2015; Packer et al., 2009; Rodríguez Muñoz et al., 2015). Excessive

* Corresponding author.
E-mail address: jmiller@panthera.org (J.R.B. Miller).

http://dx.doi.org/10.1016/j.biocon.2016.07.003
0006-3207/© 2016 Elsevier Ltd. All rights reserved.

trophy hunting has recently led to localized unsustainable exploitation of ecologically and economically important species, including elephants (Selier et al., 2014), leopards (Pitman et al., 2015), and lions (Bauer et al., 2015). The negative impacts of hunting in some areas contributed to 'Cecil gate' in 2015, prompting global public outcry and scrutiny over the use of trophy hunting as a management tool (Di Minin et al., 2015; Lindsey et al., 2016). In light of this recent media spotlight and increasing anthropogenic threats to species, science based techniques are urgently needed to guide the sustainable management of harvests if trophy hunting is to continue.

Most harvested species, particularly long lived large mammals, exhibit age and sex specific rates of survival and reproduction (Milner Gulland et al., 2007). Thus, age is a common metric used to guide the sustainable harvest and management of wildlife, including large carnivores, ungulates, and fish (Balme et al., 2012; Bender et al., 1994; Berkeley et al., 2004; Garel et al., 2006; Gipson et al., 2000; Hiller, 2014; Hoefs and Konig, 1984; Lundervold and Langvatn, 2003). Age based hunting addresses the age structured nature of populations by harvesting animals at certain age thresholds, which, in combination with conservative quotas, can help reduce negative demographic impacts (Whitman et al., 2004). The success of age based hunting depends on hunters' abilities to accurately age individuals, and requires traits that indicate relevant age thresholds and are easily discernible in the field. These indicators of age would be equally useful to enforcement authorities for ensuring that trophies meet permitted age thresholds. Because age structure is critical to understanding the dynamics of wildlife populations, determining precise indicators of age at biologically important life stages is also useful for wildlife research, management and conservation (Delahay et al., 2011; Van Horn et al., 2003). Here we investigate age determination and aging accuracy for African lions in an effort to test the feasibility of using age based trophy hunting regulations to manage and conserve threatened and economically significant species.

Lions are one of the most highly desired big game trophy species, and ensuring ecological and economic sustainability of lion hunting has been recently prioritised at national and international levels (Lindsey et al., 2013). Lion hunts attract some of the highest mean prices of all trophy species (US$24,000–125,000 per hunt) and produce 5–17% of national gross trophy hunting income in countries where lion hunting is allowed (Lindsey et al., 2012, 2007). Yet lion numbers are declining rapidly: the global population has decreased by as much as 42% over the past 21 years (3 generations) to 20,000–35,000 individuals (Bauer et al., 2015; Riggio et al., 2012). In many areas, excessive trophy harvests have contributed to declines in the southern and eastern African subspecies (Groom et al., 2014; Loveridge et al., 2007; Packer et al., 2011, 2009; Rosenblatt et al., 2014). Concerns over lion population decline led Australia and France in 2015–2016 to ban lion trophy imports and resulted in the United States uplisting some lion subspecies to 'Endangered' on the Endangered Species Act (Milman, 2015; U.S. Fish and Wildlife Service, 2015; Vaughan, 2015).

Modelling studies that have assessed the impact of age based trophy hunting on lion demography indicate that sustainable trophy hunting may be achieved by restricting offtakes to males old enough to have reared their first cohort of offspring, or ≥5 years of age (note that harvesting females is not sustainable; Edwards et al., 2014; Packer et al., 2009; Whitman et al., 2007, 2004). Following these guidelines, Tanzania, Zimbabwe and Niassa National Reserve in Mozambique began implementing age based hunting restrictions in 2007–2013. In these ongoing programmes, age restrictions are paired with quotas revised annually based on compliance with age limits, whereby operators that harvest males equal or older than 5–6 years are 'rewarded' the following year with an equal or higher quota, and operators harvesting males <4–5 years are 'punished' with reduced quotas (age limits vary between countries; Begg and Begg, 2012; Mandisodza et al., 2009; Wildlife Division, 2012). The implementation of age restrictions has resulted in reduced lion quotas and harvests in all three countries in which they have been implemented. Reduced harvests may be due to greater selectivity on the part of hunters, and/or due to the relatively low number of old male lions in hunted populations. Some professional hunters, safari operators, and conservationists have resisted the implementation of age restrictions, citing insufficient scientific evidence for which physical traits are the most reliable indicators of lion age, and disputing the practicality of accurately aging lions in the field.

Age based hunting systems require simple methods for aging quarry *pre mortem* in the field with high precision. In the case of lions, the harvest of younger males (<5 years) has a particularly significant impact due to the removal of individuals before they have raised a litter of cubs to independence and the associated risk of infanticide following the removal of pride males (Whitman et al., 2004). In the countries where age restrictions on lions are in place, lion ages are assessed *post mortem* based on teeth size, wear, and development (often using dental radiographs) and skull ossification (using weight and cranial sutures; Ferreira and Funston, 2010a; Smuts et al., 1978; Wildlife Division, 2012). The utility of various potential aging cues *pre mortem* is currently less clear. Only one trait has been suggested as a reliable *pre mortem* indicator of age: nose pigmentation, which grows darker as lions age (Whitman et al., 2004). However, the correlation between nose pigmentation and age has only been studied in the Serengeti population of lions and doubt has been raised as to whether the relationship holds across Africa (Lindsey et al., 2013). Furthermore, nose darkness can be challenging to assess in the field under varying light and visibility, especially from a distance.

A more practical and effective strategy for aging lions *pre mortem* would be to identify a suite of traits that that can be collectively referenced to accurately estimate a lion's age, as has been recently done for leopards (Balme et al., 2012). Because professional hunters often use camera trap photographs to identify animals suitable for trophy hunting, and wildlife managers and researchers use photographs to study individuals and monitor populations, characteristics that are easily identifiable from photographs would be especially useful in aging individuals. Previous studies have identified several candidate traits (Ferreira and Funston, 2010a). Males' manes grow with age, however length can be influenced by injury, testosterone, and nutrition (Smuts, 1980; West and Packer, 2002). Mane colour typically darkens with age but can vary with ambient temperature (West and Packer, 2002; West et al., 2006). Facial scarring and slack jowl also increase with age, with older individuals appearing pockmarked and loose jowled (Schaller, 1972; Smuts, 1980; West et al., 2006). In order for these traits to be used as reliable indicators of age, the relationship with age should ideally show low variation between individuals and across regions to establish consistent aging guidelines. Furthermore, practitioners should be able to easily grasp associations between traits and age to achieve high aging accuracy.

We aimed to identify distinct phenotypic traits for determining *pre mortem* age and to test the utility of these traits for accurately aging male lions. Using an extensive photo dataset of known age male lions from ten long term study sites across eastern and southern Africa, we examined associations between physical characteristics and age in a suite of traits between individual lions and across regions. Finally, we tested how accurately practitioners could age lions with varying levels of hunting experience as well as before and after training. We discuss the applicability of our results for use in the conservation and management of harvested large carnivores and their broader implications for the future conservation of lions and other threatened and economically significant species.

2. Methods

We collected 601 high resolution photographs (≥150 dpi) of 228 known age male lions (1–16 photos per individual and 92 individuals with >1 photo) from ten long term study sites across eastern and

southern Africa: the Okavango Delta region (n = 17) in Botswana; Kgalagadi Transfrontier Park (n = 3) in Botswana and South Africa; the Amboseli Tsavo ecosystem (n = 17) and Laikipia (n = 2) in Kenya; Niassa National Reserve (n = 14) in Mozambique; Etosha National Park (n = 3) in Namibia; Kruger National Park (n = 29) in South Africa; Serengeti National Park (n = 48), Selous Game Reserve (n = 11), and Ngorongoro Conservation Area (n = 21) in Tanzania; South Luangwa Valley (n = 19) in Zambia; and Hwange National Park (n = 44 individuals) in Zimbabwe. These sites represent a broad range in elevation (340 1820 m) and climate (arid, warm temperate, and equatorial zones; Fig. 1). Lion populations at these sites have been intensively studied for extended periods. Cubs were typically first seen at 3 8 weeks of age and subsequently identified from natural markings (e.g., whisker spots, ear notches, scars; Packer and Pusey, 1993) and/or through radio collaring. Dates of parturition were estimated from the mother's denning behavior and lactation stains and from physical development in comparison to other cubs of known birthdates (Pusey and Packer, 1994). Only photographs of individuals first viewed at <3 months of age were included to enable high precision in aging.

2.1. Aging traits

For each photo, author JRBM used sliding scales to score the characteristics of ten phenotypic traits (Table 1): mane development; mane colouration of the chest, neck, shoulder, and forehead; teeth colour and wear; facial scarring; slack jowl; and nose darkness. These traits were known indicators of age in different lion populations (Ferreira and Funston, 2010a; Smuts et al., 1978; West et al., 2006; Whitman and Packer, 2007). Traits were scored in a photo only when they were clearly visible (e.g. teeth traits were scored only in photos of yawning lions). Mane development and colour were assessed using single or paired photos that clearly displayed all upper body parts of the individual.

To test the repeatability of scoring, two naïve observers (graduate students unfamiliar with the study) scored a random subset of 14 50 photos per trait (Balme et al., 2012; Loehr et al., 2008). We compared scores given by students and JRBM using a repeated measures ANOVA with an error term of 'photo/observer' to test for differences between scores in each photo. Student scores were comparable to those given by JRBM, indicating high repeatability (mane development: $F_{2,64}$ =

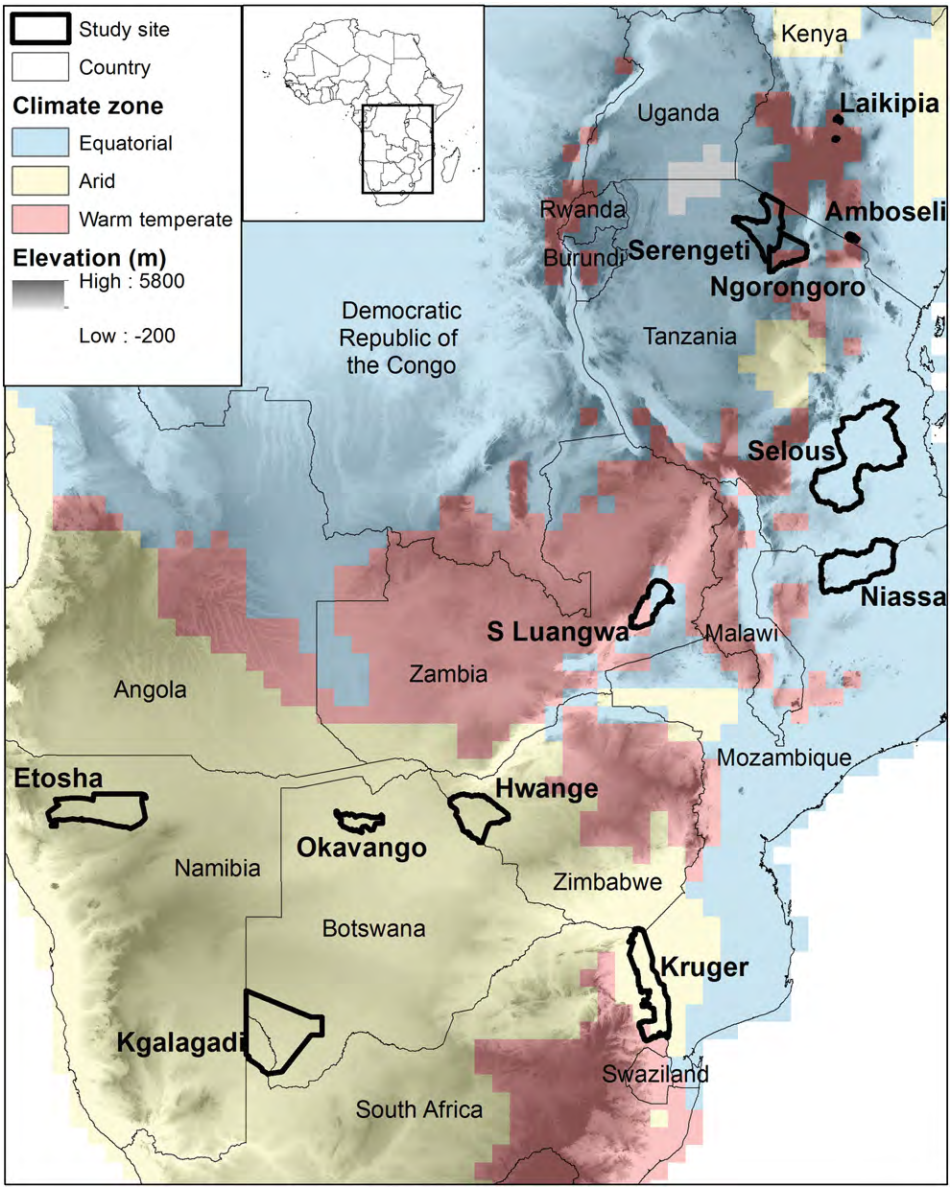


Fig. 1. Map of study sites in Africa with respect to climate zones and elevation.

Table 1
Score descriptions for the phenotypic traits assessed in known-age male lions.

Trait	Scoring code	Characteristics
Mane development	1	No or very short hair around face and on chest and neck
	2	Short hair around face and on chest and neck; Mohawk not visible
	3	Short Mohawk visible; bare patches between Mohawk and ears
	4	Long Mohawk with bare patches between Mohawk and ears; full around face and chest; incomplete on shoulder
	5	Fully developed, with forehead section fully filled between ears; some growth but mostly incomplete on shoulder
	6	Fully developed, with forehead section fully filled between ears; shoulders filled in
	7	Fully developed but thinning; the end of the hair looks fuzzy or frayed and/or the mane may thin or fall out in sections
Chest, neck, shoulder and forehead mane darkness (independent score for each)	1	Blonde
	2	Light brown
	3	Dark brown
	4	Black
Teeth colour	1	White
	2	Light yellow
	3	Dark yellow
Teeth wear	1	No wear (sharp)
	2	Slightly worn or chipped
	3	Heavily worn, very flat and very chipped
Facial scarring	1	Unscarred
	2	Lightly scarred or pocked
	3	Heavily scarred or pocked
Slack jowl	1	Absent: lower and upper lips tightly meet when mouth closed (not drooping)
	2	Present: lower lip obviously droops apart from top lip and downward when mouth closed
Nose darkness	0%	No black, all pink
	10%	Between 0 and 10% black
	20%	Between 10 and 20% black
	30%	Between 20 and 30% black
	40%	Between 30 and 40% black
	50%	Between 40 and 50% black
	60%	Between 50 and 60% black
	70%	Between 60 and 70% black
	80%	Between 70 and 80% black
	90%	Between 80 and 90% black
	100%	All black, no pink

2.352, $P = 0.103$; chest mane colour: $F_{2,64} = 0.267$, $P = 0.767$; neck mane colour: $F_{2,64} = 2.596$, $P = 0.082$; shoulder mane colour: $F_{2,64} = 0.195$, $P = 0.823$; forehead mane colour: $F_{2,64} = 0.209$, $P = 0.812$; slack jowl: $F_{2,60} = 1.000$, $P = 0.374$; teeth colour: $F_{2,26} = 1.560$, $P = 0.229$; teeth wear: $F_{2,26} = 1.368$, $P = 0.272$; facial scarring: $F_{2,56} = 1.314$, $P = 0.277$; nose darkness: $F_{2,96} = 2.731$, $P = 0.070$).

A previous study had found a correlation between nose darkness and age by digitally quantifying the proportion of black pigmentation pixels in the nose (Whitman et al. 2004). To test whether digital assessment differed from human scoring by eye, we additionally measured nose darkness with a similar digital method. Using Adobe Photoshop CS6 v.13.0.6, we clipped the fleshy part of the nose in each photo and set the colour value threshold to differentiate between the 'black' versus 'not black' (pink) portions of the nose. We then used the histogram tool to calculate the percentage of black nose pixels. To determine whether nose darkness differed by age between measurements made 'by eye' and digitally, we ran a Pearson correlation and tested whether values were comparable for each photo using a repeated measures ANOVA.

We examined the age associated with scores for each trait using ANOVA with Tukey post hoc tests to see which scores significantly differed by age range. To identify which characteristics within a trait could be used to determine age, we grouped together adjacent score categories when doing so produced significantly different age classes. For example, we initially measured nose darkness with 11 categories (0%, 10%, …90%, 100% black) but some of these categories (e.g. 0% and 10%) did not differ significantly in age. In these cases, non-significance indicated natural variation in the trait within an age and we grouped the adjacent score categories into a single group for analysis (e.g. 0–10%). To test how well each trait predicted age, we used linear mixed effects models to model 'age' by 'trait score' (fixed effect) with a random intercept effect of 'site' and 'individual' within each site ('site/individual' in the model) to account for pseudo-replication due to the availability of multiple photographs for some individuals and for the clustering of individuals with sites. We assessed model fit using the conditional R^2, a standard metric which describes the proportion of variance explained by both the fixed and random factors (Johnson, 2014). We additionally investigated how mane colouration changed with age by body part. We did this by running ANOVA tests on scores by age, with age grouped into 1-year age classes, and compared colouration scores by body part. All traits data were normally distributed.

We also explored whether trait development varied for lions in different geographical regions and climates. In particular, mane development and colour have been suggested to vary regionally and with temperature and humidity (West and Packer, 2002). We therefore tested how traits varied with elevation (data from the CGIAR-CSI SRTM; Jarvis et al., 2008) and climate zone (Koppen-Geiger Climate Classification, major zone; Kottek et al., 2006). Regional variable values were calculated as the mean of pixels within each study site boundary (data from The World Database on Protected Areas; IUCN and UNEP-WCMC, 2015) using zonal statistics in ArcGIS (Table A1). We added the interaction term 'trait score' * 'regional variable' to the previous linear mixed effects models and ran Chi-square tests to determine whether the regional variable significantly improved the model. Effects of regional variation were tested for all traits except slack jowl and facial scarring due to uneven sample sizes across regions. All statistical tests were run in R v.3.1.3 (R Development Core Team 2008).

2.2. Aging accuracy

A subset of known-age male lion photos was used to measure the effectiveness of training with phenotypic traits on improving accuracy in aging lions. We tested accuracy levels before and after training using a survey consisting of three sections: (1) a "pre-test", where participants aged individuals in 32 photos based on their baseline knowledge of lions; (2) a training, where participants reviewed brief educational materials on the traits for recognising lion age (based on the traits analysis); and (3) a "post-test", where participants aged individuals in 32 different photos. Participants were asked to assign the lions in photos to one of four age classes: (1) 1–2.9 years, (2) 3–4.9 years, (3) 5–6.9 years, and (4) ≥7 years. Because participants' ability to distinguish between the middle two age classes (3–4.9 years and 5–6.9 years) have the greatest implications for sustainable trophy hunting, to reduce variance we included in each section ten photos for each of the middle age classes and six photos for each the youngest and oldest age classes. Most traits were visible in all photos except for teeth colour and wear, which were not included in the survey assessment or training because photos with these traits excluded most other traits (e.g. featured only the mouth).

We conducted the anonymous survey online with two groups: professional hunters, who are responsible for determining which individual lions are suitable for clients to harvest, and inexperienced observers (college students), who offered a baseline for comparison against

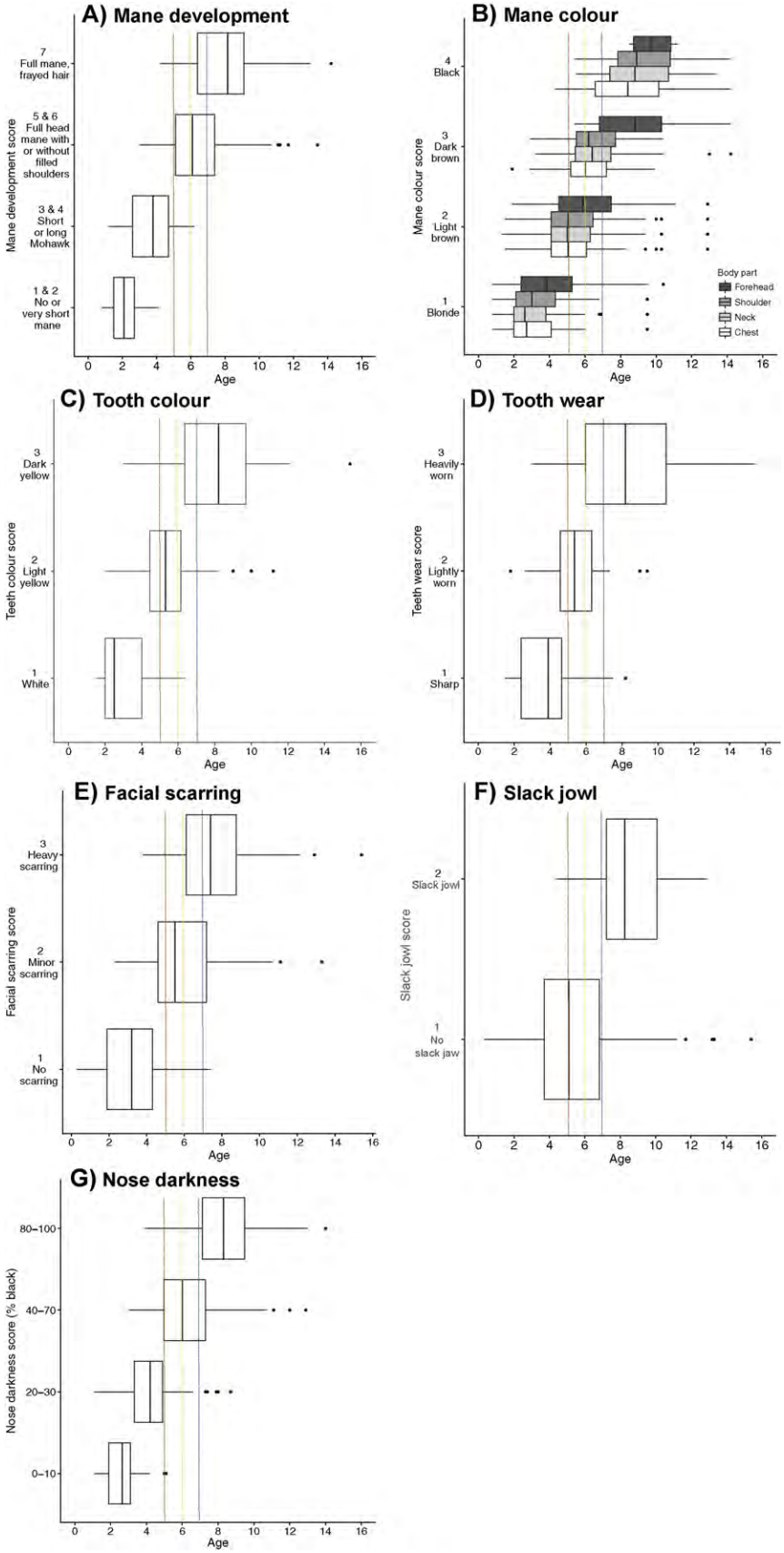


Fig. 2. Relationship between phenotypic traits and age in male lions in study sites across Africa for (A) mane development, (B) mane colour, (C) teeth colour, (D) teeth wear, (E) facial scarring, (F) slack jowl, and (G) nose darkness. Boxes indicate the lower, median and upper quartiles; horizontal lines represent the sample minimum and maximum; dots represent outliers. Vertical lines mark traits at 5 (orange), 6 (yellow), and 7 (blue) years of age. Data represents photographs of individual lions (see Methods for details). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

hunters. To explore how experience influenced participants' accuracy in aging, we asked both students and hunters how many hunts (any species) they had participated in and whether they had previously received education on aging lions. We additionally asked hunters how many years they had worked as professional hunters, how many lion hunts they had attended, and whether they had previously participated in a lion hunt that followed age restrictions. We included these data as predictor variables in multivariate linear regressions with a response variable of aging accuracy score for each participant group before and after training. We calculated each participant's aging accuracy score for the pre and post test sections as the percentage of correctly aged photos. We compared scores between sections and participants using unpaired and paired t tests with equal variances, respectively. We also examined which lion ages were most often categorised accurately by calculating the mean percentage of photos assigned to each of the four age classes and used ANOVA to compare differences by age class.

3. Results

3.1. Aging traits

For all ten phenotypic traits, age was strongly predicted by score (statistics below) and varied across scores (Fig. 2; mane development: $F_{6,210} = 37.17$, $P < 0.001$; chest mane colour: $F_{3,213} = 68.30$, $P < 0.001$; neck mane colour: $F_{3,213} = 55.19$, $P < 0.001$; shoulder mane colour: $F_{3,213} = 65.77$, $P < 0.001$; forehead mane colour: $F_{3,213} = 44.45$, $P < 0.001$; teeth colour: $F_{2,90} = 33.82$, $P < 0.001$; teeth wear: $F_{2,90} = 36.72$, $P < 0.001$; facial scarring: $F_{2,189} = 59.47$, $P < 0.001$; slack jowl: $F_{1,208} = 22.21$, $P < 0.001$; nose darkness [by eye]: $F_{10,306} = 41.17$, $P < 0.001$). Traits showed overlap in the ages associated with some scores, especially for mane development and nose darkness. Post hoc analyses revealed that compiling mane and nose darkness scores each into four categories of characteristics produced significantly distinct age classes between scores ($P < 0.006$ and $P < 0.0002$, respectively; Fig. 2A, Fig. 2G); all other traits showed significant differences in age between scores without grouping ($P < 0.01$; except mane forehead colour between dark brown and black, $P = 0.858$). Four age classes could be distinguished based on the revised grouping of trait characteristics: 1 2.9 years, 3 4.9 years, 5 6.9 years, and ≥7 years.

By age class, the majority of males (≥50%) 1 2.9 years of age were characterised by a smooth face (no facial scarring), tight jowl (no slack jowl), no mane or a small Mohawk, blonde hair colour on the chest, neck, shoulder, and forehead, sharp white teeth, and nose darkness of 0 30% black (Fig. 2). Most males 3 4.9 years showed a smooth face or light facial scarring, tight jowl, large Mohawk or full mane, blonde or light brown hair colour on the chest, neck, shoulder, and forehead, sharp or lightly worn light yellow teeth, and nose darkness of 20 60% black. Males 5 6.9 years predominantly showed light facial scarring, tight jowl, full mane, light or dark brown mane colour on the chest, neck, shoulder, and forehead, lightly or heavily worn light yellow teeth, and nose darkness of 40 70% black. Most males ≥7 years showed light or heavy facial scarring, full mane with or without fraying hair, black mane colour on the chest, neck, shoulder and forehead, lightly or heavily worn dark yellow teeth, nose darkness of 40 100% black, and a tight jowl. Jowl slackness was a unique identifying characteristic for the oldest age class: though only 24% of lions ≥7 years old showed slack jowls, 73% of individuals with slack jowls were ≥7 years old (Table A2).

Trait score, but not elevation or climate zone, was a significant predictor of ages associated with mane development (score: $t_{196} = 14.338$, $P < 0.001$, $R^2 = 0.73$; $P > 0.4$ for all Chi square tests with regional variables) and colour (chest: $t_{214} = 13.963$, $P < 0.001$, $R^2 = 0.74$; neck: $t_{216} = 12.386$, $P < 0.001$, $R^2 = 0.70$; shoulder: $t_{216} = 13.747$, $P < 0.001$, $R^2 = 0.73$; forehead: $t_{216} = 9.865$, $P < 0.001$, $R^2 = 0.55$; $P > 0.3$ for all Chi square tests), nose darkness ($t_{306} = 18.704$, $P < 0.001$, $R^2 = 0.78$; $P > 0.20$ for all Chi square tests), and teeth colour ($t_{76} = 7.749$, $P < 0.001$, $R^2 = 0.62$; $P > 0.07$ for all Chi square tests) and wear ($t_{77} = 7.765$, $P < 0.001$, $R^2 = 0.60$; $P > 0.4$ for all Chi square tests). Assessments of nose darkness made by eye and digital methods were statistically correlated ($r = 0.825$, $t_{315} = 25.938$, $P < 0.001$) and numerically equivalent ($F_{1,316} = 0.367$, $P = 0.545$; Fig. 3). Though not statistically significant, we observed differences in mane development by climate. Lion manes appear to grow more slowly and sparsely at sites in the equatorial climate zone (Selous and Niassa) than in warm temperate or arid climates, causing these individuals to resemble lions 2 3 years younger than same aged individuals in other sites (Fig. S1).

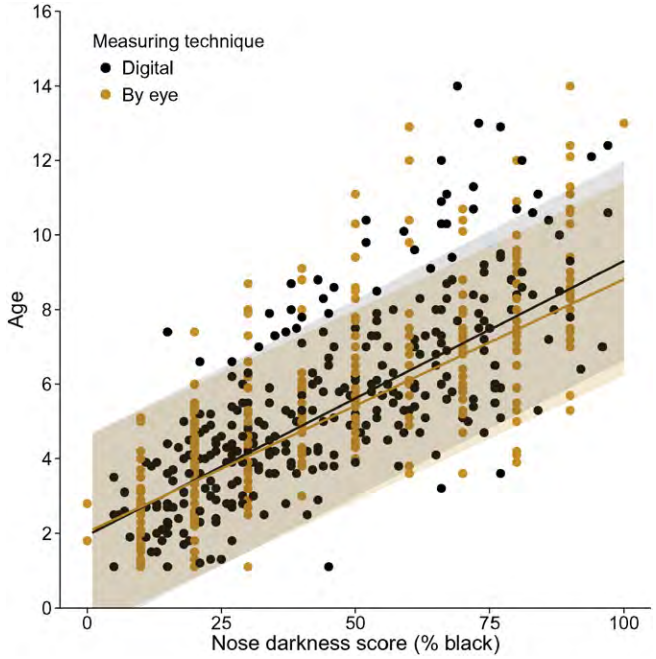


Fig. 3. Differences in nose darkness with age by measuring technique. Each point represents a different photograph of an individual lion; in some cases (64 out of n = 138 individuals), the same individual was measured at multiple ages. Lines represent linear mixed model predictions; shaded ribbons represent 95% prediction intervals (orange = by eye; grey = digital).

3.2. Aging accuracy

Fifty three professional hunters and 52 students completed the survey. Hunter participants averaged 16 years of professional hunting experience (range of 1 40 years) in numerous African countries, primarily Tanzania (45%), Zimbabwe (45%), South Africa (30%), Namibia (21%), Zambia (19%) and/or Mozambique (17%; note that most hunters worked in more than one country). Nearly all hunters (92%) had previously participated in a lion hunt, with 42% having attended >20 lion hunts, and 62% had attended lion hunts with age restrictions on harvested individuals. However, less than half (43%) had previously received education (participated in a training or read educational materials) on aging lions. The majority of students had never participated in a wildlife hunt (65%) and had never received education on aging lions (90%).

Professional hunters scored significantly higher than students before training (mean percent of correctly aged photos for hunters = 63 ± 2% [standard error], range of 38 78%; students = 48 ± 2%, range 22 78%; $t_{103} = -5.897$, $P < 0.001$) and similarly to students after training (hunters: 69 ± 1%, range 44 84%; students: 67 ± 2%, range 38 88%; $t_{103} = -0.783$, $P = 0.435$). Paired t tests revealed that both hunters and students scored higher after training ($t_{52} = -3.274$, $P = 0.002$ and $t_{51} = -8.129$, $P < 0.001$, respectively). Students improved significantly more than hunters ($t_{103} = 4.350$, $P < 0.001$), increasing their accuracy by an average of 19 ± 2 percentage points compared to 6 ± 2 for

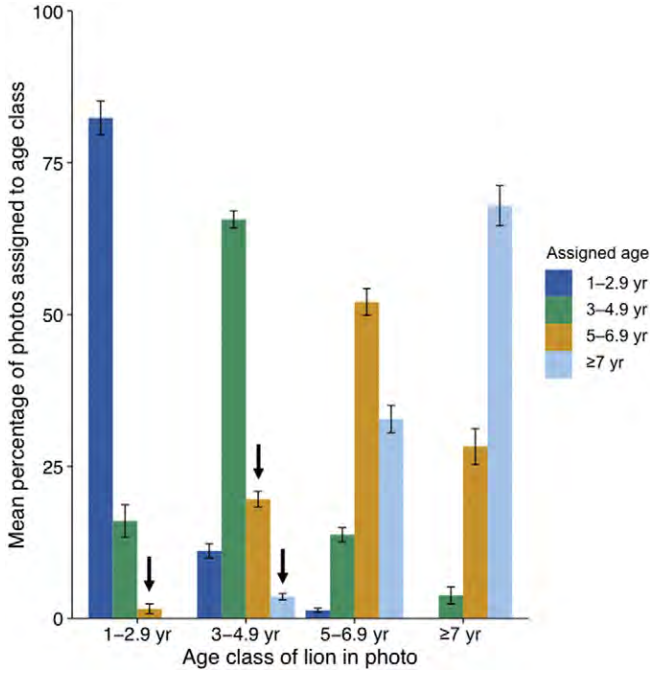


Fig. 4. Mean percentage of male lion photos assigned to different age classes by professional hunters compared to the actual age of the lion photo. Correctly aged lion photos are indicated where the assigned age (colour) matches the age class of the lion photo (x-axis). Arrows indicate lions <5 years that were overestimated as ≥5 years (unsustainable harvest). Bars indicate standard error (n = 53 participants).

hunters. Linear regression found no associations between aging accura cy and experience variables for either hunters or students before ($F_{8,44} = 1.282$, adjusted $R^2 = 0.042$, $P = 0.278$; $F_{4,47} = 3.197$, adjusted $R^2 = 0.147$, $P = 0.021$, respectively) or after training ($F_{8,44} = 1.539$, ad justed $R^2 = 0.077$, $P = 0.172$; $F_{4,47} = 2.532$, adjusted $R^2 = 0.107$, $P = 0.527$, respectively).

The percentage of lions accurately aged assigned by hunters after training significantly differed among all age classes except 3 4.9 years and ≥7 years ($F_{3,208} = 24.350$, $P < 0.001$; Tukey post hoc $P = 0.920$, $P < 0.001$ for all other pairs). Hunters most accurately aged 1 2.9 year old lions (82% correct) and least accurately aged 5 6.9 year old lions (52%); 3 4.9 year olds and ≥7 year olds were aged with 67% and 68% accuracy, respectively (Fig. 4). Hunters overestimated the age of 20% of 3 4.9 year olds and 2% of 1 2.9 year olds by mis categorising photos as 5 6.9 years, and 4% of 3 4.9 year olds as ≥7 years. Hunters underestimated the age of 15% of 5 6.9 year olds and 4% of ≥7 year olds by mis categorising photos as <5 years old.

4. Discussion

The ability to age individual animals in wildlife populations is neces sary for informed wildlife management and conservation as well as sus tainable, age selective hunting of threatened, high valued species. Our study revealed a suite of phenotypic traits in African lions that conspic uously change with age at biologically meaningful intervals. Most of these traits are consistent across regions, and can be used *pre mortem* to categorise individuals by age class with a moderate to high degree of accuracy. Most importantly, these traits do help in distinguishing the minimum age threshold of ≥5 years recommended for sustainable harvest of lions (Whitman et al., 2004). However, our results revealed that a large proportion (22%) of 'underage' lions (<5 years) were mis takenly overestimated to be 5 6.9 year olds, or suitable for hunting ac cording to current age based hunting systems in several African countries. This high error rate in critical age classes should be further in vestigated and suggests that an older minimum age threshold (e.g. ≥7 years) may be a more practical threshold for achieving sustainable harvests.

We found that that no single trait can be relied upon exclusively to precisely age lions; rather, multiple traits must be examined in combi nation to cross validate an individual's age. For example, our findings corroborate previous evidence that nose darkness can be used for aging following the "50% rule" (lions with noses ≥50% black are on average ≥ 5 years; Whitman et al., 2004) by the human eye (in addition to digital measurement). Yet nose darkness showed such high variation around this age threshold (25% of lions with noses ≥50% black were <5 years old and 10% were <4 years old) such that nose darkness should not be used as alone to estimate age. Referring to nose darkness as well as mane development, facial scarring, and teeth colour and wear will ac count for age variation within each trait and improve the accuracy of age assessment. An exception is slack jowl, which was a strong indicator of older lions when present, although only one third of lions ≥7 years old showed slack jowls. Due to large overlap in mane colour among ages, we did not find this trait to be useful for precisely determining age.

Based on synchronised development across the suite of phenotypic traits, we were able to categorise lions into four age classes that also corresponded to important biological stages of development: 1 2.9 years (dependent and non reproductive), 3 4.9 years (independent and beginning to reproduce), 5 6.9 years (prime reproductive age), ≥7 years (final reproductive years and past prime, non reproductive). For carnivores and lions in particular, precisely estimating an animal's age is necessary for assessing population demographic parameters, such as survival and reproduction, to manage and conserve species. Thus, in addition to assisting hunters, these classes may be especially in formative to wildlife researchers and managers for assessing individual behavior and population structure.

Surprisingly, we did not find statistically significant regional varia tion in mane development or colour by age. This contrasts with previous studies that have documented shorter length, lower density, and slower growth rates as well as blonder colour in the manes of lions living at warmer and more humid climates (Kays and Patterson, 2002; Patterson et al., 2006; West and Packer, 2002; Fig. A1). We attribute this result to our small sample size of mane photos from sites in the equatorial climate zone (n = 6 compared to n = 103 from arid and n = 108 from warm temperate zones). If our sample size for this climate zone had been larger, we suspect that our results would have mirrored the findings of previous studies. Consequently, in sites where manes are short and sparse, such as Selous and Niassa, we recommend that other traits in addition to mane development be used for aging lions.

Accuracy survey results suggest that, with rigorous training, people with varying levels of experience can use phenotypic traits to accurately age lions. Both inexperienced observers and hunters improved their ac curacy scores after training, with inexperienced observers scoring on par with hunters. The fact that both hunters and inexperienced ob servers scored similarly after training suggests a proficiency threshold, after which more intense training is necessary to improve; however, this threshold is likely test specific (e.g. dependent on the number and quality of photos). Hunters improved only 6% after training, empha sizing a need for a more rigorous training than our survey provided. Considering that the online training was self administered, computer based, and brief (10 min), participants would likely further improve their accuracy through a more comprehensive, interactive, and field based training. The need for adequate training cannot be stressed enough, as the success of age based hunting is fundamentally depen dent on hunters' abilities to accurately age. Until a rigorous training pro gram which raises hunters' aging accuracy to acceptable levels (which must also be determined by management authorities) can be devel oped, quotas and minimum age thresholds must account for large mar gins of error. Our finding that previous experience with hunting or aging did not improve participants' lion aging abilities aligns with previous findings from a similar aging assessment of African leopards (Balme et al., 2012).

Hunters were least successful in aging lions in the 5 6.9 year age class, the most important age threshold for sustainable lion offtake. Hunters mis categorised and overestimated 24% of 3 4.9 year old lions to be of suitable hunting age (≥5 years), which in the field would have resulted in unsustainable harvest. Notably, hunters also underestimated 15% of photos of 5 6.9 year olds and 4% of ≥7 year olds as ages unsuitable for sustainable hunting, which could benefit lion conservation by allowing these males in their prime reproductive stage to sire additional offspring. The effects of such aging errors on lion demography and conservation have not been well studied (Whitman et al., 2007). Government agencies may wish to consider raising the minimum age threshold to ≥7 years as a more assured way of achieving sustainability by accounting for aging error. The traits that characterise ≥7 year old lions are more unique and distinct than those associated with younger age classes, and although some 5 6.9 year old lions were mis categorised as ≥7 year old and vice versa, very few 'underage' lions (<5 years) were mis categorised as ≥7 years (4%). This suggests that setting a minimum age threshold of 7 years would be more likely to achieve sustainable rates of hunting because individuals that are inaccurately aged would be mistaken as ≥5 years, the minimum age for sustainable offtake assuming no effect of aging error (Whitman et al., 2004). Lions ≥7 years old are also more likely to have successfully reproduced and raised at least one litter to maturity, thus reducing the impacts of infanticide (Bertram, 1975; Packer, 2001). Finally, this threshold is in line with emerging evidence that ≥7 years is a more sustainable minimum harvest age for lions in some parts of Africa (Creel et al., 2016). If 7 years were legally set as a minimum threshold, a simple rule could be to restrict harvest to lions with slack jowls or to lions with majority black noses (>60% black), heavy facial scarring, and dark yellow and heavily worn teeth (an appearance which could also potentially be more desirable to hunters).

In the age based quota systems of Mozambique, Tanzania, and Zimbabwe, punishments and rewards based on trophy ages are decided through age validation using *post mortem* assessment conducted by wildlife government authorities. Many of these assessments are made based on photographs of the trophy head and side body that are required to be submitted with hunt return forms. The trait characteristics identified in our study (with the exception of slack jowl) could assist authorities in more precisely estimating ages and regulating harvests.

Our results indicate the importance of education and outreach for improving the aging skills of wildlife professionals. We recommend that hunting operators and authorities prioritise and consider requiring trainings for professional hunters. Lion aging techniques could be included more widely in the curricula and final examination of hunting courses as a prerequisite for licensing, as is the case in Zimbabwe with lions, in the United States with mountain lions (http://cpw.state.co.us/thingstodo/Pages/LionExam.aspx, accessed February 2016), and is being developed in South Africa for leopards. Several lion aging guides have already been produced (Whitman and Packer, 2007; Whitman, 2010), and we reiterate the need for simple, user friendly resources and consistent messaging to improve the aging ability of wildlife professionals. The results of this study have been developed into hardcopy and digital resources which are freely accessible online (http://AgingTheAfricanLion.org) and are being actively shared with hunting operators and wildlife managers, researchers, and conservation practitioners.

The tractability of age based hunting systems has ramifications for international policy level decision making about lion conservation and the economic markets tied to the hunting industry. Age restrictions and adaptive quota systems that are transparent and properly implemented may offer more realistic and attainable metrics for sustainability than wildlife population assessments (Creel et al., 2016; Whitman et al., 2004). We recommend that agency authorities in market countries, such as the U.S. Fish and Wildlife Service, consider the use of age restrictions and adaptive quota systems for making decisions about trophy imports. Until alternatives to trophy hunting can be found to support conservation (Lindsey et al., 2016), we recommend that these agencies work with range countries to develop and monitor age based hunting quotas that are adequately conservative to achieve desired conservation goals for each lion population.

The implications of our study also extend beyond hunting and lions. Age determination is a critical component of accurately estimating the demographic parameters (recruitment, survival, dispersal, population size) of wildlife populations for successful conservation and management (Becker et al., 2013; Ferreira and Funston, 2010b; Skalski et al., 2005). Because tracking individual animals is rarely logistically or monetarily feasible, the ability to accurately and non invasively age from physical appearance may help to interpret social interactions as well as population dynamics. The aging traits identified in our study could be used in numerous applications, including aging individuals involved in research (e.g. animals collared for telemetry or photographed in camera trap surveys), human wildlife conflict (e.g. captured problem animals), tourism and nature education (e.g. animals seen on safari or in documentaries), and in populations where close monitoring is required due to intense poaching or other pressures. Several of the lion aging traits identified by our study have been relevant for other species, such as African leopards (Balme et al., 2012), European badgers (Delahay et al., 2011), grey wolves (Gipson et al., 2000), and spotted hyenas (Van Horn et al., 2003), and we hope that our methodology will serve as a model for age determination in other species.

The recent illegal killing of 'Cecil the lion' placed an international spotlight on African trophy hunting that questioned the integrity of hunting practices and the future value of hunting for funding conservation (Di Minin et al., 2015; Lindsey et al., 2016). If lion trophy hunting is to continue, practices must at least adhere to science based regulations and achieve population sustainability. We present practical criteria to support an age based hunting system for lions that would reduce over harvest and that could potentially halt the decline of the species in hunted populations. This could benefit hunting operators and professional hunters at multiple scales by assisting compliance with recent international regulations requiring hunting to have a net positive impact on lion populations, by securing the financial stability of trophy hunting (Lindsey et al., 2012) and by improving trophy quality (Whitman et al., 2004). Zimbabwe and Niassa National Reserve in Mozambique, which began implementing age based lion trophy hunting over the past few years, are reporting successes in the management of lion hunting that include increasing lion trophy age, hunt success, and population size. In demonstrating a reliable toolset for aging, we hope that this study facilitates continued and increasing positive outcomes in these countries as well as others that choose to sustainably manage wildlife for the long term.

Acknowledgements

We express our thanks to the hunters and students who participated in our survey and the professional hunters associations who worked to increase participation. Special thanks to N. Fordyce, M. Lewis, N. Okes, and S. Viljoen for assistance with the study. This manuscript benefited from feedback from members of the Cornell University Human Dimensions Graduate Seminar and several anonymous reviewers. Finally, we wish to acknowledge the government agencies, hunting operators, and professional hunters that have embraced and encouraged age based hunting as a sustainable practice.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.biocon.2016.07.003.

References

Aryal, A., Dhakal, M., Panthi, S., Yadav, B., Shrestha, U., Bencini, R., Raubenheimer, D., Ji, W., 2015. Is trophy hunting of bharal (blue sheep) and Himalayan tahr contributing to their conservation in Nepal? Hystri http://dx.doi.org/10.4404/hystrix-26.2-11210.

Balme, G.A., Hunter, L.T.B., Braczkowski, A.R., 2012. Applicability of age-based hunting regulations for African leopards. PLoS One 7, 1–9. http://dx.doi.org/10.1371/journal.pone.0035209.

Bauer, H., Chapron, G., Nowell, K., Henschel, P., Funston, P.J., Hunter, L.T.B., Macdonald, D.W., Packer, C., 2015. Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas. Proc. Natl. Acad. Sci. 112, 14894–14899. http://dx.doi.org/10.1073/pnas.1500664112.

Becker, M.S., Watson, F.G.R., Droge, E., Leigh, K., Carlson, R.S., Carlson, A.A., 2013. Estimating past and future male loss in three Zambian lion populations. J. Wildl. Manag. 77, 128–142. http://dx.doi.org/10.1002/jwmg.446.

Begg, C.M., Begg, K.S., 2012. The status of lions and their threats in Niassa National Reserve, Mozambique. Technical Report Produced for SRN, Maputo.

Bender, L.C., Roloff, G.J., Haufler, J.B., 1994. Antler characteristics as an age discriminator in Michigan elk (*Cervus elaphus*). Am. Midl. Nat. 132, 401–404.

Berkeley, S.A., Hixon, M.A., Larson, R.J., Love, M.S., 2004. Fisheries sustainability via protection of age structure and spatial distribution of fish populations. Fisheries 29, 23–32. http://dx.doi.org/10.1577/1548-8446(2004)29[23:FSVPOA]2.0.CO;2.

Bertram, B., 1975. Social factors influencing reproduction in wild lions. J. Zool. 177, 463–482.

Burke, T., Page, B., van Dyk, G., Millspaugh, J., Slotow, R., 2008. Risk and ethical concerns of hunting male elephant: behavioural and physiological assays of the remaining elephants. PLoS One 3. http://dx.doi.org/10.1371/journal.pone.0002417.

Creel, S., M'Soka, J., Droge, E., Rosenblatt, E., Becker, M., Matandiko, W., Simpamba, T., 2016. Assessing the sustainability of African lion trophy hunting, with recommendations for policy. Ecol. Appl. http://dx.doi.org/10.1002/eap.1377.

Delahay, R.J., Walker, N., Gunn, M.R., Christie, C., Wilson, G.J., Cheeseman, C.L., Mcdonald, R.A., 2011. Using lifetime tooth-wear scores to predict age in wild Eurasian badgers: performance of a predictive model. J. Zool. 284, 183–191. http://dx.doi.org/10.1111/j.1469-7998.2011.00796.x.

Di Minin, E., Leader-Williams, N., Bradshaw, C.J.A., 2015. Banning trophy hunting will exacerbate biodiversity loss. Trends Ecol. Evol. 2037, 1–4. http://dx.doi.org/10.1016/j.tree.2015.12.006.

Edwards, C.T.T., Bunnefeld, N., Balme, G.A., Milner-Gulland, E.J., 2014. Data-poor management of African lion hunting using a relative index of abundance. Proc. Natl. Acad. Sci. 111, 539–543. http://dx.doi.org/10.1073/pnas.1219615110.

Ferreira, S.M., Funston, P.J., 2010a. Age assignment to individual African lions. S. Afr. J. Wildl. Res. 40, 1–9. http://dx.doi.org/10.3957/056.040.0103.

Ferreira, S.M., Funston, P.J., 2010b. Estimating lion population variables: prey and disease effects in Kruger National Park, South Africa. Wildl. Res. 37, 194–206. http://dx.doi.org/10.1071/WR09030.

Garel, M., Cugnasse, J.M., Hewison, A.M., Maillard, D., 2006. Errors in age determination of mouflon in the field. Wildl. Soc. Bull. 34, 300–306. http://dx.doi.org/10.2193/0091-7648(2006)34.

Gipson, P., Ballard, W., Nowak, R., Mech, L., 2000. Accuracy and precision of estimating age of gray wolves by tooth wear. J. Wildl. Manag. 64, 752–758.

Groom, R.J., Funston, P.J., Mandisodza, R., 2014. Surveys of lions *Panthera leo* in protected areas in Zimbabwe yield disturbing results: what is driving the population collapse? Oryx 48, 385–393. http://dx.doi.org/10.1017/S0030605312001457.

Hiller, T., 2014. Comparison of two age-estimation techniques for cougars. Northwest. Nat. 95, 77–82.

Hoefs, M., Konig, R., 1984. Reliability of aging old dall sheep ewes by the horn annulus technique. J. Wildl. Manag. 48, 980–982.

IUCN, UNEP-WCMC, 2015. The World Database on Protected Areas (WDPA). www.protectedplanet.net (accessed 10.1.15).

Jarvis, A., Reuter, H., Nelson, A., Guevara, E., 2008. Hole-filled SRTM for the Globe Version 4. CGIAR-CSI SRTM 90 m Database.

Johnson, P.C.D., 2014. Extension of Nakagawa & Schielzeth's R^2_{GLMM} to random slopes models. Methods Ecol. Evol. 5, 944–946. http://dx.doi.org/10.1111/2041-210X.12225.

Kays, R.W., Patterson, B.D., 2002. Mane variation in African lions and its social correlates. Can. J. Zool. 80, 471–478. http://dx.doi.org/10.1139/z02-024.

Keehner, J.R., Wielgus, R.B., Maletzke, B.T., Swanson, M.E., 2015. Effects of male targeted harvest regime on sexual segregation in mountain lion. Biol. Conserv. 192, 42–47. http://dx.doi.org/10.1016/j.biocon.2015.09.005.

Kottek, M., Grieser, J., Beck, C., Rudolf, B., Rubel, F., 2006. World map of the Köppen-Geiger climate classification updated. Meteorol. Z. 15, 259–263. http://dx.doi.org/10.1127/0941-2948/2006/0130.

Lindsey, P.A., Balme, G.A., Booth, V.R., Midlane, N., 2012. The significance of African lions for the financial viability of trophy hunting and the maintenance of wild land. PLoS One 7. http://dx.doi.org/10.1371/journal.pone.0029332.

Lindsey, P.A., Balme, G.A., Funston, P.J., Henschel, P., Hunter, L.T.B., 2016. Life after Cecil: channeling global outrage into funding for conservation in Africa. Conserv. Lett. 0, 1–5. doi:http://dx.doi.org/10.1007/s13398-014-0173-7.2

Lindsey, P.A., Balme, G.A., Funston, P.J., Henschel, P., Hunter, L.T.B., Madzikanda, H., Midlane, N., Nyirenda, V., 2013. The trophy hunting of African lions: scale, current management practices and factors undermining sustainability. PLoS One 8, 1–11. http://dx.doi.org/10.1371/journal.pone.0073808.

Lindsey, P.A., Roulet, P.A., Romañach, S.S., 2007. Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. Biol. Conserv. 134, 455–469. http://dx.doi.org/10.1016/j.biocon.2006.09.005.

Loehr, J., Carey, J., Ylönen, H., Suhonen, J., 2008. Coat darkness is associated with social dominance and mating behaviour in a mountain sheep hybrid lineage. Anim. Behav. 76, 1545–1553. http://dx.doi.org/10.1016/j.anbehav.2008.07.012.

Loveridge, A.J., Searle, A.W., Murindagomo, F., Macdonald, D.W., 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biol. Conserv. 134, 548–558. http://dx.doi.org/10.1016/j.biocon.2006.09.010.

Lundervold, M., Langvatn, R., 2003. A comparison of age estimation methods for the saiga antelope *Saiga tatarica*. Wildl. Biol. 9, 219–227.

Mandisodza, R., Lindsey, P.A., Funston, P.J., Loveridge, A.J., 2009. Lion Aging and Adaptive Quota Management: The Application of the Points System in Zimbabwe in 2014. Zimbabwe.

Milman, O., 2015. Australia bans hunting "trophies" from lions entering or leaving the country. Guard 12–13.

Milner-Gulland, E.J., Nilsen, E.B., Andreassen, H.P., 2007. Demographic side effects of selective hunting in ungulates and carnivores. Conserv. Biol. 21, 36–47.

Naidoo, R., Weaver, L.C., Diggle, R.W., Matongo, G., Stuart-Hill, G., Thouless, C., 2016. Complementary benefits of tourism and hunting to communal conservancies in Namibia. Conserv. Biol. 30, 628–638. http://dx.doi.org/10.1111/cobi.12643.

Packer, C., 2001. Infanticide is no fallacy. Am. Anthropol. 102, 829–857.

Packer, C., Brink, H., Kissui, B.M., Maliti, H., Kushnir, H., Caro, T., 2011. Effects of trophy hunting on lion and leopard populations in Tanzania. Conserv. Biol. 25, 142–153. http://dx.doi.org/10.1111/j.1523-1739.2010.01576.x.

Packer, C., Kosmala, M., Cooley, H.S., Brink, H., Pintea, L., Garshelis, D., Purchase, G., Strauss, M., Swanson, A., Balme, G.A., Hunter, L.T.B., Nowell, K., 2009. Sport hunting, predator control and conservation of large carnivores. PLoS One 4, e5941. http://dx.doi.org/10.1371/journal.pone.0005941.

Packer, C., Pusey, A.E., 1993. Should a lion change its spots? Nature http://dx.doi.org/10.1038/362595a0.

Patterson, B.D., Kays, R.W., Kasiki, S.M., Sebestyen, V.M., 2006. Developmental effects of climate on the lion's mane (*Panthera leo*). J. Mammal. 87, 193–200. http://dx.doi.org/10.1644/05-MAMM-A-226R2.1.

Pitman, R.T., Swanepoel, L.H., Hunter, L.T.B., Slotow, R., Balme, G.A., 2015. The importance of refugia, ecological traps and scale for large carnivore management. Biodivers. Conserv. http://dx.doi.org/10.1007/s10531-015-0921-9.

Pusey, A.E., Packer, C., 1994. Non-offspring nursing in social carnivores: minimizing the costs. Behav. Ecol. http://dx.doi.org/10.1093/beheco/5.4.362.

Development Core Team, R., 2008. R: A Language and Environment for Statistical Computing. Vienna, Austria.

Riggio, J., Jacobson, A., Dollar, L., Bauer, H., Becker, M.S., Dickman, A.J., Funston, P.J., Groom, R., Henschel, P., de Iongh, H., Lichtenfeld, L., Pimm, S., 2012. The size of savannah Africa: A lion's (*Panthera leo*) view. Biodivers. Conserv. 22, 17–35. http://dx.doi.org/10.1007/s10531-012-0381-4.

Rodríguez-Muñoz, R., del Valle, C.R., Bañuelos, M.J., Mirol, P., 2015. Revealing the consequences of male-biased trophy hunting on the maintenance of genetic variation. Conserv. Genet. 16, 1375–1394. http://dx.doi.org/10.1007/s10592-015-0747-8.

Rosenblatt, E., Becker, M.S., Creel, S., Droge, E., Mweetwa, T., Schuette, P.A., Watson, F., Merkle, J., Mwape, H., 2014. Detecting declines of apex carnivores and evaluating their causes: an example with Zambian lions. Biol. Conserv. 180, 176–186. http://dx.doi.org/10.1016/j.biocon.2014.10.006.

Schaller, G.B., 1972. The Serengeti Lion: A Study of Predator-prey Relations. University of Chicago Press, Chicago.

Selier, S.A.J., Page, B.R., Vanak, A.T., Slotow, R., 2014. Sustainability of elephant hunting across international borders in southern Africa: A case study of the greater Mapungubwe Transfrontier conservation area. J. Wildl. Manag. 78, 122–132. http://dx.doi.org/10.1002/jwmg.641.

Skalski, J., Ryding, K., Millspaugh, J., 2005. Wildlife Demography: Analysis of Sex, Age, and Count Data. Elsevier Inc., Burlington, MA.

Smuts, G.L., 1980. Comparative growth of wild male and female lions (panthera leo.pdf).

Smuts, G.L., Anderson, J.L., Austin, J., 1978. Age determination of the African lion. J. Zool. 185, 115–146.

U.S. Fish and Wildlife Service, 2015. Endangered and threatened wildlife and plants; listing two lion subspecies. Fed. Regist. 80, 80000–80056.

Van Horn, R.C., McElhinny, T.L., Holekamp, K.E., 2003. Age estimation and dispersal in the spotted hyena (*Crocuta crocuta*). J. Mammal. 84, 1019–1030. http://dx.doi.org/10.1644/BBa-023.

Vaughan, A., 2015. France Bans Imports of Lion Hunt Trophies Considers Stricter Controls on Other Species 1–2.

West, P.M., MacCormick, H., Hopcraft, G., Whitman, K.L., Ericson, M., Hordinsky, M., Packer, C., 2006. Wounding, mortality and mane morphology in African lions, *Panthera leo*. Anim. Behav. 71, 609–619. http://dx.doi.org/10.1016/j.anbehav.2005.06.009.

West, P.M., Packer, C., 2002. Sexual selection, temperature, and the lion's mane. Science 297, 1339–1343. http://dx.doi.org/10.1126/science.1073257.

Whitman, K.L., 2010. Pocket Guide to Aging Lions. Conservation Force.

Whitman, K.L., Packer, C., 2007. A Hunter's Guide to Aging Lions in Eastern and Southern Africa. Safari Press, Long Beach, California.

Whitman, K.L., Starfield, A.M., Quadling, H., Packer, C., 2007. Modeling the effects of trophy selection and environmental disturbance on a simulated population of African lions. Conserv. Biol. 21, 591–601. http://dx.doi.org/10.1111/j.1523-1739.2007.00700.x.

Whitman, K.L., Starfield, A.M., Quadling, H.S., Packer, C., 2004. Sustainable trophy hunting of African lions. Nature 428, 175–178. http://dx.doi.org/10.1038/nature02395.

Wildlife Division, 2012. Comment on ESA Status Review of the African Lion. Tanzania.

Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting

A report prepared by Professor David W. Macdonald CBE, FRSE, DSc*

Director of WildCRU, Department of Zoology, University of Oxford

at the request of Rory Stewart OBE

Under Secretary of State for the Environment

28 November 2016



WILDCRU
Wildlife Conservation Research Unit

UNIVERSITY OF OXFORD

* david.macdonald@zoo.ox.ac.uk

Contributors

This report was prepared with the assistance of members of the Wildlife Conservation Research Unit, Department of Zoology, University of Oxford, of which the core team was Dr Amy Dickman, Dr Andrew Loveridge, Mr Kim Jacobsen, Dr Paul Johnson, Dr Christopher O'Kane and Dr Byron du Preez, supported by Dr Kristina Kesch and Ms Laura Perry.

It benefitted from critical review by:

Dr Guillaume Chapron
Dr Peter Lindsey
Professor Craig Packer

It also benefitted from helpful input from:

Dr Hans Bauer
Professor Claudio Sillero
Dr Christiaan Winterbach
Professor John Vucetich

Under the aegis of DEFRA the report was helpfully informed by evidence and opinions offered during consultations with the following organisations:

Born Free
LionAid
Safari Club International Foundation (SCIF)
The British Association for Shooting and Conservation (BASC)
The European Federation of Associations for Hunting and Conservation (FACE)
The International Union for Conservation of Nature (IUCN)
The Wildlife Conservation Society (WCS)
The World Wide Fund for Nature (WWF)

Contents

Contributors ii

Abbreviations Used in the Text viii

Preface ix

Executive Summary and Recommendations xiii

1 Reasons for examining the issue of trophy hunting with respect to lion conservation 1

1.1 Reasons for being concerned about lion conservation 1

1.1.1 What value do lions have? 1

1.1.2 To what extent have lions declined, in terms of numbers and geographic range? 1

1.1.3 What is the current threat status of lions? 2

1.1.4 What are the major current threats to lions? 2

1.1.5 Future considerations for lion conservation 3

1.1.6 Summary of reasons for being concerned about lion conservation . . 4

1.2 Background to lion trophy hunting 5

1.2.1 What is lion trophy hunting? 5

1.2.2 Legality of lion trophy hunting 6

1.2.3 Ethical acceptability of lion trophy hunting 10

1.2.4 Extent of lion trophy hunting and its markets 11

1.2.5 Reason for the UK Government examining this issue now 12

1.3 Summary of reasons for examining trophy hunting with regard to lion conservation 18

2 Threats and impacts associated with lion trophy hunting 19

2.1 The significance of trophy hunting as a threat to lions 19
2.1.1 Significance of trophy hunting as a threat to lions at a population scale 19
2.1.1.1 Negative population effects associated with the removal of females 20
2.1.1.2 Negative population effects associated with the removal of pride males 20
2.1.1.3 Threat to lion populations of trophy hunting relative to other threats 22
2.1.2 Significance of trophy hunting as a threat to lions at a national scale 23
2.1.2.1 Significance of trophy hunting as a threat to lions in Botswana 24
2.1.2.2 Significance of trophy hunting as a threat to lions in Mozambique 24
2.1.2.3 Significance of trophy hunting as a threat to lions in Namibia 25
2.1.2.4 Significance of trophy hunting as a threat to lions in Tanzania 27
2.1.2.5 Significance of trophy hunting as a threat to lions in Zambia 29
2.1.2.6 Significance of trophy hunting as a threat to lions in Zimbabwe 30
2.1.3 Factors mediating the threat posed by trophy hunting 31
2.1.4 Significance of trophy hunting as a threat to lions at a regional scale 32
2.1.5 Summary of the significance of trophy hunting as a threat to lions . 32
2.2 Impacts associated with lion trophy hunting 34
2.2.1 Ecological impacts 34
2.2.1.1 Habitat protection 34
2.2.1.2 Reduction of other threats to lions and other wildlife 35
2.2.2 Impacts of economic benefits generated from trophy hunting 36
2.2.2.1 Level of trophy hunting revenue generated 36
2.2.2.2 The economic contribution of lion hunting and its impact on land-use 37
2.2.2.3 Trophy hunting and economic incentives for lion conservation 41

2.3 Summary of the impacts associated with trophy hunting 44

3 Current and recommended lion trophy hunting practices 45

3.1 Lease length, allocation and fixed quotas 45

3.2 Restrictions on lions able to be hunted 46

4 Options to improve the conservation impact of trophy hunting 49

4.1 Possible impacts of maintaining the status quo 49

4.2 Possible impacts of a total import ban 49

4.3 Possible impacts of stricter controls on the import of lion trophies to the UK 51

4.3.1 Reasons for considering stricter controls 51

4.3.2 Possible options for stricter conditions 52

4.3.2.1 Best-practice: Lion populations are sustainably managed, as determined by professional-standard science-based monitoring 54

4.3.2.2 Age-based harvesting 54

4.3.2.3 Interim scenario 55

4.3.2.4 Dealing with areas which do not meet the desired conditions 55

4.3.3 Notes on scale and conditions of import 56

4.3.3.1 Recommended scale at which criteria are applied 56

4.3.3.2 Verification of hunting practices 57

5 An overview: Framing trophy hunting in the context of wider lion conservation 59

5.1 Summary of lion trophy hunting in the context of conservation 61

Appendix A Ethics and trophy hunting 64

A.1 The ethical background to trophy hunting 64

A.2 What is the moral status of animals? 64

A.3 If trophy hunting is permissible in principle, what affects this? 67

A.4 How does emotion affect judgements concerning trophy hunting? 69

A.5 What inconsistencies are there in value judgments concerning acceptable reason for killing animals? 70

A.6 Does the Cecil event highlight changing perspectives on the acceptability of trophy hunting? 72

A.7 Summary 73

Appendix B Extent of trade in lion trophies **74**

B.1 Botswana 74

B.2 Mozambique 75

B.3 Namibia 76

B.4 Tanzania 77

B.5 Zambia 78

B.6 Zimbabwe 79

Appendix C Case study of a successful hunting area: the Bubye Valley Conservancy **80**

C.1 Background to Bubye Valley Conservancy 80

C.2 Lions in Bubye Valley Conservancy 80

C.3 Revenue generated from lion hunting in Bubye Valley Conservancy 81

Appendix D Example of an Adaptive Age Based Quota System **82**

Literature Cited **85**

List of Figures

1 International lion trophy trade map 13

2 Threat Rankings for Lions in (a) West and Central Africa and (b) East and Southern Africa 33

List of Tables

1 Summary of the historic extent of trophy hunting practice across Africa . . 8

2 Summary of the total number of wild-sourced lion trophies 12

3 Comparison of hunting revenue per country per year 38

4 Reported international imports vs exports 2006-2015: *Botswana* 74

5 Reported international imports vs exports 2006-2015: *Mozambique* 75

6 Reported international imports vs exports 2006-2015: *Namibia* 76

7 Reported international imports vs exports 2006-2015: *Tanzania* 77

8 Reported international imports vs exports 2006-2015: *Zambia* 78

9 Reported international imports vs exports 2006-2015: *Zimbabwe* 79

10 Zimbabwe's adaptive quota points system 82

11 Worked examples of an adaptive quota points system 83

Abbreviations Used in the Text

ALWG	African Lion Working Group
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DEFRA	Department for Environment, Food and Rural Affairs
FSC	Forest Stewardship Council
ISO	International Organisation for Standardisation
IUCN	International Union for Conservation of Nature
PAC	Problem Animal Control
SCI	Safari Club International
SCIF	Safari Club International Foundation
TAWIRI	Tanzania Wildlife Research Institute
UNPD	United Nations Population Division
USFWS	US Fish and Wildlife Service
WWF	World Wide Fund for Nature
ZPWMA	Zimbabwe Parks and Wildlife Management Authority

Preface

This is a scientific report about one aspect of the conservation of wildlife and, specifically, of lions in Africa. That aspect is the trophy hunting of wild lions, and the remit is to evaluate evidence that trophy hunting has, or could, impact on the distribution and abundance of lions for better or worse in terms of their conservation. Other considerations beyond this, most obviously ethics (Macdonald et al. 2016b), are relevant to society's decisions on whether hunting lions for trophies is an acceptable activity. These other considerations are very important, and potentially decisive, but they are not the remit of this report. Indeed, those who have contributed to this report have done so strictly from a position of professional neutrality that is neither pro- nor anti-hunting, although they are united in being pro good evidence and anti bad management of lion populations.

The question of whether trophy hunting of lions harms or benefits lion conservation has become important and topical because lion numbers are declining fast and because the allegedly illegal hunting in Zimbabwe in 2015 of a lion nicknamed Cecil has focused unprecedented international attention on the issue (Macdonald et al. 2016a). It has also revealed that, at least in many of the countries into which lion trophies are currently imported, large sections of society regard hunting lions for sport as an ethically inappropriate activity for the twenty-first century (Macdonald et al. 2016a). Others take the opposite view, most notably often amongst people who actually have to live with lions in their range countries (Nzou 2015). Crucially relevant to the consequences of this disagreement is the proposition that rather than being a threat, hunting lions contributes significantly to their conservation, primarily through the maintenance of wild habitat, and that its cessation would worsen the species' already deteriorating status (Lindsey et al. 2012b; Di Minin et al. 2016). These ethical and pragmatic views may be irreconcilable, but before deciding what to do about it, individuals and nations need to know the facts, and indeed the gaps in

knowledge. Providing these facts, and identifying important gaps, is one function of this report, and it is particularly important insofar as policies applied impulsively could have perverse consequences if the intention to improve lion conservation resulted in worsening it. In that case, even those implacably opposed to lion hunting on ethical grounds might favour a *journey* rather than a *jump*. For example, if society judged trophy hunting lions unacceptable, but also concluded that it benefited lion conservation, then this dilemma might be approached via a journey to find ways of replacing the benefits of hunting before jumping to end them.

It was against this background that the then Minister for the Environment, Rory Stewart, invited this review of existing lion trophy hunting practice with the aim of:

1. providing recommendations for criteria for best practice in the industry to inform assessments of whether trophy hunting is well managed and sustainable;
2. providing recommendations for what the UK, working with the our partners in the EU and also internationally, could do to assist implementation of best practice; and
3. framing these recommendations within the wider context, and overall goal, of supporting lion conservation.

As will become clear, the topic is vast, its ramifications endless, and the knowledge gaps numerous. Plugging those gaps could take a substantial inter-disciplinary research programme, and compiling even what is known now might usefully take a team of scholars a year. In reality, only a few months have been available, and so amongst the things this report is not, is entirely comprehensive or complete. Nonetheless, it aspires to set the scene and offer recommendations that are evidence-based, precautionary and workable.

Having stated that this report is concerned with trophy hunting in terms only of its impact on lion, and other wildlife, conservation, it is worth being clear on the meaning of conservation as used in this report. It is a highly inter-disciplinary blend of natural and social sciences that together provide the evidence from which

to understand, and thereby to provide the basis for conserving, species and their diversity. That evidence is necessary, but not sufficient, to make decisions on policy, because like other political matters good decisions rest upon wise judgement beyond the facts. Conservation is often characterised as being focused on populations, but insofar as the behaviour of populations emerges from the behaviour of the individuals that comprise them, conservation is also concerned with the fates and well-being of individuals. Conservation is sometimes characterised as being disinterested in animal welfare, but that is an error: for example, welfare is one of the factors that would be considered in evaluating different conservation policies. Furthermore, there was a time when conservation was thought to prioritise wildlife over people, but this too is a simplification to the point of error. Modern wildlife conservation strives to find mutual advantage between the well-being of wildlife and the people who live, often with difficulty and in poverty, alongside it.

In this report, the 'lion estate' refers to the area of land occupied by wild lions (more technically, their geographical range) and relevant to the species' conservation in the wild. Due to ecological factors (principally linked to variation in rainfall, vegetation and prey abundance) lion abundance varies across their geographical range (East 1984). But over and above that natural intra-specific variation in population density (e.g. between <1 and 40 lions 100 km^{-2}; Packer et al. 2013a), their numbers are frequently below carrying capacity due to human factors. For example, lions are often poisoned in reprisal for stock-raiding, or killed by snares set by poachers for bushmeat, or they may be hunted unsustainably for trophies. This report is concerned with lion conservation in terms of impacts on the extent of the lion estate and the abundance of lions occupying it. Any human action that diminishes the extent of that estate is considered here as inimical to lion conservation; any action that maintains or increases the lion estate is a benefit to lion conservation. In terms of the abundance of lions, while in the face of their widespread decline increasing the numbers of lions is generally considered a benefit to conservation, maximising their numbers is not necessarily the goal of conservation. This is because, in the context of natural communities, a greater abundance of lions can lead, through competition, to smaller numbers of other wild carnivores (e.g. leopards, cheetahs, African wild dogs) or, through predation, to fewer of their prey. Notwithstanding these nuances, the

primary aim of this report is to evaluate how trophy hunting impacts lion conservation, where the goal is to maintain or increase the lion estate and the eventual abundance of lions thereon.

The original Ministerial request to prepare this report had the intention of informing the British government delegation to the 17th meeting of the Conference of the Parties to CITES (CoP17), at which a proposal by Niger and eight other countries to up-list lions to Appendix I was anticipated to have implications that could have added further restrictions to the trophy hunting of wild lions, and thus had consequences, some of them perhaps unintended, for lion conservation. As Bauer and Breittenmoser (2016) report, the proposal was not adopted and so trophy hunting of wild lions was not directly affected. However, the mood of the meeting, and perhaps also of a wider global community, was that if trophy hunting had on this occasion avoided strictures it was nonetheless the moment for that industry to take decisive steps to ensure forcefully not only that it caused no detriment to lion conservation but actively enhanced it. Thus an additional and timely role emerges for this report: to address the question of how, for so long as it continues, trophy hunting can be managed to maximise its contribution to lion conservation.

David W. Macdonald

WildCRU, Oxford

28th November 2016

Executive Summary and Recommendations

Value and Status: Lions are charismatic, widely valued and have the potential to act as conservation 'ambassadors' for biodiversity. As a species, they are not doing well: lions have disappeared from 92% of their historic range and their numbers have declined drastically to approximately just 20,000 individuals.

Grasping the moment to create the movement: Given this rapid decline of one of the world's most iconic species, action to conserve lions is urgently needed. Considering this urgency, and from the perspective of conservation, it is unacceptable to tolerate factors worsening the lion's status where options exist for mitigating them. With the world's attention galvanised by the killing of 'Cecil' the lion, there is an opportunity to convert that *Cecil Moment* into the *Cecil Movement* for global conservation. From the perspective of conservation, there is a global responsibility to grasp that opportunity.

Threats to lions: The primary threats to lions (which vary regionally), are habitat loss and degradation, loss of prey base and conflict with people over livestock. These threats are likely to intensify with climate change and rapidly increasing human population, predicted to double in Africa by the year 2050. Trophy hunting of lions can be a threat to some populations.

Extent of lion trophy hunting: Trophy hunting of lions was legal in 18 African countries in 2014, is currently practised at a significant level in at least 12 countries, and is an extensive form of land use therein. 'Canned' hunting of captive animals is legal in some countries but these are not considered wild lions and so are considered only in passing in this report.

Ethical considerations: The ethics of trophy hunting are much debated. This report focuses on trophy hunting's consequences for lion conservation, while recognising that ethics, particularly relating to animal and human welfare, will influence policy decisions.

Numbers of lions hunted for trophies: Most trophy-hunted lions are bred in captivity. The number of wild lions trophy-hunted is hard to establish with precision due to inconsistencies in the data. Between 2006 and 2015, CITES recorded 4,474 'wild'-sourced lion trophies (which include parts of lions so may not reflect numbers of individuals) as imported world-wide, with only 2,429 reported as exported. Between 1991 and 2013, CITES records 80 wild lion trophies (not individual lions) exported to the UK; the UK importation records show 4 trophies.

Effects of trophy hunting on lion populations: Trophy hunting, particularly of females and pride males, can be a significant (and in some cases even primary) threat to lion populations at a local level, especially when additive to other effects. The damaging effects of unsustainable trophy hunting can extend beyond hunting areas into adjacent protected areas. However, there is little evidence that trophy hunting has substantial negative effects at a national or regional level. Where trophy hunting is well-regulated, transparent and devolves sufficient authority to the land managers, it has the potential to contribute to lion conservation, but in many countries, poor governance and weak regulation can lead to unsustainable trophy hunting.

Impact of trophy hunting on lion populations: There is little evidence that trophy hunting has substantial negative effects at a national or regional level. Where trophy hunting is well-regulated, transparent and devolves sufficient authority to the land managers, it has the potential to contribute to lion conservation, but in many countries, poor governance and weak regulation can lead to unsustainable trophy hunting.

Trophy hunting as a contributor to lion conservation: The most fundamental benefit of trophy hunting to lion conservation is that it provides a financial incentive to maintain lion habitat that might otherwise be converted to non-wildlife land uses. It has been estimated that trophy hunting areas cover 1.4 million km^2 – 22% more land than National Parks – in Africa. How much of that area could viably be converted to phototourism is unknown, but this certainly could not be accomplished everywhere.

Revenue generated from trophy hunting: The revenue generated by trophy hunting is debated, with estimates of >US$200 million in gross revenue annually across sub-Saharan Africa. Lion hunting probably accounts for 5-17% of that income, depending on the country. Overall, the trophy hunting industry is not heavily

dependent on lions for its financial viability, but if lion hunting was ruled out, trophy hunting could, according to the only peer-reviewed published estimate (Lindsey et al. 2012), become unviable across approximately 60,000 km^2.

Approaches to reducing the risk of over-harvesting: Two main proposals have been made for reducing the risk of unsustainable trophy hunting – the first is area-based, with removal level ideally capped at 0.5 lions 1,000 km^{-2} (unless there is evidence it can withstand a higher level), and the second is age-based, where it is recommended that only males of 7 years or above are taken. In areas where other threats are present then combining the age- and area-based methods would be the safest policy (if other risk factors are not increasing, this should have a <10% risk of population extirpation within 25 years).

Trophy hunting in perspective: Over and above the issue of trophy hunting, international attention should be focused on generating new financial mechanisms to secure lion populations across their range. In this context lions are a metaphor, and an ambassador, for wider biodiversity conservation. Given that there are probably 60 remaining wild lion populations, a priority, and a call to arms, is to secure the six remaining ones of those which have substantial lion numbers and to safeguard all 60 remaining wild lion populations.

Recommended criteria for importing trophies to the UK: The criteria for whether a lion trophy could be imported into the UK should be that the hunting (a) was unlikely to cause detriment to the lion population from which it was taken, and (b) contributes to lion conservation. Therefore, we recommend that the following essential criteria should be applied to the consideration of lion trophy imports to the UK:

i. That the UK should import trophies only from areas that are sufficiently large to offer conservation benefit to lions (we suggest 500 km^2 or more), and where the lion population is demonstrably well-managed.

ii. Good management requires either adequate monitoring, which allows scientific quota-setting and shows a stable or increasing population, or age-based harvesting. Age-based harvesting could include either the precautionary approach (0.5 male lions of $\geqslant$7 years per 1,000 km^2, with rest periods, unless there are good data showing it can withstand a higher level), or adaptive age-based quotas.

iii. Areas that fail to qualify under the foregoing criteria could possibly receive a 'grace period' of up to 3 years under very strict criteria and annual review in order to allow

them to reach the required standards. During any such period, hunting should be heavily limited, e.g. to a maximum of 0.5 lions 1,000 km^{-2} aged $\geqslant$7 years. Failure to meet the required conditions after the grace period would result in a moratorium on UK imports from the area until they are in place.

iv. In areas where lion populations are declining unsustainably under any of the permitted harvesting systems, hunting should be stopped or, if there is a significant risk of losing that habitat from the wildlife estate, the area should be examined on a case-by-case basis and any lion hunting kept only at a very minimal level until the situation can be improved.

v. These criteria should ideally be applied at the level of the hunting area not the country, and exports should be managed by an independent committee of stakeholders in each country. That committee should audit hunting practices, set and monitor quotas, encourage certification of hunters, ensure adequate training of professional hunters, ensure transparency and compliance, and verify the age of hunted lions based on hunt reports, photos and tooth X-rays. The costs of operating these national committees would normally be met by stakeholders such as the hunting industry, relevant NGOs, international and local governments.

In addition, the likelihood of trophy hunting contributing to lion conservation would be increased if regulations were designed to maximise the revenue procured that was, at least partly, available to conservation. Therefore, this report recommends that the following desirable elements should be in place:

i. Short leases, and the short-termism and incentive for over-harvesting that they encourage, should not be issued to hunting blocks. A suitable minimum would be ten years, with option for extension by the current tenant (assuming conservation requirements have been met).

ii. Hunting blocks should be allocated according to an open auction system.

iii. Trophy hunting fees should only be applied following successful hunts, thereby reducing the incentive to kill inappropriate individuals.

Because trophy hunting involves killing a wild animal that, if not killed cleanly, has the potential to suffer, and because human safety is also at risk with the use of firearms, this report recommends reviewing the evidence and codes of practice that would ensure:

- that professional hunters are strictly accredited as evidenced by membership of internationally recognised associations that put standards first and foremost (including those

of marksmanship and animal welfare), and will conduct investigations into reports of misconduct and expel guilty members (national governments should support such expulsions by refusing disciplined PHs permission to hunt). Membership with such an association would be necessary to market hunts (e.g. at the large international conventions where an estimated >75% of the hunts are booked).

Finally, broader scale analysis of imports and exports of lion trophies is an essential element of monitoring the industry and its impact on conservation. The CITES database is a potentially incomparable resource for doing so. However, ambiguities over the muddling of entire lions and parts of lions, and some lack of clarity between exports and re-exports, currently confound the data, and lamentably diminish the value of the database. Therefore, this report also recommends that:

- CITES procedures are adjusted so that it is possible to assign various body parts to a single trophy lion (thereby avoiding the double-counting of, say, the pelt and skull of a single animal), and to track successive re-exports of that individual.

These recommendations, based on an impartial review of the scientific evidence, represent feasible steps for minimising risk of adverse effects of trophy hunting on lion populations, while ensuring that where trophy hunting occurs it contributes significantly to the benefit of lion conservation. This is important, but the UK government, and its partners and collaborators in this grand vision, will also need to invest heavily in tackling even greater issues beyond trophy hunting to secure the long-term future of this globally iconic species.

Wider implications for the governance of lion trophy hunting to ensure it is not detrimental to lion conservation and has the potential to enhance it: Although this report was commissioned by the then Under Secretary of State to inform decisions on the conditions that might apply to the import of lion trophies to the UK, the recommendations set out in that context in the foregoing section apply equally to the wider question of how the lion trophy hunting industry might be regulated to ensure that it is not detrimental to lion conservation and is best placed to enhance it.

1. Reasons for examining the issue of trophy hunting with respect to lion conservation

1.1 Reasons for being concerned about lion conservation

1.1.1 What value do lions have?

The African lion is one of the world's most iconic species, and has played a rich role in the symbolism and culture of the United Kingdom. At a wider scale, at least a large part of the global public assign great existence value to lions (Dickman et al. 2011), and there is vast international interest in lion welfare and conservation (Macdonald et al. 2016a). Lions and other big cats are viewed as particularly charismatic species amongst people likely to engage with conservation campaigns, making them powerful ambassadors for conservation (Macdonald et al. 2015a).

As apex predators, lions also have great ecological value, and the removal of top carnivores from ecosystems can have long-lasting negative ecological impacts (Ripple et al. 2014). In addition to their cultural and ecological significance, lions undoubtedly have very high economic value, and are one of the top draws for both photographic tourists and trophy hunters to the countries where they remain, generating large amounts of revenue (McNeely 2000; Lindsey et al. 2012b). Lions are a regular part of the trophy hunting industry in at least 10 African countries and more information on the specific economic revenue of lion trophy hunting is provided in Section 2.2.2.

1.1.2 To what extent have lions declined, in terms of numbers and geographic range?

The urgency and importance of lion conservation arises from the fact that lions have experienced a dramatic decline in both numbers and geographic range over recent decades. The latest IUCN estimates suggest a population of 23,000 – 39,000 African lions (probably closer to the lower estimate), representing a decline of at least 43% between 1993 and 2014 (approximately three lion generations) (Bauer et al. 2016). Most alarmingly, lions are now considered to have been extirpated from at least 92% of their historic range[1] (Bauer et al. 2016).

[1] *Lions occur in 24 African countries (Bauer et al. 2016). Since 1977, 20 of these countries have exported lion trophies (CITES: http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12])*

According to the 2016 Red List Assessment, in Africa, lions are now extinct in 15 countries (including Western Sahara, which is technically a disputed territory), are possibly extinct in another seven and now occur in only 24 countries (Bauer et al. 2016). Lion decline may be even more severe than currently estimated by the IUCN, due to the assessment being based on data from relatively well-known populations. This is a common practice, but well-monitored populations are also those which are likely to have relatively high levels of attention, investment and protection, so a possible bias is that they are likely to be less threatened than many other subpopulations (Durant et al. submitted).

1.1.3 What is the current threat status of lions?

The lion is classed as 'Vulnerable' by the IUCN (Bauer et al. 2016) based on its declining population size, so is thought to be facing a high risk of extinction in the wild. However, across the majority of its range, the lion meets the IUCN criteria for 'Endangered' status, with an inferred rate of decline of over 50% across three lion generations, but the positive trends from southern Africa reduce that average decline at a range-wide level (Bauer et al. 2015). Only two African countries (Namibia and Zimbabwe) had substantially increased lion populations between 1993 and 2014, and it is of note (given the purpose of this report) that both those countries are ones which trophy-hunt lions. Similarly, while lions in most parts of Mozambique are declining, in Niassa Game Reserve where hunting was tightly regulated, lion populations increased locally between 1993 and 2014. However, trophy hunting is clearly not a guarantee of increasing lion populations, as other key trophy hunting countries such as Tanzania showed declines (Bauer et al. 2016), with previous data from Packer et al. (2009) showing highest declines in countries with highest trophy hunting rates.

1.1.4 What are the major current threats to lions?

The 2016 IUCN Red Listing for the lion states that "*Among the causes of decline, the most important are indiscriminate killing in defence of human life and livestock, habitat loss, and prey base depletion. Prey base depletion is partly linked to habitat loss, but more importantly to poaching and bushmeat trade (Becker et al. 2013). An emerging threat is trade in bones and other body parts for traditional medicine, both within Africa and in Asia (IUCN 2006a, b; Riggio et al. 2013). Furthermore, although trophy hunting contributes positively to Lion conservation, improvements in management practices have been recommended (Hunter et al. 2013; Lindsey et al. 2013; Edwards et al. 2014), as when poorly regulated, it also contributes to population declines (Packer et al. 2009; Croes et al. 2011;*

Packer et al. 2011; Rosenblatt et al. 2014). While attention is currently focused on Lion hunting reforms to ensure sustainability, the leading causes of population decline are more difficult to address and are likely to continue" (Bauer et al. 2016).

The CITES/CMS meeting of all lion range states in May 2016 summarised that: "*...the main threats (listed in no particular order) for lions in Africa are: (1) Unfavourable policies, practices and political factors (in some countries); (2) Ineffective lion population management; (3) Habitat degradation and reduction of prey base; (4) Human-lion conflict, (5) Adverse socio-economic factors; (6) Institutional weakness; and (7) Increasing trade in lion bones.*" The two 2006 IUCN regional reports for lions noted that the major factors affecting lion viability were availability of wild prey, indiscriminate killing of lions, size and extent of the lion population, and loss, degradation and fragmentation of lion habitat, with increasing human populations and poverty acting as key underlying root causes of decline, as well as institutional weakness and poor management (IUCN 2006a, b). A 2016 report by Panthera, WildAid and WildCRU named human-lion conflict and bushmeat poaching as critical threats to lions, while human encroachment was a high threat and trophy hunting and lion poaching were deemed medium threats (Panthera et al. 2016). In short, experts agree that the primary threats to lions (which vary to some extent by region; see Section 2.1.4) are habitat loss and degradation, loss of prey base and conflict with people over livestock depredation.

1.1.5 Future considerations for lion conservation

There are significant global challenges facing lions and other biodiversity, particularly the impacts of human population growth and climate change. Human populations are set to swell over the 21st century, as is their demand for resources including land. Africa, with a current population size of ~1.2 billion (UNPD 2015), has the fastest population growth rate in the world, with projections estimating a population tripling across 27 African states by 2100, leading to a continental estimate of ~4 billion. Eight lion range states[2] (as well as Mali, where lions are possibly extinct, and Burundi, where they are extinct) are estimated to have a five-fold increase in human population by 2100 (UNPD 2015). At current rates of population growth, by the end of the century the population of Tanzania will be two-thirds that of the United States of America (USA) but in an area ten times smaller. Worse still, Nigeria, also with a surface area roughly one-tenth that of the USA, is projected

[2] *Angola, Democratic Republic of the Congo, Malawi, Niger, Somalia, Uganda, Tanzania and Zambia*

to have a population that will be double that of the USA (European Commission 2015). The impact of this human population growth on the lion estate depends on many variables, but even supposing favourable economic development and land-use transitions were to occur (which seems unlikely in many places), it is expected that pressure on lion habitat and prey will increase substantially. Livestock numbers are expected to grow concomitantly, leading to intensified human-lion conflict. Changes in human populations may also be associated with changes in patterns of tourism, which might affect both photographic and hunting revenues for lion range states.

Regarding climate change, under moderate emissions scenarios, global mean temperature is expected to reach 2° above pre-industrial levels by 2050. More likely, and given the reticence or incompetence with which governments have faced climate change, these temperature scenarios will be exceeded. A more likely prediction is 2.5–3° warming by 2050[3]. Climate changes are likely to have pervasive effects such as reduced and more erratic rainfall (Fields 2005; Toulmin 2009). Although lions have broad habitat tolerance within the savannah biome, the predicted drying trend is likely to affect lions through declines and changes in prey species communities. The implications of changing climate for lions are not limited to direct effects: it could also feasibly alter the potential human land-uses. There is uncertainty about how increasing aridity may affect land conversion and the implications for the lion estate. However, there is likely to be increasing pressure on water-rich regions from growing human populations, increasing demand for land and increasing pressure on currently protected areas.

1.1.6 Summary of reasons for being concerned about lion conservation

Lions have great value at national and international scales, including significant existence, ecological and economic value. Furthermore, lions hold both symbolic meaning and widespread affection in the UK, making their conservation important for the British populace. Rural populations in many African countries often take a different view of animals that can and do kill their stock and even members of their families, and to them, lion killing can be not only ethical but often desirable (Hazzah et al. 2009; Dickman 2015). Furthermore, governments in lion range countries, often affected by poverty and all the attendant pressures, will have different priorities from West-

[3] *IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.*

ern audiences. Over only a few decades, the lion estate has shrunk strikingly, as have numbers of lions occupying parts of it, so to those who value it, the conservation of this iconic species is now more urgent than ever. With perhaps not many more than 20,000 free-ranging lions remaining, and in the light of increasing pressure on lion populations, there is a pressing requirement for effective conservation, and anything that might imperil it necessitates careful scrutiny. There have been vociferous arguments that trophy hunting is one of the factors that imperils lions, while others state equally vigorously that restricting trophy hunting would be a larger danger factor for lion conservation. Therefore, it is urgent that this issue is examined impartially, in order to develop suggestions for policy that would minimise negative impacts for lion conservation.

1.2 Background to lion trophy hunting

1.2.1 What is lion trophy hunting?

According to the IUCN, "*Trophy hunting generally involves the payment of a fee by a foreign or local hunter for a hunting experience, usually guided, for one or more individuals of a particular species with specific desired characteristics (such as large size or antlers). The trophy is usually retained by the hunter and taken home*" (IUCN 2016). Trophy hunting is also known as 'safari hunting' and is often referred to as a type of 'sport' or 'recreational' hunting (and justifications are clearly distinct from those when hunting is primarily for pest control or subsistence; Loveridge et al. 2007b). Regarding lions, the trophy is normally the animal's skull and skin (and clavicle, hyoid bone and claws). The mane is the prominent feature of the skin, with longer, thicker and darker hairs signifying a better quality of trophy, although ultimately Safari Club International (SCI) define trophy quality by skull size (Safari Club International 2005). Trophies are usually mounted for display and associated kudos and nostalgia.

Although an important part of the pursuit, trophies themselves are not usually the sole motivation for hunting. Motivations may include engagement in outdoor pursuits, an enthusiasm for collection, social status and owning 'bigger' trophies (as evidenced by the emphasis on trophy size in SCI Awards and record book). Surveys of over 600 international trophy hunters who had hunted in South Africa between 1999 and 2003 revealed that spiritual or emotional motives (particularly the enjoyment of being in nature), were the most commonly mentioned reasons for hunting, followed by 'emotional' aspects such as enjoying the challenge of the hunt, although col-

lection of the trophy was an important theme for many people (Radder 2005).

In Africa, government or wildlife management agencies make hunting concessions available, usually on leasehold, and normally issue trophy hunting licences that are available to the hunting client through hunting outfitters, also known as safari operators[4], for a fee. The overall cost to the hunting client covers the direct costs of the hunt (e.g. trophy fees, per diem rates [which differ between species and are significantly larger for dangerous species], concession fees, accommodation, subsistence, staff and travel costs). It also usually covers a levy that goes to the Government, part of which may be used by the Government to provide funds for wildlife areas and local communities (see Section 2.2.2.3). The motivation of the lion range states for permitting trophy hunting is, as for other forms of tourism, to generate revenue and jobs; this has the consequence of financing a wildlife economy on land where in some cases alternative forms of land-use are less profitable or practical.

The hunting operations are usually run by outfitters (although sub-leasing and external marketing complicates the system and the task of regulating it); outfitters are responsible for all hunting requirements in-country, such as obtaining the correct licences, permits, liaising with landowners, and organising all other logistics. Outfitters also provide access to a professional hunter (which may be the outfitter themselves), whose responsibility it is to accompany the client and ensure that the hunt is conducted to the required standard. Professional hunters are variously accredited by national hunting bodies or wildlife management authorities. The exact mechanisms of lion trophy hunting vary by country, but once the lion has been killed, the outfitter or professional hunter is responsible for the field preparation and care of the trophy, and ensuring that all the relevant permits are in place for the client to export the trophy to its final destination.

1.2.2 Legality of lion trophy hunting

The global outcry over the trophy hunting[5] of Cecil the lion in July 2015 (Macdonald et al. 2016a) revealed widespread surprise amongst the public, particularly in more developed countries, that trophy hunting remains a legal practice

[4] *Hunting outfitters or safari operators have the legal rights to hunt on a defined piece of land (either private land, government concession, or community land) for which they may be issued a hunting quota for particular species. Professional hunters are contracted by the safari operators to guide paying tourist hunters in their pursuit of quarry; doubling up as instructors, first aiders, bodyguards etc.*

[5] *All legal charges relating to the hunting of Cecil were dropped in November 2016. A Zimbabwe court ruled that they were too vague for a proper defence to be mounted (http://www.bbc.co.uk/news/world-africa-37948866). Most trophy hunting is legally practiced.*

(and an expansive land use) in many African countries. Trophy hunting (of certain wildlife species, not just lions) is currently practiced at a significant level in approximately 12 African countries (historically at least 33 African countries permitted trophy hunting; CITES data: http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12]). A summary of which African countries historically hunted and currently hunt lions, according to CITES data, is shown in Table 1.

As of December 2015, trophy hunting was banned in six African lion range countries that are still thought to have lions – Angola, Botswana, Kenya, Malawi, Niger and Nigeria (U.S. Fish and Wildlife Service 2015). While some of these bans are long-standing (e.g. Kenya banned all trophy hunting in 1977), some are recent bans – for example Botswana enforced a ban on all trophy hunting in public areas from the start of 2014 (following a moratorium on lion hunting between 2001 and 2004, and successive restrictions thereafter). Trophy hunting is also banned in Congo, Gabon and Mauritania, where the lion is regionally extinct, in Ghana where they are possibly extinct, and in Rwanda where a small number of lions were reintroduced in 2015[6] (U.S. Fish and Wildlife Service 2015; Bauer et al. 2016).

The US Fish and Wildlife Service found that as of May 2014, 18 African countries in Africa legally permitted lion hunting: Benin, Burkina Faso, Central African Republic, Democratic Republic of the Congo, Ethiopia, Côte d'Ivoire, Mali, Mozambique, Namibia, Senegal, Somalia, South Africa, Sudan, Tanzania, Togo, Uganda, Zambia and Zimbabwe (U.S. Fish and Wildlife Service 2015). However, lions are thought to be extinct in three of those countries (Côte d'Ivoire, Mali and Togo), and in Ethiopia and Uganda, trophy hunting is restricted to problem or dangerous animals (U.S. Fish and Wildlife Service 2015), with some similar restrictions in places in Namibia. However, they also found that as of 2013, lion trophy hunting was only documented to occur in eight countries, namely Benin, Burkina Faso, Central African Republic, Mozambique, Namibia, Senegal, Somalia, South Africa, Tanzania and Zimbabwe – Zambia imposed a moratorium on the trophy hunting of big cats in 2013, but lifted it for the 2015/16 hunting season for leopards, and announced the lifting of the ban on lions for the following year (U.S. Fish and Wildlife Service 2015). Swaziland has no legal protection for lions (similar to Guinea Bissau, where lions are possibly extinct, and Burundi and Lesotho where they are regionally extinct) (U.S. Fish and Wildlife Service 2015; Bauer et al. 2016). There have

[6] *Rwanda is amongst the 7 countries we cite on a list of those from which lions have probably become recently extinct according to the IUCN Redlist. This situation may be retrieved by the 2015 reintroduction.*

also been some restrictions on lion hunting within countries – for example, Zimbabwe imposed a regional moratorium on lion hunting between 2004 and 2008 (Loveridge et al. 2010).

As with any other form of wildlife management, permitted trophy hunting activities are legislated by the relevant national government and wildlife authorities, and the specifics of that legislation (as well as how well it is enforced) vary considerably. In some countries (most notably South Africa) lions can be shot within very small enclosures, a practice known as 'canned', 'captive' or 'put-and-take' hunting. As long as the landowner complies with the relevant national and provincial legislation regarding minimum standards for fencing and enclosure sizes, it is legal to breed lions and hunt them within those small fenced areas (although trophies from these captive lions from South Africa can no longer be imported into the US as a result of the October 2016 evaluation by the USFWS). Most lion hunting in South Africa is from captive animals: Lindsey et al. (2012a) reported that South African hunting operators estimated that only 0.9% – 1.1% of lions hunted in 2009 and 2010 were wild. The CITES Scientific Authority for South Africa have given a slightly higher estimate, with wild lions accounting for 5% of total successful lion hunts, but the vast majority of hunting in South Africa is clearly from captive animals (Williams et al. 2015). There is widespread opposition to the practice of canned or captive hunting on ethical and animal welfare grounds (IUCN 2016) and it has been condemned by the IUCN, which states: "*Canned hunting...raises very different issues from trophy hunting of free-ranging animals, and is condemned by existing IUCN policy*" (IUCN Recommendation 3.093, 'Application of the IUCN Sustainable Use Policy to sustainable consumptive use of wildlife and recreational hunting in southern Africa', 2004; IUCN 2016).

Table 1: *Summary of the historic extent of trophy hunting practice across Africa, including information on the recent export of trophies from that country. The current lion conservation status for each country is summarised as per Bauer et al. (2015). The relative scales as a proportion of 1 for both general trophy hunting and lion hunting are provided for the decade 2006 and 2015. Data were extracted from the CITES database* (http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12]) *for the years 1975 to 2015 and for the purpose of* 'H – Hunting trophy'. *The data were then subset by* 'W' *(wild) source and term* 'trophies'. *As there may be a lag in exporting trophies and updating the records, the* 'Recently exported' *columns consider data from 2014 to 2015.*

Country	Historically hunt *Trophies*	Recent export *Trophies*	Relative scale *Trophies*	Lion status	Historically hunt *Lions*	Recent export *Lions*	Relative scale *Lions*
Algeria	no	no	-	Extinct	no	no	-
Angola	no	no	-	EXTANT	no	no	-
Benin	YES	YES	0.002	EXTANT	YES	YES	0.004
* Botswana	YES	YES	0.044	EXTANT	YES	no	0.025
Burkina Faso	YES	YES	0.007	EXTANT	YES	YES	0.050
Burundi	no	no	-	Extinct	no	no	-
Cameroon	YES	YES	0.028	EXTANT	YES	YES	0.026
Cape Verde	no	no	-	absent	no	no	-
Central African Republic	YES	YES	0.010	EXTANT	YES	no	0.007
Chad	YES	no	0.001	EXTANT	YES	no	0.001
Comoros	no	no	-	absent	no	no	-
Congo	YES	YES	0.000	Extinct	no	no	-
Congo	YES	no	0.000	EXTANT	YES	no	0.000
Cote D'ivoire	YES	no	0.000	*Unsure*	no	no	-
Djibouti	no	no	-	Extinct	no	no	-
Egypt	no	no	-	Extinct	no	no	-
Equatorial Guinea	no	no	-	absent	no	no	-
Eritrea	no	no	-	Extinct	no	no	-
Ethiopia	YES	YES	0.004	EXTANT	YES	YES	0.001
Gabon	YES	no	0.000	Extinct	YES	no	0.000
Gambia	no	no	-	Extinct	no	no	-
Ghana	YES	no	0.000	*Unsure*	no	no	-
Guinea	YES	no	0.000	*Unsure*	no	no	-
Guinea-bissau	no	no	-	*Unsure*	no	no	-
Kenya	no	no	-	EXTANT	no	no	-
Lesotho	YES	no	0.000	Extinct	no	no	-
Liberia	YES	no	0.000	absent	no	no	-
Libya	no	no	-	Extinct	no	no	-
Madagascar	YES	no	0.000	absent	no	no	-
Malawi	YES	no	0.000	EXTANT	no	no	-
Mali	YES	no	0.000	*Unsure*	no	no	-
Mauritania	no	no	-	Extinct	no	no	-
Mauritius	YES	YES	0.000	absent	no	no	-
Mayotte	no	no	-	absent	no	no	-
Morocco	YES	no	0.000	Extinct	no	no	-
Mozambique	YES	YES	0.035	EXTANT	YES	YES	0.040
Namibia	YES	YES	0.186	EXTANT	YES	YES	0.024
Niger	YES	YES	0.000	EXTANT	no	no	-
Nigeria	YES	no	0.000	EXTANT	no	no	-
Reunion	no	no	-	absent	no	no	-
Rwanda	no	no	-	*Unsure*	no	no	-
Sao Tome And Principe	no	no	-	absent	no	no	-
Senegal	YES	no	0.000	EXTANT	YES	no	0.000
Sierra Leone	no	no	-	Extinct	no	no	-
Somalia	no	no	-	EXTANT	no	no	-
South Africa	YES	YES	0.436	EXTANT	YES	YES	0.269
South Sudan	no	no	-	EXTANT	no	no	-
Sudan	YES	no	0.001	EXTANT	no	no	-
Swaziland	YES	no	0.000	EXTANT	no	no	-
Tanzania	YES	YES	0.118	EXTANT	YES	YES	0.424
Togo	YES	no	0.000	*Unsure*	YES	no	0.000
Tunisia	no	no	-	Extinct	no	no	-
Uganda	YES	YES	0.000	EXTANT	no	no	-
Western Sahara	no	no	-	Extinct	no	no	-
§ Zambia	YES	YES	0.060	EXTANT	YES	no	0.079
Zimbabwe	YES	YES	0.069	EXTANT	YES	YES	0.047

** Botswana banned lion trophy hunting in 2008, and all trophy hunting in public arenas in 2014.*

§ Zambia implemented a lion and leopard hunting moratorium in 2013, which was reversed in 2015 for leopards and 2016 for lions.

Across Africa, there is also a bias towards hunting captive lions rather than wild ones[7]: CITES export records document more than twice as many captive lion trophies as wild ones, with a ratio of 2.35 to 1 (5,715 'captive' versus 2,429 'wild'), although the importers record a slightly different ratio, of 1.89 captive trophies for every wild one (4,474 'captive' versus 2,367 'wild').

In South Africa at least, captive lions are bred for the purpose of supplying the demand for lion trophies, with this industry regulated by the Department of Environmental Affairs (DEA) and the Department of Agriculture, Forestry and Fisheries (DAFF)[8]; however these lions are generally neither considered as wild or contributing to lion conservation[9].

The African Lion Working Group (ALWG) in 2016 stated that "*the sport hunting of lions that are captive bred and reared expressly for sport hunting, and/or sport hunting of lions that occur in fenced enclosures and are not self-sustaining, does not provide any demonstrated positive benefit to wild lion conservation efforts and, therefore, cannot be claimed to be conservation... The estimated 8,000 lions in South Africa currently being maintained and bred on game farms as part of this industry should not be included in any assessments of the current status of wild lions.*"

As this report is focused on wild lion conservation, canned or captive hunting does not fall within its remit, and will therefore not be considered further, except insofar as it might indirectly affect lion conservation.

1.2.3 Ethical acceptability of lion trophy hunting

There has been more than a century of concern over the ethics of hunting (e.g. fox hunting in the UK: Burns Inquiry 2002; Macdonald and Johnson 2015a), against which background the killing of Cecil the lion triggered widespread outrage over the perceived ethical unacceptability of trophy hunting (Macdonald et al. 2016a). The motivation for that outrage varied, but tended to centre around the unacceptability of killing an animal purely for sport, particularly when that animal is a threatened species.

However, views regarding trophy hunting (and indeed the killing of animals in general) vary markedly across

[7] *Similar systems of put-and-take hunting are familiar in the West, for example, in the UK the shooting of reared game birds or angling in stocked trout lakes*

[8] https://www.environment.gov.za/sites/default/files/docs/lionmanagementinSA_questions_answers2015

[9] http://www.repository.up.ac.za/dspace/bitstream/handle/2263/19272/Lindsey_Possible(2012).pdf

the world (Macdonald et al. 2016b). In many African communities, the killing of a lion is often something to be celebrated (Hazzah et al. 2009; Dickman 2015), and there is a commonly-held view that it was unethical for foreigners to care so much about the killing of one lion (or indeed lions in general), particularly when lions themselves kill people and endanger their livelihoods (Nzou 2015). It was also noted that much of the demand for banning trophy hunting in Africa came from the United States, which has one of the largest domestic trophy hunting markets in the world (Sharp and Wollscheid 2009). The ethical debates around trophy hunting are important and merit consideration (Macdonald et al. 2016b), but they are beyond the scope of this report, which is focused specifically on the role of trophy hunting with regard to conservation. Conservation action does not of course take place in an ethical vacuum – Vucetich and Nelson (2012) provide an accessible account of applied conservation ethics. An exploration of the specific issues raised by trophy hunting is provided in Appendix A. Some people find any form of lion hunting morally unjustifiable, regardless of the sustainability question, particularly if it is done in ways that involve animal suffering. This report focuses on conservation. But welfare and other ethical issues (which dominated the much of the public discourse following Cecil's death) are inextricably part of the process that shapes conservation policy.

1.2.4 Extent of lion trophy hunting and its markets

It is surprisingly hard to determine exactly how many lions are trophy hunted across Africa each year, because the CITES database (which records imports and exports of such trophies) records the number of trophies (i.e. individual parts moved) and not the number of animals killed. One trophy-hunted lion could result in multiple trophies, for example if the skin, skull and claws were counted separately. This is an issue which is clearly highlighted by CITES itself, which states that "*Because 'specimens' include parts and derivatives, the numbers of specimens do not reflect numbers of individual animals*" (CITES 2014). In addition, the records of exported trophies often do not match the number imported, partly because of delays in the system and partly because of inconsistencies in the ways different countries record their data. Despite this, many reports publish the number of trophies as if it was the number of lions hunted, which is misleading. Bearing in mind these caveats, the CITES database gives an overall idea of trends and comparative numbers, and a summary of the number of wild-sourced lion trophies

(using data from the CITES database, http://trade.cites.org/) is given in Table 2, with more information on the international extent of trade in lion trophies by country is given in Appendix B.

Table 2: *Summary of the total number of wild-sourced lion trophies (not necessarily the number of lions) recorded as exported or imported by CITES.*

Country	Reported exports *Lion trophies*	Reported imports *Lion trophies*	Total destinations *Lions*
Benin	25	18	6
Botswana	168	151	20
Burkina Faso	333	78	12
Cameroon	176	78	15
Central African Republic	48	49	12
Chad	10	6	2
Congo, Democratic Republic Of	0	1	1
Ethiopia	10	13	3
Gabon	2	0	1
Mozambique	268	197	19
Namibia	163	168	28
Senegal	3	0	2
South Africa	1801	3572	69
Tanzania, United Republic Of	2842	2305	49
Togo	1	0	1
Zambia	530	562	33
Zimbabwe	317	1117	34
Total	**6697**	**8315**	-

The UK was recorded as having 80 wild lion trophies exported to it (from 9 source countries) during the 22 years from 1991–2013, with the importation records showing 4 trophies[10]. Figure 1 provides an overview of the movements of lion trophy across the globe, and highlights the significance of the US and European markets for such trophies.

1.2.5 Reason for the UK Government examining this issue now

Wildlife conservation has been a concern in Britain for centuries, and remains a strong interest of the UK public (Sutherland 2008).

[10] *These numbers have to be interpreted bearing in mind the problems of inferring number of lions from number of trophies.*



Figure 1: *Overview of international movements in lion trophies, showing source (red) and destination (blue) countries for lion trophies linked by directional arrows. Arrow width indicates the scale of trade from one country to another. Tone of colour per country indicates the relative scale of either export or import relative to all other exporters or importers respectively. ISO2 country codes of exporter and importer countries are indicated on the map. Lion hunting data was obtained from CITES and considered for the decade between 1996 and 2015. The data was subset to include only* 'lion' 'trophies' *from a* 'wild' *source and that were* 'hunted'. (CITES data: http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12])

For the roots of modern conservation some might look to 1066 when King William I set aside forests, such as New Forest, Sherwood and Forest of Dean as royal hunting reserves (others trace the roots of conservation to concerns over UK forests in the 1660s). John Muir, a Scotsman, inspired the movement to preserve wilderness in the USA, including Yosemite National Park. In 1892, he founded the Sierra Club, one of the first organisations devoted to environmental conservation.

The roots of conservation in Europe and the USA are inextricably bound to hunting, initially by protecting wild animals for it and latterly more often protecting them from it. In 1903, British naturalists helped found another pioneering conservation society (the Society for the Preservation of the Wild Fauna of the Empire, which has evolved today into Fauna and Flora International) (Loveridge et al. 2007b). As a group they were known as 'The Penitent Butchers' because all were former sportsmen or trophy hunters who became concerned by the wide-scale decimation of wildlife through unregulated hunting particularly in Africa (Loveridge et al. 2007b). Their aim was to safeguard Africa's large mammals from over-hunting and habitat encroachment. The Society worked with Governments, land-owners and hunters to pass legislation which restricted hunting across large swathes of East and southern Africa, and which ultimately led to the creation of some of Africa's most iconic parks, such as the Serengeti National Park.

In short, hunting and conservation has long been a preoccupation within British society. There has long been a demand to examine and reform trophy hunting, but public awareness of the issue reached a peak in July 2015 over the killing of Cecil the lion (Macdonald et al. 2016a). Much of the reaction to Cecil's killing focused on pressing for bans on trophy hunting, or at least of the carriage and import of trophies to countries such as the USA and the UK. As of August 2016, 32 airlines, including British Airways, have instigated complete bans on carrying trophies. Seven more refuse to carry 'Big Five' trophies, and a further five have implemented specific embargoes, from a ban on CITES Appendix I species by Emirates to a much broader ban on dead/processed/research animals by Turkish Airlines. In total, 44 airlines now refuse to carry lion trophies[11], with pressure on other carriers to do the same[12].

As a measure of feeling (although it floundered), in January 2016 a group of members in the European Parliament

[11] http://www.hsi.org/news/news/2015/08/airlines-shipping-hunting-trophies
[12] http://www.ifaw.org/united-states/news/trophies-back-board-south-african-airways-cans-its-ban
[13] http://www.europarl.europa.eu/sides/getDoc

called for the signing of a declaration restricting trophy imports[13], while the UK Government is actively considering its position on the importation of lion trophies, including asking for this report to be produced to inform its thinking.

As of August 2016, several countries have already banned lion trophy imports, including the Netherlands, France, Australia and Costa Rica. Whilst the USA has refrained from an outright ban, lion trophies had been made illegal in Washington State and New Jersey[14], although in late August 2016, the New Jersey ban was deemed illegal by US authorities[15].

Moreover, in December 2015 the US Fish and Wildlife Service (USFWS) listed the lion in southern and eastern Africa, *Panthera leo melanochaita*, as threatened under the Endangered Species Act (the lion in west, central, northern Africa and India, *P. l. leo*, was listed as endangered). Although this threatened listing comes with an addendum permitting the import of sport-hunted trophies, the conditions under which a permit may be granted are rigorous, perhaps prohibitively so, requiring that exporting countries address concerns over "*evaluating population levels and trends; the biological needs of the species; quotas; management practices; legal protection; local community involvement; and use of hunting fees for conservation*" (Federal Wildlife Service, 2016[16]). This evaluation has now taken place for South Africa[17] (with the conclusion that only trophies from wild or wild-managed lions could be imported to the US); evaluations will follow for other relevant countries.

A proposal (CoP17 Prop 4) for consideration at the 2016 Conference of the Parties (CoP) to CITES was made by nine countries (Chad, Côte d'Ivoire, Gabon, Guinea, Mali, Mauritania, Niger, Nigeria and Togo) for all African populations of *Panthera leo* to be transferred from Appendix II to Appendix I. However, it should be noted that only three of those countries (Chad, Niger and Nigeria) are still thought by the IUCN to have any extant lions (Bauer et al. 2016), and the proposed listing was met with significant opposition by many of the key lion range countries, particularly the southern African lion hunting countries where lion populations are stable.

In fact, the first CITES/CMS (Convention on International Trade in Endangered Species of Wild Fauna and Flora / Convention on the Conservation of Migratory Species of Wild Animals) meeting of all lion range states, which

[14] http://www.nj.com/politics/index.ssf/2016/06/christie_signs_law_banning_trophy_animals_in_nj
[15] http://www.africahunting.com/threads/victory-for-new-jersey-hunters-in-the-anti-trophy-law.30930/
[16] https://www.fws.gov/endangered/what-we-do/pdf/Lion_FL_FAQs_Final.pdf
[17] http://www.huffingtonpost.com/entry/a-major-step-forward-for-lion-conservation-in-africa_us_5808f6ffe4b099c434319294

took place in 2016, highlighted the importance of trophy hunting under certain conditions, stating: "[*We*] *Highlight the benefits that trophy hunting, where it is based on scientifically established quotas, taking into account the social position, age and sex of an animal, have, in some countries, contributed to the conservation of lion populations and highlight the potentially hampering effects that import bans on trophies could have for currently stable lion populations*".

Regarding the 2016 proposal to list lions on CITES Appendix I, the CITES/CMS report states that "*Lion Range States have different views on the inclusion of all African populations of* Panthera leo *in Appendix I, with some arguing that the populations in West and Central Africa are fragmented and highly threatened; and others arguing that the species does not meet the listing criteria and is threatened by factors other than those CITES can address*".

The 2016 CITES CoP (CoP17) eventually decided not to list lions on Appendix I, but did state they would work towards lion conservation in a more active way, including helping to develop and support the implementation of joint lion conservation plans and strategies (CITES 2016). CoP17 did add an amendment which prohibited the export of bones, bone pieces, bone products, claws, skeletons, skulls and teeth from wild lions for commercial purposes, although it remained possible for these parts to be exported from captive-bred lions in South Africa (CITES 2016).

This decision, and the subsequent October 2016 evaluation by the USFWS which banned the import to USA of trophies from 'canned' lions, interact to raise two new questions of relevance to the conservation of wild lions. First, insofar as the majority of farmed lion trophies would hitherto have been imported to the USA, will this prohibition cause a proportion of the American hunters who might formerly have hunted farmed lions to turn to wild lions, thereby affecting the demand on the wild sector? Second, and considering the report by Williams et al. (2015) on the export from South Africa of farmed lion products aside from trophies, with the loss of their income from trophies destined for America, will the farmers flood the market with lion body parts with the possible result, through predatory pricing, of increasing the subsequent demand?

In terms of lion conservation, banning the importation of trophies to the UK would have little significant direct effect because the numbers of lions involved are so few (<4 lions yr^{-1} between 1991 and 2013 exported from Africa to Britain; CITES data; see Section 1.2.4). However, the cascading indirect effects of UK policy are difficult to predict and possibly wide-reaching. The UK may have impact beyond its borders through the influence of the evidence it is able to present (e.g. this report) and through ad-

vocating for greater alignment of North American and European positions.

Even if the UK doesn't change policy, the status quo will not be maintained, as international policy developments will bring about change. For example, it has been proposed that lions should be uplisted to CITES Appendix I, most recently in 2016 and previously by Kenya to the CoP in 2004 (although that was subsequently withdrawn) – such uplisting has not been passed but similar proposals could be submitted again in the future. It is very likely that any such listing would lead to increased regulation and/or limitation of trophy exports to all Parties, including the UK. Although strictly tangential to the issue of trophy hunting, the UK's influence on the classification of lions under CITES is likely to be influenced by lobbying motivated by opposition to hunting. Listing lions on CITES Appendix I would prevent commercial trade in wild specimens but hunting trophies are currently considered personal effects. It is not necessary to have specific Resolutions (cf black rhinos and leopards) to permit future trade.

Although the CITES uplisting has not passed to date, there has been a significant recent change in international policy regarding lions, when in 2015 the US listed them as Endangered in West and Central Africa and as Threatened in East and southern Africa on the annexes of the Endangered Species Act. As a consequence, imports of lion trophies into the large and lucrative American market are no longer allowed from West and Central Africa, and the industry in other regions is forced to demonstrate that trophy hunting is of net benefit to lion conservation. Many trophy hunting areas are now setting up monitoring systems to be able to demonstrate net positive effect in order to maintain access to the US market, and the US is currently considering whether those areas do provide enhancements for the species. The USFWS announced their first finding, for South Africa, in October 2016, stating that it would not permit the importation of trophies from captive-bred lions as they did not meet the criteria for conservation enhancement, but would permit the import of trophies from wild and wild-managed lions on a case-by-case basis[18]. Some possible consequences for wild lions of this prohibition on the import to the USA of farmed lion trophies are mentioned above.

In another policy development, many Parties to the Convention on Migratory Species are arguing that the lion should be listed under that Convention[19] – the implications would depend on which Appendix they were added to, but this

[18] http://www.huffingtonpost.com/entry/a-major-step-forward-for-lion-conservation-in-africa_us_5808f6ffe4b099c434319294

[19] https://cites.org/eng/news/sg/Lion_Range_State_Meeting_Joint_statement_by_CITES_CMS_300516

could facilitate management of transboundary lion populations. The UK plays an active role in these international developments, but that doesn't preclude further domestic policy development.

Given the intensity of global interest in this subject, and the wide range of views and stakeholders involved, the UK government has recognised the need for comprehensive and impartial advice on how possible trophy hunting might affect lion conservation, as well as how the UK Government can best support lion conservation in a wider context.

1.3 Summary of reasons for examining trophy hunting with regard to lion conservation

Lions are one of the world's most iconic species, and are under increasing threat. The degree to which trophy hunting plays either a negative or positive role in lion conservation is hotly debated and will be covered in more detail below, but it is clear that there is a long history of polarised views over trophy hunting. Recently – and particularly notably since the killing of Cecil the lion – a large section of the global public appears to have concluded that lion trophy hunting in particular, is unethical. However, this contrasts strikingly with the views of many people in the African countries where lions occur, and it is important to consider how any actions taken by the UK and its partners would affect those range countries with regard to wild lion conservation.

2. Threats and impacts associated with lion trophy hunting

2.1 The significance of trophy hunting as a threat to lions

2.1.1 Significance of trophy hunting as a threat to lions at a population scale

Trophy hunting can have marked impacts at a population scale, particularly when harvest rates are high (Loveridge et al. 2007a; Caro et al. 2009; Creel et al. 2016). Trophy hunting tends to be particularly negative when it is additive to other threats – and the magnitude of those other threats also depends strongly on how well the hunting area is managed. For example, lion populations are declining across the Benoue complex in Cameroon, thought to be due to a combination of high poaching pressure and excessively high lion trophy off-takes (Croes et al. 2011). However, there are strong underlying pressures in Cameroon – large mammal populations have declined steeply since the 1970s due to habitat destruction and poaching, and are particularly precarious due to the small size and fragmentation of protected areas, as well as poor management of those areas (Croes et al. 2011). Modelling by Creel et al. (2016) suggested that in the presence of additional (and stable) threats such as human encroachment, poaching and prey depletion, the addition of any hunting produced some degree of population decline and an increased probability of local extirpation, although conservative limits on hunting (see Section 3.2), resulted in situations with relatively stable dynamics and low probability of extirpation over a 25 year period.

In some populations, hunting alone explains lion declines – Packer et al. (2009) found that within Tanzania's Selous Game Reserve (the largest lion trophy hunting landscape in the world), the hunting blocks with the highest lion offtakes per 1,000 km^2 had the steepest declines in lion populations, unrelated to the impact of habitat loss. In western Zimbabwe lion populations rebounded by 50% when lion hunting was suspended, suggesting that previously high quotas were a cause of population decline (Loveridge et al. 2010; Loveridge et al. 2016). In Zambia, trophy hunting was the major factor behind declining lion populations (Rosenblatt et al. 2014). Poorly calculated and/or enforced quotas are thus perilous for lion populations (Caro et al. 2009; Packer 2015). The severity of impacts at a population level depends upon both the number and de-

mography of the animals removed, and this is covered in more detail below (see Section 3.2).

2.1.1.1 Negative population effects associated with the removal of females

Currently, only male lions are now hunted in most countries, but females were hunted in Zimbabwe until 2004 (Packer et al. 2006) and are still hunted in Namibia (Lindsey et al. 2013), as well as South Africa[20] (although many of those lionesses are in canned hunting operations). The number of females in a pride has a strong effect on per capita reproductive success, with the lowest cub production in prides with fewer females (Packer et al. 1988).

Larger prides have greater survival of all cub age-classes, benefitting from collective defence and possibly from synchronous breeding and communal nursing (Packer et al. 2001; Loveridge et al. 2010). Therefore, the removal of adult females is particularly damaging to populations of lions and other long-lived species.

2.1.1.2 Negative population effects associated with the removal of pride males

Loss of male lions from a pride facilitates pride takeover by other males, and infanticide of dependent cubs (Loveridge et al. 2007a; Loveridge et al. 2010). Rapid turnover of males also results in premature eviction and subsequent death of sub-adults (Elliot et al. 2014). The difference in male turnover between hunting/non-hunting periods was evident from cub survival rate, with only 66% of cubs surviving to 1 year of age during the trophy hunting period, which increased to 80% in the absence of hunting (Loveridge et al. 2010). Similarly, cubs in protected core areas experienced >40% greater survival than did cubs in edge prides, presumed as a result of reduced male turnover (Loveridge et al. 2010).

Moreover, the consequences for hunted populations are not limited to those individuals on hunting concessions: there can be knock-on effects even across core protected areas, as a result of the vacation of territories. In Hwange, removal of territorial males from the adjoining hunting zone resulted in a 'vacuum effect' where the availability of territory and lack of competition drew individuals from the safe area into hunting zones (Loveridge et al. 2010). Thus, removal of males within hunting areas adjacent to protected areas can have pervasive effects at a population scale when hunting offtake is high (Whitman et al. 2004; Loveridge et al. 2007a; Loveridge et al.

[20] https://www.discountafricanhunts.com/hunts/south-africa-spot-stalk-lioness-hunting-safari.html

2010). That excessive levels of trophy hunting can negatively impact lion populations is illustrated by Hwange National Park. Sport hunting of lions over the period 1999–2004 greatly reduced the number of males in the population, resulting in sex ratios heavily skewed towards females. However male densities and sex ratios recovered quickly once trophy hunting levels were reduced (Barthold et al. 2016a; 2016b; Loveridge et al. 2016a). Similarly, the number of male coalitions across the population was lower and the average coalition size smaller than in the absence of hunting (Loveridge et al. 2010). The number of adult females also increased when hunting was absent or light, probably as a response to increased adult and cub survival (Loveridge et al. 2016b). In the absence of hunting, there was an average reduction in male lion territory size of 421 km^2 in Hwange, which was probably due to a resultant increase in lion density from the lack of harvest offtake (Davidson et al. 2011).

Trophy hunting was the primary cause of death in Zambia's South Luangwa landscape between 2008 and 2012, with 46 males harvested (Rosenblatt et al. 2014). This was linked to a declining population, low recruitment, low survival of sub-adult and adult males, depletion of adult males and an ageing population of adult females (Rosenblatt et al. 2014). Similarly, Loveridge et al. 2016b show that trophy hunting areas form 'attractive sinks' for male lions, in that they represent areas with intact habitat and available prey and thus attractive to lions. The risk of mortality in these areas is however very high with few cues available to the lions to facilitate avoidance.

These strong negative impacts associated with the removal of pride males forms the biological basis for stipulating a minimum age limit where only older (and ideally post-reproductive) males can be hunted, as this should theoretically limit these 'cascading effects' of pride male removal. The principle behind restricting trophies to older males is that their tenure in the pride should have overseen the raising of at least one generation of cubs to adulthood. Following early models setting the minimum age at 5 years or older (Whitman et al. 2004), age limits set within countries have traditionally been set at $\geqslant$6 years. However, more recent modelling (Creel et al. 2016) has suggested that it would be prudent to raise this to $\geqslant$7 years (see Section 3.2 for more detail), while Packer et al. (2006) suggest that because the '6-year rule' was developed in Tanzania and male lions seem to mature later in southern Africa, it might be prudent to use a 7 year minimum in southern Africa. Nonetheless, it has been evident that in some populations, e.g. in Hwange National Park, almost all trophy males, even very old ones such as Cecil, were reproductively active in a pride when hunted. Old males evicted from prides in Hwange National Park rarely survive long enough to be hunted,

and even elderly males in prides seem to be reproductive, meaning that their deaths are followed by perturbation in the same way as those of younger pride males.

2.1.1.3 Threat to lion populations of trophy hunting relative to other threats

It is important to view trophy hunting within the context of all threats facing lion populations. Trophy hunting is usually only one of several threats facing lions, and the relative magnitude of those threats varies between sites. In South Luangwa, Zambia, trophy hunting was indeed the major threat at the population scale – although snaring was a significant concern, 87% of known snared lions were immobilised and successfully treated for their injuries, so this had little impact on lion dynamics (Rosenblatt et al. 2014). The snaring of prey is likely to contribute to the declining lion population as well, but the magnitude of this threat had not been quantified, and trophy hunting was the only obvious cause of the severe male depletion seen in the population (Rosenblatt et al. 2014).

In western Zimbabwe, trophy hunting was the primary source of recorded mortality for adult lions (mostly males), followed by snaring bycatch and retaliatory killing. Natural annual mortality rates were only 0.11 for males and 0.30 for females, compared with trophy hunting mortality rates of 0.65 and 0.30 for males and females respectively, which underlines the profound effect that anthropogenic factors can have on population dynamics (Loveridge et al. 2016b). In Tanzania's Selous Game Reserve, trophy hunting is thought to also pose one of the largest threats to lions (Creel and Creel 1997), but this is Africa's largest protected area, where other anthropogenic threats are likely to be relatively small.

In some other populations, trophy hunting is an additional (and often important) factor but not the major reason for any lion decline. In Tanzania's Ruaha landscape, another major trophy hunting landscape, there is an extremely high level of lion killing to protect livestock or to fulfil cultural roles (Dickman 2015), and it is likely that the impact of trophy hunting is dwarfed by these other threats. In that landscape, 37 lions were documented as killed through conflict with pastoralists in an area of less than 500 km^2 in one year – which equates to over 100 times the recommended maximum offtake if that was a hunting area (Dickman pers. comm.). That level of lion killing across just a few rural villages (which is likely to be an underestimate of the real level of killing), exceeds the number of lions imported as trophies into the US (the major importer) in 2013 from Botswana, Mozambique, Namibia, Zambia and Tanzania combined (U.S. Fish and Wildlife Service 2015). Similarly, in the Niassa National Reserve, 12 lions

were trophy hunted in 2014–15, while at least 42 lions were killed by local people. Across Africa, the number of lions killed illegally has been estimated as perhaps 5 times as many as those killed by trophy hunters, with the level of illegal killing being up to 10 times higher in some populations (Panthera et al. 2016).

We are not aware of any documented case of trophy hunting being the primary driver of lion population extirpation – Tanzania's Katavi National Park is one case where lions have apparently been extirpated, according to the latest IUCN listing (Bauer et al. 2016) and anthropogenic mortality is a likely driver of that decline, but that includes both unsustainable trophy hunting and traditional killing (Kiffner et al. 2009).

However, it should be noted that there is considerable debate about whether lions have truly been extirpated from Katavi – in communication with the EU CITES Scientific Authorities, Tanzanian authorities maintain that "*there are substantial numbers of lions remaining in Katavi ecosystem and a significant proportion of prime age males are still present, suggesting a balanced age pyramid and population structure (despite trophy hunting in the area)*" (Sigsworth pers. comm.).

2.1.2 Significance of trophy hunting as a threat to lions at a national scale

There are several guidelines for the percentage of a hunted lion population that can be sustainably harvested. Creel and Creel (1997) and Greene and Mangel (1998) suggest sustainable offtakes of 5% and 10% of adult males respectively. Caro et al. (2009) recommend harvests of 5% of total population, which if only males are hunted (as is the norm) would result in a higher proportion of males in the population being hunted than Creel and Creel (1997) or Greene and Mangel (1998) recommend. But few lion populations are adequately surveyed at the population level, so using a percentage harvest to determine sustainable offtakes is generally unworkable. If the above guidelines are accepted then at the current scale, trophy hunting offtake in most of the countries where it currently occurs is relatively conservative with no more that 2–4% of lions hunted annually (Loveridge et al. 2009)[21].

However, in the past, offtakes have often been considerably higher (e.g. in Zambia, offtakes occasionally reached 8–9% of the population per year, while in Zimbabwe historically offtakes reached 20–30% (Packer et al. 2006). Although, in a review for the Eastern and Southern

[21] *Given that there is a large degree of uncertainty surrounding lion population size and status across much of the species range these figures should be treated with some caution. The utility of defining sustainable offtakes as a percentage of a population is limited when population sizes is unknown.*

African regional lion plan, Packer and colleagues concluded that "*quota sizes have probably been too small in almost every country to contribute to any decline in lion numbers in the past 20–30 yrs...[with] one exceptional country, Zimbabwe, there is some evidence that trophy hunting can have a significant effect at a national scale, as over the past 25 years the steepest declines in lion harvests occurred in countries with the highest hunting intensities*" (Packer et al. 2009).

Next, we examine the potential significance of trophy hunting as a threat to lions in the six most significant countries for lion conservation (including Botswana as the ban is very recent, and excluding South Africa as the vast majority of its hunting involves captive lions).

2.1.2.1 Significance of trophy hunting as a threat to lions in Botswana

Our latest data suggest that Botswana holds approximately 2,800 free-ranging lions[22] in an estimated lion range of 237,000 km^2 (Dickman in prep.). The latest Red List assessments compiled data from three populations in Botswana (none of which were hunting areas), and found they had undergone an overall decline of 26% between 1993 and 2014, although this was heavily biased by the 46% decline in the Okavango, while Kwando/Chobe had an increase of 84% and Magkadikgadi had an increase of 121% (Bauer et al. 2016). Di Minin et al. (2016) estimated that 37.2% of the country was in terrestrial protected areas, while 23.0% was in hunting areas, although Botswana has banned all lion trophy hunting since 2008 and all trophy hunting in public areas since 2014. Botswana does not have a national action plan for the lion, but did adopt a 6-year minimum for trophy males in March 2005. Botswana has imposed various temporary bans on trophy hunting – after the ban of 2001–2004 there was an expectation of high quality trophy lions, which pushed the price per lion hunt from US$25,000–US$30,000 pre-ban, to US$85,000–US$115,000, and meant that the country was able to generate more income with half the quota (Winterbach pers. comm.). Before the most recent cessation of lion trophy hunting the country had an annual quota of 30 lions, of which 13–18 trophies were exported (Winterbach et al. in prep.). Due to this low offtake, lion trophy hunting in the recent past may have been sustainable in Botswana.

2.1.2.2 Significance of trophy hunting as a threat to lions in Mozambique

[22] *Defined, for this and all countries in this section, as lions which are either completely free-ranging, in areas of at least 500 km^2 if the population is partially fenced, or in areas of at least 1,000 km^2 if the population is partially fenced.*

Our latest data suggest that Mozambique holds approximately 1,500 free-ranging lions in an estimated lion range of 247,000 km^2 (Dickman in prep.). Di Minin et al. (2016) estimates that 17.6% of the country is in protected areas, while 10.5% is covered by hunting areas. Lions have declined substantially across Mozambique (with some areas, such as the Niassa National Reserve, apparently showing population increases; Bauer et al. 2016), and the key causes for the reduction in lion distribution and are thought to be declining prey numbers and conflict with livestock-rearing pastoralists (Fusari et al. 2010). The IUCN Red List obtained population trend data from only one population (Niassa National Reserve, where hunting occurs), which showed a 246% increase between 1993 and 2014 (Bauer et al. 2016). Although Niassa might not be representative of the whole country, as it has had relatively high conservation investment, it does hold perhaps two-thirds of Mozambique's lions (Dickman et al. in prep.), so this trend is significant for the country's overall population.

The lion trophy hunting quotas in Mozambique have been criticised as being too high, as well as being issued without any scientific basis (Fusari et al. 2010). The annual quota was 50 animals in 2007, 111 in 2008 and 60 in 2009 (Fusari et al. 2010), but the actual offtake appears to be significantly lower than that. Many wildlife areas have been depleted in Mozambique, due to factors including government culling of wildlife (including lions) during the 1960s and 1970s, and extensive poaching for meat during and after the civil war (Fusari et al. 2010). Due to this wildlife depletion, most hunting areas currently generate negative returns on investment, with hunting operators investing in unprofitable concessions on the assumption that wildlife populations will recover. Age-based export regulations have now been developed and enforced in Niassa National Reserve, with a 6-year minimum implemented in September 2006, limiting the negative impacts of trophy hunting (and leading the EU to conclude a positive opinion for lion trophies from Niassa only rather than the whole of Mozambique; Sigsworth pers. comm.). The small number of lions trophy hunted per year in Mozambique relative to its population size suggests that trophy hunting unlikely to have a significant negative impact at a national scale, with bushmeat pressure, growing human populations and pastoralist-lion conflict more significant threats.

2.1.2.3 Significance of trophy hunting as a threat to lions in Namibia

The 2008 draft Namibian national lion conservation strategy suggested that, based on data collected within the two previous years, Namibia had fewer than 1,000 lions, including between 615 and

799 free-ranging lions (as termed in the report) and an additional 100 to 125 animals on private land (MET 2008). Our latest data suggest that Namibia holds approximately 750 free-ranging lions in an estimated lion range of 170,000 km^2 (Dickman in prep.).

The draft national lion conservation strategy states that lions are subject to extreme human pressure, with nearly 900 lions destroyed over the past 20 years, mainly due to conflict with livestock keepers (MET 2008). Di Minin et al. (2016) estimated that 43.2% of Namibia was covered by protected areas, with 11.4% covered by game ranches. As well as state protected areas and private game ranches, by the end of 2014, Namibia had 82 communal conservancies (including 36 in Kunene region, mentioned below), which covered over 17% of the country and encompassed 184,000 people, around 8% of the national population and around one in four rural Namibians (NACSO 2011, 2015). Sustainable use of wildlife (including trophy hunting), with devolved power and benefits to local communities, are a cornerstone of the conservancies – about half the conservancies benefit solely from hunting, and the revenues from trophy hunting totalled US$1.6 million in 2013 (NACSO 2015). This community-based conservation model is thought to be one of the key factors behind Namibia's expanding population of free-roaming lions (NACSO 2011, 2015). The latest Red List assessment of Namibian lion populations, based on three areas (one of which had hunting) showed an overall increase of 41% between 1993 and 2014. However, this was strongly influenced by the huge increase in lions in Kunene (the area where trophy hunting occurred), which had an increase of 3,933%, going from an estimated 6 lions in 1993 to 242 lions in 2014 (Bauer et al. 2016).

At least as of 2008, Namibia had no annual national-level lion quota. Trophy hunting permits are allocated to kill problem lions (males only) on conservancy land. 38 lions were hunted this way between 1998 and 2008, with an average offtake of less than 4 a year. In addition, trophy hunting is permitted on free-roaming lion populations in hunting concessions, which may be conservancies or protected areas (excluding Etosha National Park) (MET 2008). Most lions shot as trophies in Namibia are from hunting concessions, mostly in the Kunene and Caprivi regions (MET 2008).

The draft national lion conservation strategy revealed that some illegal trophy hunting was occurring along the southern boundary of Etosha National Park, making the allocation of quotas and maintenance of trust with landowners very difficult (MET 2008). The draft national lion conservation strategy set out some key activities for improving trophy hunting in Namibia, specifically that efforts should be made to:

- Develop and implement an approved

quota setting methodology rigorously and consistently across all hunting areas

- Review and analyse annual quotas and offtakes to ensure these are adaptive and responsive to population changes, trophy quality and levels of PAC over time
- Allocate quotas at a scale reflective of lion ecological and biological functionality which invariably acts across different and/or smaller land units or uses
- Develop and implement standardised hunt return forms and trophy hunting databases and review annually thereafter
- Ensure centralised database and cost-effective system for data collection from hunting areas and subsequent collation, entry, analysis, reporting and feedback to key stakeholders in the wildlife industry (MET, NAPHA, NAU, NNFU, Conservancies, conservation NGOs and researchers etc. as appropriate)
- Provide training to MET, Conservancy and NAPHA personnel and other relevant field staff in the approved quota setting methodology
- Review trophy fees to maximise benefit and generate additional revenue

Overall, trophy hunting does not seem to pose a threat to lions in Namibia, and is in fact (particularly in the conservancy areas) thought to be one of the reasons why Namibia's lion population has increased over recent years (NACSO 2011, 2015). However, Namibia is an unusual case in having relatively good governance and very low human population density, so it is unlikely that the successes seen here could easily be replicated across many other African countries. More generally, governance and infra-structural capacity, of which corruption is a factor, are relevant to the delivery of felid conservation as documented by (Dickman et al. 2015), and governance has been highlighted as a key issue with regard to the sustainability or otherwise of trophy hunting operations (Packer 2015).

2.1.2.4 Significance of trophy hunting as a threat to lions in Tanzania

Our latest data suggest that Tanzania holds approximately 9,900 free-ranging lions in an estimated lion range of 380,000 km^2 (Dickman in prep.). Tanzania has around 32.2% of its land covered by protected areas, and 26.4% in game reserves (Di Minin et al. 2016). Tanzania contains about half of the continent's remaining lion population (Riggio et al. 2013), but the IUCN found significant declines, based on an analysis of five populations, one of which had trophy hunting (Bauer et al. 2016). There was

an overall decline of 66% in the lion populations between 1993 and 2014 – only one population (the Serengeti) increased, while the population with trophy hunting (Katavi) was apparently extirpated during that period, according to the IUCN data (Bauer et al. 2016; although this is disputed – see Section 2.1.1.3).

Tanzania has long hosted the largest lion trophy hunting industry, with 100–300 lions hunted per annum (Packer et al. 2010). The Selous Game Reserve is the largest uninhabited protected area in Africa (55,000 km^2) and is a premier destination for lion trophy hunters. Lions are considered to be declining in a significant proportion of Tanzanian hunting areas, with trophy hunting considered to be the primary driver of this decline outside (and inside some) protected areas (Packer et al. 2011). Lion harvests declined by 50% across Tanzania between 1996 and 2008, and hunting areas with the highest initial harvests suffered the steepest declines; the intensity of trophy hunting was the only significant factor in a statistical analysis of lion harvest trends (Packer et al. 2009).

Tanzania introduced a 6-year age minimum for lion trophies in 2012 (based on the recommendations of Whitman et al. 2004); lion offtakes have further declined in the past few years, with only 40 lions exported in 2014; it is not clear if this recent drop has resulted from hunting clients restricting their offtakes to lions aged 6yrs or older or from a continuation of the trend reported by Packer et al. (2009). Leader-Williams et al. (2009) and Packer (2015) note that Tanzania has a poor record of hunting governance, and the recent scandal over Green Mile Safaris (whose clients posted evidence of multiple trophy hunting and animal welfare infractions online, but who nevertheless were apparently permitted to continue hunting in Tanzania[23]) is one clear example of very poor management of the country's trophy hunting industry. Similarly, a recent report from East Africa has raised concerns that corrupt officials in Tanzania and Kenya in particular, have been compromised through bribes to allow the killings of wildlife and the illegal export of trophies[24].

While there is evidence that trophy hunting has had negative impacts on Tanzania's lion populations (Packer et al. 2011), other threats are more significant. Tanzania's National Action Plan for lions and leopards concluded that prey availability, land use and land cover change, anthropogenic killing, inadequate management and disease may

[23] http://www.huffingtonpost.com/entry/abusive-safari-company-tanzania_us_57769240e4b04164640fbba8
[24] http://allafrica.com/stories/201608291000.html

pose threats to those species, with retaliatory killing, land use change and problems arising from inadequate management the most important factors (TAWIRI 2007).

2.1.2.5 Significance of trophy hunting as a threat to lions in Zambia

Our latest data suggest that Zambia holds approximately 1,200 free-ranging lions in an estimated lion range of 135,000 km^2 (Dickman in prep.). The IUCN examined only one population in Zambia (Luangwa) for the IUCN Red Listing – this population was hunted for trophies and had declined by 28% between 1993 and 2014 (Bauer et al. 2016).

Di Minin et al. (2016) estimated that 37.8% of Zambia was covered by terrestrial protected areas, with 21.3% in hunting ranches. However, it is notable that despite this extensive coverage of hunting areas, which is second only to Tanzania and Botswana (before the ban), Zambia generates very little revenue from trophy hunting (see Table 3 for comparison of estimates). This concurs with the findings of Lindsey et al. (2012b), who stated that most Zambian trophy hunting concessions appear to be running at a loss, probably as a result of the depletion of prey populations due to human settlement and the bushmeat trade in Game Management Areas (Lewis and Alpert 1997; Simasiku et al. 2008). Quotas of lions have been excessive, are established arbitrarily and there is a lack of monitoring of wildlife populations or of trophies. Per annum, 39 lions are hunted, while 13–18 trophies are exported (Lindsey et al. 2007). This level of hunting is approximately 3.4% of the estimated population, so is a relatively high level compared to many other countries.

Zambia's national authorities appeared to consider trophy hunting as a significant threat to lions (hence the ban on big cat trophy hunting implemented in 2013) but later reversed the decision (with some adjustments to quotas and regulations), mainly because of concerns over a lack of revenue[25].

The Zambian lion management strategy highlights poor management of the trophy hunting process, and states that there is inconsistency in the collection of data at temporal scale and in terms of measurable variables making it difficult to assess trophy quality trends in the country. The management plan states that it is focusing on the "*promotion of age-based harvesting of lions and setting of hunting quotas based on empiri-*

[25] http://www.bbc.co.uk/news/world-africa-32815508

cal biological data in addition to the ongoing collection of trophy measurements" (Zambia Wildlife Authority 2009). The national lion management strategy also highlights the following issues relevant to improving trophy hunting within the country:

- Standardization of lion survey methods and conducting baseline survey of lion numbers
- Setting of sustainable lion off take quotas
- Monitoring and evaluation of the lion population in the context of existing conservation and tourism programmes
- Preparation and implementation of field age determination techniques
- Development of area-specific lion management strategies especially for Game Management Areas (GMAs)

However, that strategy was developed in 2009 and it is unclear how much progress, if any, has been made since then towards improving the management of lion trophy hunting in Zambia. Therefore, it is still possible that poorly-managed trophy hunting could be a threat to Zambia's lion populations.

2.1.2.6 Significance of trophy hunting as a threat to lions in Zimbabwe

Our latest data suggest that Zimbabwe holds approximately 1,500 free-ranging lions in an estimated lion range of 57,000 km^2 (Dickman in prep.). The IUCN Red Listing used data from five populations in Zimbabwe, four of which had trophy hunting. All populations showed a significant increase (the lowest level was in Hwange, but even that was 86%) so overall, there was a very impressive 1,252% increase in lion numbers across those areas between 1993 and 2014, mainly due to increases in relatively small populations (Bauer et al. 2016). The largest increase was in Gonarezhou, the non-hunted population, which had a 7,900% increase (from 1 lion to 80), and this was closely followed by Savé Valley Conservancy, with a 6,967% increase (3 lions to 212) (Bauer et al. 2016).

Di Minin et al. (2016) estimated that 27.2% of the country was covered by terrestrial protected areas, with game ranches covering 16.6%. From the 1970s lion trophy hunting harvests in Zimbabwe were some of the highest in relation to population size in Africa, with annual offtakes of between 90 and 141 lions between 1992 and 2002 (Loveridge et al. 2009; Packer et al. 2009), but quotas were reduced to 75 individuals in 2015 (ZPWMA 2015) and lion numbers are now increasing in several populations (Bauer et al. 2016). Since the elephant trophy import ban in the US, there is

anecdotal evidence that lion have become relatively more important to the national hunting industry economically.

Zimbabwe introduced a 5-year age limit on hunted lions in January 2006, and has used an adaptive age-based quota system with evidence of success. This calculates a fluid quota per area based on the previous season's performance in terms of hunting only older males. The Zimbabwean adaptive system has been associated with a rising age of hunted lions, a desirable outcome illustrating the role of quotas and age-based restrictions in influencing population demographics (ZPWMA 2015). The goal of the Zimbabwean system of inbuilt feedbacks is to discourage outfitters from hunting lions that are too young, thereby minimising negative impacts on the lion population whilst maximising the sustainable yield, and therefore the economic incentive to conserve lions. With these lowered quotas and age-based systems, there is little evidence that trophy hunting is negatively affecting Zimbabwe's lion population at a national scale.

2.1.3 Factors mediating the threat posed by trophy hunting

Despite the threats posed by trophy hunting to individual populations, trophy hunting has never (to our knowledge) been implicated as a significant factor in the extirpation of lions from a country. While Chardonnet's (2002) estimate that 32 African countries supported wild lions may have been optimistic, by 2015 seven of them no longer did so (Bauer et al. 2016); however, none of these countries had exported a lion trophy over that period [CITES trade database: http://trade.cites.org/en/cites_trade/ (Accessed 11 July 2016)].

It seems as if where trophy hunting is well-regulated, transparent and has a significant amount of power devolved to the landowners (for example in Namibia; Naidoo et al. 2016a), it has the potential to deliver significant conservation benefits in terms of protecting habitat and allowing lion populations to persist (NACSO 2011, 2015; Naidoo et al. 2016a). However, in many countries, poor governance[26] and weak enforcement of hunting regulations increases the threat posed by trophy hunting; indeed, Packer (2015) argues that corruption within the hunting industry

[26] *Lion hunting countries rank poorly in governance scores from Transparency International (www.transparency.org)*

and wider frameworks is the reason why lion hunting often fails to deliver the benefits to lion conservation that might be expected in principle, and Dickman et al. (2015) consider corruption as a limiting factor in delivering felid conservation in some countries.

According to the IUCN in 2009, good governance was absent from almost the entire trophy hunting sector in many countries, with those currently in control of the system not prepared to share power and undertake adjustments that would mean relinquishing control; a position that IUCN (2009) concludes serves individual interests, but not those of conservation, local communities or good governance (UICN/PACO 2009). However, even poor national governance does not always preclude relatively well-managed trophy hunting: Zimbabwe has recently implemented an age-based adaptive quota strategy (see Section 2.1.2.6), which has resulted in the reduction of hunting under-age animals (ZPWMA 2015).

Similarly, despite weak governance across much of Mozambique, age-based adaptive management of trophy hunting (and work to address other threats to lions) has been implemented effectively in the Niassa National Reserve, and lion populations are increasing there despite hunting (Bauer et al. 2016).

2.1.4 Significance of trophy hunting as a threat to lions at a regional scale

The IUCN 2006 regional conservation Strategies for lions (in West and Central Africa, and in Eastern and Southern Africa), considered possible threats to lions, and ranked them using a points-based system (IUCN 2006a, b).

The top five threats (i. *prey depletion*, ii. *conflict with humans*, iii. *small population size*, iv. *livestock encroachment* and v. *habitat loss*) were the same in each region, albeit in slightly different orders (see Figures 2a and 2b).

Trophy hunting was not ranked by experts as one of the top three threats to any lion populations across West and Central Africa (IUCN 2006a). Trophy hunting emerged as a higher threat across Eastern and Southern Africa than in West and Central Africa, but was not ranked as a high level threat.

2.1.5 Summary of the significance of trophy hunting as a threat to lions

Poor quota management and unregulated hunting of lions, in particular that of dominant males and pride females, can result in significant negative impacts at a population scale (e.g. Loveridge et al.

2007a; Packer et al. 2009; Croes et al. 2011; Packer et al. 2011; Becker et al. 2013). These negative impacts could be ameliorated (either in whole or in part, depending on the population) by restricting offtake to males of $\geqslant$7 years, which should have reproduced, and in some areas by combining this with an area-based hunting quota. However, when assessed at either a national or a regional level, the negative impacts on lions from trophy hunting are deemed by experts to be substantially smaller than other threats, particularly those of human-lion conflict and loss of prey (IUCN 2006a, b).

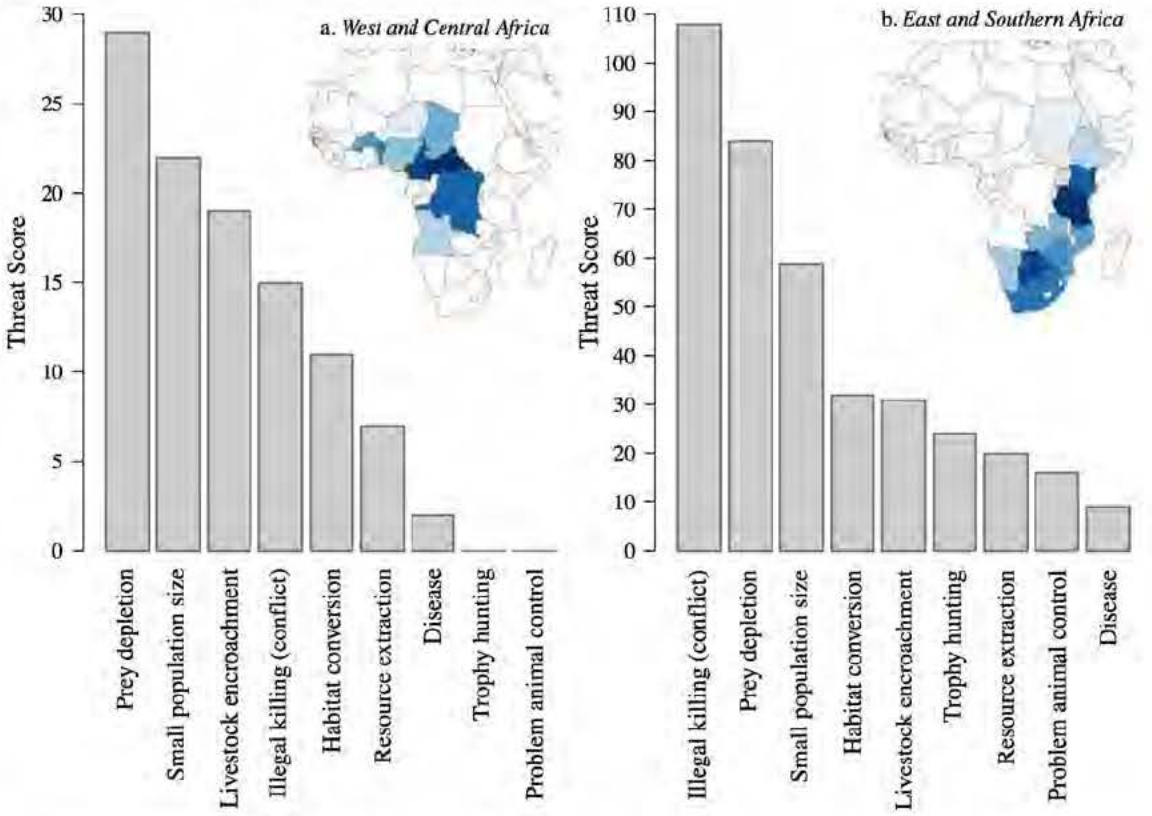


Figure 2: *Threat ranking for lions in (a) West and Central Africa, and (b) East and Southern Africa, as assessed by experts at the 2006 IUCN Lion Conservation Strategy meetings (note that the y-axes are different scales as the magnitude of threats was considered higher in East and Southern Africa). The maps show the countries assessed in the strategies, with the colour showing the relative lion population in the range country, with darker colour showing a larger population.*

2.2 Impacts associated with lion trophy hunting [27]

2.2.1 Ecological impacts

2.2.1.1 Habitat protection

The protection of wildlife habitat is the primary benefit associated with trophy hunting, as it reduces the major threat of habitat loss – conversion to other forms of land use such as agriculture is often irreversible. In 2007, Lindsey et al. estimated that a total area of at least 1,394,000 km^2 was conserved for trophy hunting in sub-Saharan Africa, which exceeded the area of national parks in those countries by 22%. In 2013, it was estimated that lions were hunted across at least 558,000 km^2, which comprised 27–32% of the lion range in countries where trophy hunting of lions was permitted (Lindsey et al. 2013), and at least 16% of the total lion distribution in Africa (Riggio et al. 2013). Given the dates of those studies, the extent of this hunting range will now have declined slightly since Botswana imposed its lion trophy hunting ban in 2014.

Many of the areas that are (or recently were) hunting zones are not currently suitable for photographic tourism (e.g. even in Botswana, which is one of Africa's premier destinations for photographic tourists, over three-quarters of hunting land in the Northern Conservation Zone had low potential for phototourism; Winterbach et al. 2015), so hunting enables this land to be maintained under a wildlife-based land use. This maintenance of habitat (even if lions themselves are negatively affected at some level) is by far the most significant benefit provided by trophy hunting of lions, particularly given the fact that habitat loss and degradation is such a significant threat to lions at all scales (IUCN 2006a, b; Fusari et al. 2010; Henschel et al. 2010; Henschel et al. 2014). Particularly in West and Central Africa, trophy hunting maintains lion habitat in areas where photographic tourism and philanthropy are absent – and those land uses are much less developed than in other regions. This is evident from the fact that lions have been extirpated from most protected areas in the region (Henschel et al. 2014) whereas the last two remaining substantial populations (>250 lions) are both within large complexes of National Parks interconnected and buffered by hunting zones that appear to be at least partially effective at reducing livestock encroachment, with hunting not

[27] *Throughout, we try to provide as much specific data as possible with regard to lion trophy hunting, but in some cases information is only available for trophy hunting in general.*

appearing to significantly affect the last remaining lion stronghold in West Africa, the W-Arly-Pendjari (WAP) ecosystem (Bouché et al. 2016).

Although lions are one of the main draws of trophy hunting areas and increase their financial viability, these areas are also very important for many other species, including some highly threatened ones. For example, in the case of the critically endangered black rhino (*Diceros bicornis*), only 10 'IUCN Key 1' populations remain (i.e. populations that are crucial to the survival of the species), and three of those occur on private hunting conservancies in Zimbabwe where lions are also key hunted species (N. Anderson, International Rhino Foundation, pers. comm.).

However, not all the ecological impacts of trophy hunting are positive. In areas managed predominantly for lions, high densities have negative impacts on the populations of smaller competitors, such as cheetahs (*Acinonyx jubatus*) and African wild dogs (*Lycaon pictus*). Where provided with adequate resources and protection (even where they are hunted), lion populations can achieve very rapid growth rates (e.g. Groom and Watermeyer 2015; Miller et al. 2015; du Preez et al. 2016a). High lion densities (particularly within fenced reserves, including non-consumptive photographic areas) can lead to significant ecological and social problems such as severe reductions in prey populations and intra-specific lion killing (Ferreira and Funston 2010; du Preez et al. 2015). The associated management issues (overpopulation and overpredation) may necessitate lethal control of the lions (Miller et al. 2015), or intensive management strategies such as contraception or translocation.

2.2.1.2 Reduction of other threats to lions and other wildlife

At least within well-managed trophy hunting areas, it is common to have significant anti-poaching patrols, which would reduce threats of human encroachment, such as the loss of lion prey through bushmeat hunting. For example, in Cameroon, where bushmeat poaching is a major conservation issue, observations between 2005 and 2010 suggested that anti-poaching efforts were higher in the hunting zones than National Parks, due to economic incentives to reduce poaching in hunting areas, and a lack of government funding to conduct similar anti-poaching efforts in Parks (Croes et al. 2011). Even in poorly-managed areas, funds from hunting can still play a major role in funding anti-poaching operations. For example, in Tanzania's Selous Game Reserve (which is allegedly beset by high levels of corruption), the 'Selous Retention Scheme' has recently been re-established, where 50% of hunting revenues from the Reserve are re-invested into conservation and anti-poaching (IUCN 2016). The Re-

serve's chief warden from 1994–2008 and 2012–2015 has raised serious concerns about the impacts of trophy import bans on the capacity of the reserve to successfully conduct anti-poaching efforts (IUCN 2016). However, anti-poaching efforts run by hunting operators vary considerably between countries and operators, and they tend to be seasonal rather than year-round.

2.2.2 Impacts of economic benefits generated from trophy hunting

There are several reasons for considering the economic contributions of trophy hunting, not least because of its possible role in the economic development of African nations and as a source of income to local people (though the significance of trophy hunting revenue is debated for both those factors). However, within the remit of this report, we focus on the connection between the economic impact of trophy hunting and conservation outcomes.

2.2.2.1 Level of trophy hunting revenue generated

There are a range of estimates of the degree of economic revenue generated by trophy hunting, but there is a lack of rigorous, independent data on the economics of trophy hunting. A report commissioned by Safari Club international, an organisation that is explicitly in favour of hunting, concluded that across eastern and southern Africa (Botswana, Ethiopia, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe) hunters spend US$326.5 million annually when accounting for all in-country expenditure, including not only the cost of the hunt and associated fees but also other costs such as transportation, food and souvenirs (Southwickes Associates 2015). They found the value-added contribution to GDP (using multipliers derived from World Travel and Tourism Council) to be US$426 million (Southwickes Associates 2015). They also found that trophy hunting supports 53,400 jobs, when including supporting sectors. However, in 2009 the IUCN criticised the low proportion of jobs created by the hunting industry in comparison to the proportional area of land it occupies – it cited figures of 15,000 salaried jobs across Africa, compared to a human population of 150 million in the eight main trophy hunting countries, where trophy hunting takes up 16% of their land (UICN/PACO 2009). However, this must be considered in the context of naturally low human density in wildlife areas, and the general incompatibility of (or inverse relationship between) large human populations and maintenance of wildlife populations.

There is variation in estimates given in the peer-reviewed literature regarding the level of trophy hunting revenue,

and those estimates usually do not provide value-added estimates or account for revenue to supporting sectors etc. Lindsey et al. (2007) estimated that trophy hunting generated gross revenues of at least US$201 million per year in sub-Saharan Africa, although this estimate has been criticised in a report prepared for The African Lion Coalition, which is composed of animal welfare groups, for relying on unreliable sources of data (Economists at Large 2013). Booth (2010) estimated gross revenues of at least US$190 million for South Africa, Namibia, Botswana (the paper was published prior to Botswana's trophy hunting ban that entered into effect in 2014), Zambia, Mozambique, Zimbabwe and Tanzania. Di Minin et al. (2016) estimated total annual hunting revenue to be approximately US$217.2 million in those same countries (see Table 3 for a summary of estimates of the revenue generated by trophy hunting per country). However, the report prepared for the African Lion Coalition argues that that the contribution of trophy hunting to national economies is insignificant because it constitutes only a small percentage of Gross Domestic Product (GDP) (Economists at Large 2013). The IUCN estimated trophy hunting revenue to contribute 0.19% of GDP in Botswana, 0.03% in Mozambique, 0.45% in Namibia, 0.04% in South Africa, 0.22% in Tanzania, 0.05% in Zambia and 0.29% in Zimbabwe (UICN/PACO 2009). Though small on a national scale, income from trophy hunting can be a significant source of income for the government bodies responsible for managing wildlife. For example, the Wildlife Division in Tanzania makes 60% of its income from trophy hunting licence fees (Estes 2015). The IUCN stated that a definite positive aspect of trophy hunting is that conservation results are financed completely by the hunters, without drawing from donors or requiring government commitment (UICN/PACO 2009).

Most of the figures discussed above concern trophy hunting as a whole, and only part of these are generated by trophy hunting of lions specifically. Lindsey et al. (2012b) estimated that lions generate 5–17% of gross trophy hunting income on national levels among Mozambique, Namibia, Tanzania, Zambia and Zimbabwe, but lions were not the species that generated the largest proportion of trophy hunting income in any of these countries.

2.2.2.2 The economic contribution of lion hunting and its impact on land-use

From a conservation perspective, the overriding concern is how the economic profitability of trophy hunting of lions affects land-use.

Table 3: *Estimates of revenue generated by trophy hunting per country.*

Country	Revenue year^{-1} (US$ m)	Source
Botswana	20	*Lindsey et al. 2007*
	40	*Di Minin et al. 2016*
	12.5	*Northumbrian 2001*
	40	*Booth 2010*
Burkina Faso	0.6	*Lindsey et al. 2007*
Cameroon	2	*Lindsey et al. 2007*
CAR	1.4	*Lindsey et al. 2007*
Ethiopia	1.3	*Lindsey et al. 2007*
Mozambique	5	*Di Minin et al. 2016*
Namibia	28.5	*Lindsey et al. 2007*
	28.5	*Di Minin et al. 2016*
	9.6	*Booth 2010*
South Africa	100	*Lindsey et al. 2007*
	68	*Di Minin et al. 2016*
	68.3	*Booth 2010*
Tanzania	27.6	*Lindsey et al. 2007*
	56.3	*Di Minin et al. 2016*
	6-7 *	*Mésochina et al. 2010*
Zambia	5	*Lindsey et al. 2007*
	3.6	*Di Minin et al. 2016*
Zimbabwe	16	*Lindsey et al. 2007*
	15.8	*Di Minin et al. 2016*
	18.5	*Booth 2002*

∗ *Figure for revenue from lion hunting only*

If a ban on the import of lion trophies (or other policies) impacted the profitability of trophy hunting operations to the extent that it becomes less profitable than alternative land-uses due to reduced demand, then it is likely that there will be a transition to more profitable land-uses. The type of the land-use that replaces trophy hunting is important to predict the effect on the conservation of lions and wildlife in general. Transition to agriculture or livestock grazing is a serious threat to the survival of the lion populations (Loveridge et al. 2007b) and is the likely alternative to trophy hunting across much of Africa, because it is profitable for land-owners, or in the case of government-owned land, because there is strong political pressure to turn these areas over to livestock production

(Loveridge et al. 2007b).

To consider the effect of curtailment of hunting of lions on land-use, information on the specific contribution of lions to the viability of trophy hunting operations is required. There is a paucity of information on this, but Lindsey et al. (2012b) estimated the significance of lions for the financial viability of trophy hunting in Mozambique, Namibia, Tanzania, Zambia and Zimbabwe. They found that the trophy hunting industry is not dependent on lions to remain viable in most areas, and that other species are more important in financial terms. However, they conclude that if lion hunting was precluded, trophy hunting could still become unviable across at least 59,538 km^2, which constitutes 11.5% of the area lions are hunted in the countries included in the analysis. Lion hunting was found to be important for financial viability of trophy hunting in Mozambique, Tanzania and Zambia, but of minor importance in Namibia and Zimbabwe. Lindsey et al. (2012b) further noted that had Benin, Burkina Faso and the Central African Republic been included in the analysis, the estimated size of the area where trophy hunting will be lost is likely to increase significantly as these countries have low numbers and diversity of other key trophy species. Crucially, trophy hunting becomes unfavourable as a land-use option not only if a trophy hunting business becomes unprofitable, but also if it becomes less profitable than the alternative land-use from the perspective of the owners/custodians of a piece of land, so the extent of habitat loss could be greater than 59,538 km^2. In some areas, the net returns from livestock is similar to those from trophy hunting (Lindsey et al. 2012b)so there might be a transition to livestock production even with only relatively small decreases in profitability of trophy hunting. Estimates of the profitability of trophy hunting per hectare differ. IUCN (2009) reported US$1.1 ha^{-1}, Lindsey et al. (2012b) estimated net earnings to be between US$0.24 to US$1.64 ha^{-1} $year^{-1}$ depending on the country, and du Preez et al. (2016b) calculated that hunting in Zimbabwe's lowveld was worth approximately US$16.4 per hectare per year for all species and US$5.57 for lion hunting alone. Net returns from livestock in semi-arid African rangelands (US$0.1–US$0.3 per hectare per year in areas with 400–800 ml of annual rainfall (Cumming 2004) are similar to those from trophy hunting in some areas, so these areas are at risk of conversion (Lindsey et al. 2012b).

In the most attractive and accessible areas, land-use could shift from trophy hunting to non-consumptive wildlife use, e.g. photo-tourism, such that habitat is maintained without lions being killed. This could be the ideal outcome from conservation and welfare perspectives, as lion populations would be secured without the damaging ethical, ecological and welfare impacts of trophy hunting. Indeed, Barnes (2001) concluded that pho-

tographic tourism has greater benefits than consumptive use over about one-third of the wildlife estate in Botswana, finding that "*consumptive wildlife uses are relatively unimportant in terms of economic contribution*", whilst consumptive wildlife use is the only possibility across the "*less well-endowed two-thirds of the wildlife estate*".

However, only a subset of the areas that are currently used for trophy hunting are likely to be suitable for photographic tourism (Lindsey et al. 2006). For example, they might contain limited numbers of charismatic species, lack photogenic scenery, or be located in areas with high risk of tropical disease, poor infrastructure or political instability (IUCN 2016). Trophy hunters are less discouraged by these conditions than most tourists: during the first year of land-seizures in Zimbabwe, the tourism sector was reduced by 75% while profits from trophy hunting only dropped 12% (Booth 2002). Also, it is unknown whether there exists enough unsatisfied demand for photographic tourism to supply clients if current trophy hunting areas are converted to photographic tourism, or whether this would simply divert visitors from current protected areas. Across Africa, a large number of protected areas with high levels of biodiversity receive very few visitors (Balmford et al. 2015). This is not consistent with there being significant unsatisfied demand for photographic tourism opportunities, which suggests that the creation of new photographic tourism areas might divert visitors from existing protected areas, some of which are already operating at a loss.

Even where photographic tourism is financially viable, there is evidence for interdependence between this form of tourism and trophy hunting. In Namibia, trophy hunting was shown to be important for the establishment of conservancies because it generates benefits sooner than photographic tourism after establishment of a conservancy, so it can allow conservancies to remain financially viable while its photographic tourism is developing (Naidoo et al. 2016a). Furthermore, simulations show that a significant number of community-led Namibian conservancies would not be able to meet their operational costs if there was a ban on trophy hunting, which would remove both the incentive to maintain these protected areas and the financial means to manage them (Naidoo et al. 2016a).

However, where the land-owners value wildlife beyond their economic value they might be willing to tolerate low returns from their land in order to maintain wildlife habitat, if they have sufficient wealth to do so. In these cases, reductions in profitability of lion trophy hunting may not affect the conservation of lion habitat. It is uncertain to what extent land-owners perceive intrinsic value of wildlife, and considering that the host countries of lion hunting are developing

nations, the ability to absorb financial losses or reduced returns is likely to be low.

Although there is anecdotal evidence from such countries as Botswana and Zambia after recent trophy hunting bans (see text box below), there is no published literature on the specific impacts of the ban in terms of protecting lions, and very little information on actual land use changes. At present, we are limited to inference: Williams et al. (2016) documented substantial decreases in the density of lion, leopard, cheetah, African wild dog, spotted hyaena (*Crocuta crocuta*) and brown hyaena (*Hyaena brunnea*) as land was converted from hunting conservancies to agriculture, following land reform in Zimbabwe. Direct evidence demonstrates that local people are often unsupportive of a ban, and that significant loss of revenue to hunting zones occurs when lions can no longer be utilised (Hann 2015). Hann (2015) highlights the huge knowledge gaps regarding hunting and its association with wildlife declines. The IUCN notes that "*Revenues from trophy hunting are also important for conserving threatened species that are not hunted. Populations of Black Rhino and White Rhino and of the African Wild Dog on the Savé and Bubye Conservancies in Zimbabwe are not hunted, but proceeds from trophy hunting support their conservation*" (IUCN 2016).

2.2.2.3 Trophy hunting and economic incentives for lion conservation

Another way that the economic impact of lion trophy hunting is connected to conservation outcomes is through the revenue generated by trophy hunting that goes towards implementing conservation efforts and incentivises tolerance for lions and the maintenance of habitat for wildlife – reductions in the income generated from lion hunting could reduce these incentives among governments, local communities and private land-owners.

Governments require funds for wildlife management and income to justify the maintenance of land as game reserves/wildlife management areas in the face of increasing human populations and demand for land. Some of the funds generated by trophy hunting accrue to governments. For example, in Tanzania, direct and indirect tax flows to the government is approximately 44% of the estimated gross income of the trophy hunting industry (Booth 2010), and, based on data from 2008, 22% of the gross revenue generated by hunting is allocated to the Wildlife Division (Di Minin 2016). However, much of the income generated by the industry never enters the country, accruing instead to external parties (Booth 2010). In Namibia, 21% of the income generated is captured by the government through fees and taxes (Humavindu and Barnes 2003). Lewis

and Alpert (1997) report that in Zambia: ADMADE (Administrative Design from Game Management Areas) receives around 67% of all revenue generated by sport hunting activities in Zambia's Game Management Areas. Over half (53%) of ADMADE revenue is allocated directly to local wildlife management and the remainder to community development. However, is usually unclear how much of the revenue captured by governments across lion range countries is channelled into conservation efforts, especially in the context of high levels of corruption.

From the viewpoint of lion conservation, generating benefits for local communities from trophy hunting of lions is important because it incentivises local communities to tolerate lions despite the threat they can pose to livestock and human lives (Loveridge et al. 2007b) and the opportunity costs that they can often impose by restricting resource use. These benefits can be in the form of financial/material contributions to community development, employment or income for local producers and service providers. Before Botswana's ban on trophy hunting, 75% of the gross income generated by hunting tourism remained in the country, and of this 49% remained at the district level. This equated to approximately US$5 head^{-1} when translated to an income per capita at the national level but when attributed to the main hunting districts, the per capita income was US$48.5 head^{-1}. In Tanzania, 3.1% of estimated gross expenditure by hunting companies is spent on community development and fees paid to the community and 11.9% on wages and welfare (Booth 2010). In Namibia, agreements between conservancies and operators specify the portion of income the conservancy receives, typically 8–12% of total lodge revenue and 30–75% of trophy price (Naidoo et al. 2016a). Humavindu and Barnes (2003) found that in Namibia, 24% of the income accrues to poor segments of society in the form of wages and rentals/royalties, while Samuelsson and Stage (2007) estimated that 40% went to local communities and low income wage earners.

If trophy hunting became unviable, thousands of Zimbabwean households that benefit from the CAMPFIRE programme would lose a combined US$1.7 million per annum, and the programme's revenue has already been significantly reduced following the US ban on elephant trophy imports from Zimbabwe (C. Jonga, quoted in IUCN 2016)[28]. However, despite some successes and good examples of benefit-sharing, local communities rarely benefit from trophy hunting activities (Lindsey et al. 2006) and trophy hunting frequently occurs without meaningful community involvement or consultation, which in many countries is further complicated by corruption, lack of transparency and weak rule of law (IUCN 2009).

[28] http://www.newzimbabwe.com/news-21699-US+embargo+hits+Campfire+revenues/news.aspx

Case study: Botswana after the hunting ban in 2014

Since trophy hunting was banned in Botswana in 2014, there has been minimal uptake of hunting blocks for photographic tourism (Winterbach pers. comm.). Winterbach et al. (2015) conclude that only 22% (17,142 km^2) of the Northern Conservation Zone has intermediate to high potential for phototourism, while 78% has low phototourism potential (61,769 km^2). Ten concessions (out of 32) in the Northern Conservation Zone did not include high potential phototourism areas and only one of those ten was conducting photographic safaris (although the economic viability of this concession was reliant on access to the nearby Moremi Game Reserve). Although these ten concessions have been offered to public tender four times since the hunting ban in 2014, as of June 2016 still only one was operating phototourism, the other nine being without concessionaires or not operational. In terms of habitat connectivity between protected areas, those ten concessions are critical for ecosystem health and form a vital link between Moremi Game Reserve, Nxai/Makgadigadi Pans National Park, Chobe National Park in Botswana and Hwange National Park in Zimbabwe and surrounding concessions. While hosting what is possibly the geographically largest intact lion population in Africa, this is also a key wet season range for buffalo and elephant and hosts two long-range migration routes of zebra. Some blocks that are part of the Western corridor in southern Botswana have already been changed to agricultural use (livestock farming), disrupting the link between the Central Kalahari Game Reserve and the Kgalagadi Transfrontier Park and probably fragmenting the lion population of the Southern Conservation Zone. Although the Government of Botswana has a good conservation track record and there is no immediate threat to these areas, pressure from Botswana's livestock industry for access to areas with limited tourism potential is only likely to increase (Winterbach et al. 2015). Initial reports from some communities in Botswana suggest significantly reduced conservation incentives (including meat, jobs and pensions) and hardening negative attitudes toward wildlife since the ban was implemented (Naidoo et al. 2016b).

Furthermore, lions generate only part of the total trophy hunting revenue considered in the above figures. However, if there was no income generated by lions, communities could potentially wish to eradicate them from trophy hunting areas because they pose a threat to livestock in surrounding areas, and private land-owners might want to remove lions from their trophy hunting concessions because they predate other valuable trophy species (Funston et al. 2013).

2.3 Summary of the impacts associated with trophy hunting

Trophy hunting can have marked negative impacts on the ecology of lions at a population scale, and can also have negative impacts on other species when an area is managed primarily for lions. However, these impacts are generally small in comparison to other threats at a national and regional scale, and perhaps counter-intuitively, trophy hunting could in some areas be reducing some of the primary threats to lions, namely habitat loss and loss of prey. For example, across Africa, approximately ~1.4 million km^2 has been estimated to be conserved for trophy hunting purposes. It is likely that without trophy hunting, parts of this vast area of land would become economically unviable if maintained as ecologically intact wildlife areas, and could well be converted to agricultural use with strong negative impacts on lions and other wildlife. Governments require incentives to justify the maintenance of wildlife habitat, local communities and private landowners require incentives to maintain wildlife habitat instead of converting the land to other uses, such as agriculture, and to tolerate the presence of lions, which can pose a threat to livestock and human life. Some revenue from trophy hunting accrues to governments and to local communities, but information is lacking for most areas and in many places benefit-sharing with communities is inadequate. Furthermore, only a small portion of total trophy hunting income is attributable to lions. However, without the income from lion hunting, trophy hunting is estimated to become unviable across 59,538 km^2 in five sub-Saharan countries alone, and a transition to alternative land-uses is likely. Photographic tourism is an alternative land-use that would allow lion populations to remain, but is likely only to be viable in a subset of current trophy hunting areas. The likely outcome for many areas would be conversion to agriculture or livestock grazing, which would seriously threaten the survival of the lion populations in those areas.

3. Current and recommended lion trophy hunting practices

Many of the detrimental effects on lion conservation associated with trophy hunting are to do with failure to establish and enforce regulatory systems based on now well-established scientific principles, and within those regulatory systems, failure to follow a good code of conduct. The UK can only affect a few of these issues directly, for example potentially through specific import regulations, but it would be good to put pressure on the hunting industry to ensure that best practices are met, with strict regulations both imposed and effectively implemented.

3.1 Lease length, allocation and fixed quotas

Short leases on hunting concessions are not conducive to conservation goals (Damm 2005). The argument is that when short leases are issued with no guarantee of a long-term stake, then there is no incentive to invest in conservation, and the maximum quota is always taken so as to maximise return on the cost of lease, even if this means that wildlife are over-exploited as a result. With greater security in the future of a concession comes greater incentive to invest in the resource, and thus conservation goals are more likely to be achieved.

As an illustration, multiple use concessions in Botswana were awarded on 15-year leases. Evaluation of tender documents included a Technical Management Plan, financial plan and financial bid, which all contributed to a total point score, which determine the winner of the tender. This provided the opportunity to have wildlife monitoring, corporate social responsibility, environmentally responsible camp management etc., and the management plan became part of the lease agreement. Biannual site visits by Department of Tourism, Department of Environmental Affairs and Department of Wildlife and National Parks were conducted to ensure compliance, and operational licences could be revoked if people were not adhering to the lease agreement. This carefully regulated system contrasts with the shortcomings of patronage, and associated over-harvesting, documented by (Packer 2015) as a major impediment to hunting delivering conservation benefits to lions.

Hunting blocks should also be allocated according to an open auction system (Dickson et al. 2009) that recognizes

the extent of past investments in each block while encouraging access by well-capitalized businesses or individuals and allows options for long-term leases in the case of well-managed tenure. In some countries (e.g. Tanzania), the outfitter has to pay a mandatory fee for the lions they are allocated to hunt, even if they are not shot. Packer et al. (2006) noted that that 'fixed' quotas do not provide any incentive for hunting operators to reject lions that are too young, leading to reduced trophy quality and unsustainable harvesting. In 2013, Lindsey et al. reported that Mozambique, Benin, Burkina Faso and Cameroon had no fixed quotas, with hunters only paying for the animals they shot, but other countries did have some mandatory fees regardless of the actual offtake (Lindsey et al. 2013). This fee (regardless of actual offtake) was apparently set at 30% of the quota in Zimbabwe, 40% in Tanzania, 50% in the Central African Republic, 60% in Zambia and 100% in Namibia, where concession rights are based on the sale of the quota rather than lease of the land (Lindsey et al. 2013). Best practice would be to have no fixed quotas, with hunters only paying trophy fees for the animals that are actually shot.

3.2 Restrictions on lions able to be hunted

The negative consequences of removing females from a population have been detailed above (see Section 2.1.1.1), so best practice would be to import only male lions.

To ensure that the benefit to lion conservation from trophy hunting (through habitat protection) outweighs the costs that may be imposed, it is important to estimate how many lions can be hunted from a particular management unit without imperilling the population, and in order to import any lions, national regulators should have some confidence that the country concerned is making their calculations based on good science. Calculations of 'safe' harvests would be difficult for most species because of the practical challenges of counting animal numbers and working out their population dynamics, but in the case of lions it is made much more difficult because their social system is such that the death of a pride male can trigger a perturbation effect with cascading consequences reducing recruitment (Loveridge et al. 2007a). To avoid the hazard of overharvest, two broad approaches have been proposed by experts on lion populations, one area-based and the other age-based. Both these approaches involve hunting only adult males and there is now an emerging case for, in some circumstances, combining them (Creel et al. 2016).

The area-based approach recommends capping the number of hunted male lions at a sufficiently low number that there is minimal risk that this offtake causes a decline in the population. In most populations, the offtake has been recommended as no more than 0.5 lions 1,000 km^{-2} (Packer et al. 2011), although there might be local variation – high-density populations such as the Selous could probably sustain an offtake of 1 lion 1,000 km^{-2} (Packer et al. 2011), as could well-managed and increasing populations such as those in Bubye Valley Conservancy (ZPWMA 2015), while in particularly low-density populations, the cap may have to be adjusted downwards. Lindsey et al. (2012b) present data showing that the introduction of a recommended quota of lion offtakes of 0.5 lions 1,000 km^{-2} would allow lion hunting to be sustainable, while retaining conservation incentives from trophy hunting. They conclude such a policy would result in only 7,005 km^2 of existing hunting estate potentially become financially unviable (representing ~1% of the 516,738 km^2 where lions are currently hunted in the main lion hunting countries), and argue sustainability would be enhanced further if age-based regulations were also implemented.

The age-based approach recommends harvesting only older males that have had the opportunity to reproduce successfully and whose deaths will therefore have fewer repercussions for recruitment of cubs into the population. The assumption behind this approach is that the harvest of those males can be sustainable irrespective of population size or numbers taken, and has no deleterious effect on population genetic diversity (Whitman et al. 2007).

However, these general rules involve complications. The original computer models by Whitman et al. (2004 & 2007) indicated that so long as only males older than $\geqslant$5 years were hunted, the numbers taken had little impact on the viability of the remaining lion population. However, as Whitman et al. (2004) cautioned, this model was based on data from a well-protected and growing lion population with an increasing prey base: conditions that may not apply to the majority of lion populations in hunting areas. Furthermore, a practical difficulty is aging the candidate trophy lions accurately under challenging field conditions, although new guidelines (and an associated training website) published by Miller et al. (2016) help with this, as well as the field guide produced by Whitman and Packer (2007). Revisiting Whitman et al.'s (2007) pioneering work, Creel et al. (2016) offer more precautionary guidelines to minimise the risk of a hunted population being extirpated, and advocated the hunting of only males aged 7 years or more (along with other measures such as recovery periods from hunting and area-based quotas). Indeed, these recent models conclude that even this strengthened age-based criterion does not necessarily en-

sure that the hunted population will not decline if other threats such as bushmeat poaching are present. However, the models show that the contribution of trophy hunting to population decline, within the suite of all the threats facing lions, will be minimised if only males of 7 years or older are removed. This is at least partly because setting the age limit higher reduces the impact of misjudging age in the field by a year or so (Creel et al. 2016). Individual lion age characteristics may vary regionally (Kays and Patterson 2002; West and Packer 2002; Patterson 2007; West and Packer 2013), and lion aging techniques differ pre- and post-mortem, with pre-mortem aging being less accurate and precise (Miller et al. 2016), and thus enforcing minimum age requirements in the field is often difficult. However, Miller et al. (2016) have shown that a suite of lion age traits, in combination with training workshops, may be used to improve significantly field assessment of lion age, and could thus be used to improve sustainability of harvest by reducing levels of underage offtake. Post mortem monitoring of age is possible (Winterbach et al. in review) but not without problems (White et al. 2016).

Therefore, and as a failsafe regulation under conditions (which often prevail) where threats such as human encroachment, poaching and prey depletion are present (but not increasing) Creel et al. (2016) suggested that a combined age- and area-based method be used. They determined that an age limit of $\geqslant$7 years AND a maximum offtake of $\sim$0.5 lion 1,000 km^{-2} AND interspersing fallow periods of recovery, in combination reduced the risk of population extirpation within 25 years to less than 10% (Creel et al. 2016). Although some people may view any risk of population extirpation as unacceptable, this level of risk is low compared to the risk implied by recent declines in lion populations (43% decline in 21 years), and should be weighed against the benefit of protecting lion habitat, the degradation of which has been a primary cause of rapid lion decline at a continental scale (Bauer et al. 2016). However, Creel et al. (2016) recognise that for some responsible operators this stringency could reduce current offtakes tenfold; they suggest a compensatory rise in trophy fees to maintain the same levels of economic return from the land (Creel et al. 2016), which would only be feasible in certain areas or markets. How the demand for lion trophies would be affected by the price is a significant gap in current knowledge.

We suggest that in order to be eligible to export trophies, countries should be able to demonstrate that they are effectively implementing a quota system based on this best available science, with hunting restricted to older males, possibly with an additional area-based component. More information on how this might feed into conditions for any imports is provided in Section 4.3.2.

4. Options to improve the conservation impact of trophy hunting

Regarding the importation of lions into the UK, an option for the UK Government is to maintain the status quo, which is conditional import, with those from some countries banned and others subject to assessment against strict criteria. Options are thus to make the judgment that trophy hunting has no part in conservation, which might lead to a ban on all imports, or whether to enhance existing criteria to give greater confidence of conservation benefit (and by working with other countries have a greater impact). When considering the impacts of banning trophy imports, we acknowledge that if the decisions made by the UK Government are only adopted by them, then the impacts will be negligible, but we are assuming that the approach decided on by the UK Government could influence the development of policies more widely.

4.1 Possible impacts of maintaining the status quo

Maintaining the status quo would probably anger elements of the UK public, who have been vociferous in their demand for the Government to take action to restrict the importation of trophies from lions (as well as from other species[29]), and would put the UK at odds with the US and two EU countries, Netherlands and France (as well as Australia and Costa Rica) with regard to their positions on trophy hunting. It would also miss the opportunity to incentivise for the trophy hunting industry to improve its performance, as is clearly needed, in delivering benefits to conservation and reducing its negative impacts on threatened lion populations. This is therefore probably the least desirable option for the UK Government.

4.2 Possible impacts of a total import ban

Another option would be for the UK to impose a total ban on all lion trophy imports, and this would please a vocal section of the British public. If such a ban was done in partnership with other countries then it would reduce the eco-

[29] http://www.express.co.uk/news/nature/600874/CECIL-S-LAW-Brian-May-demands-law-to-stop-hunters-importing-trophies-back-to-UK

nomic viability of trophy hunting, which might encourage land-owners to switch to non-consumptive forms of wildlife use. This would be more ethically acceptable to large numbers of people, although the degree to which this would or could happen is uncertain. The degree to which trophy hunting can be substituted by photographic tourism is debatable (see Section 2.2.2.2), and in many areas such a substitution seems unlikely, particularly in countries that are less appealing to photographic tourists such as Cameroon and the Central African Republic, and even large sections of well-visited countries such as Tanzania or Botswana.

The major risk of a total import ban would be the removal of economic incentives to maintain the land in lion hunting areas under a wildlife-based land use, and this could have significant detrimental impacts on lions. In 2012, Lindsey et al. judged that in Mozambique, Namibia, Tanzania, Zambia and Zimbabwe, trophy hunting was not dependent on lions for viability, with other species being financially more important. They also judged that trophy hunting could nonetheless become unviable across at least 59,538 km^2 in these 5 countries, representing 11.5% of the 516,738 km^2 where lions are currently hunted in these countries. Even where a safari area remained viable despite the loss of lion hunting this could affect the overall profitability of trophy hunting and thus reduce its competitiveness relative to alternative land uses that diminished the lion estate.

To predict the impact of a ban on the import of lion trophies it is also necessary to consider what further policies it is likely to give rise to. It is possible that a ban on lion hunting will precipitate pressure for restrictions on leopard hunting as well, and other charismatic threatened species, such as the elephant. There are already calls for such bans[30], and as these species are some of the most sought-after for hunters, their collective removal would certainly reduce the economic viability of trophy hunting areas quite significantly. This is particularly true regarding potential restrictions on leopard and elephant hunting; the leopard appeared as one of the top three most-hunted species in Tanzania, Botswana, Namibia, Zambia and Zimbabwe, while the elephant was amongst the top three in Tanzania, Botswana, Mozambique and Zimbabwe (Di Minin et al. 2016). Unless an alternative wildlife-based land use was implemented at the same time as hunting was stopped, or the land was managed under conservation philanthropy, there is a significant risk that a considerable area of current hunting land could be converted to non-wildlife based land uses, with the con-

[30] https://www.theguardian.com/environment/2016/jul/25/leopards-animal-welfare-groups-endangered-us

comitant increases in lion habitat loss associated with that.

Popular disdain for lion trophy hunting appears widespread in North America and Europe, but this mood is not universal. If adopted more widely, one speculation is that a ban on imports to North America and Europe could increase uptake of trophies by hunters from other countries instead, for example the Middle East and Asia, with possible unintended consequences for conservation and animal welfare. Similar shifts in the market have been seen with other import bans, such as with Asian giant tortoises (*Manouria emys*), where an import ban was well implemented by the EU and was associated with a two-year decrease in global imports before new markets were found – however, four years after the import ban, global imports approached twice the volume of the year of ban (Hann 2015). There is also a risk that if countries feel that external views are being continually imposed on them (for example through trade restrictions) then they may decide to opt out of agreements such as CITES, which would be extremely damaging for the future validity and operation of such international agreements. There were some calls in the African media for African nations to withdraw from CITES in the run-up to CoP 17 and "*reject the power of rich elites in Europe or America to dictate how they manage their affairs*"[31], although no countries actually did so.

4.3 Possible impacts of stricter controls on the import of lion trophies to the UK

4.3.1 Reasons for considering stricter controls

It is clear that poorly managed trophy hunting of lions can have serious negative impacts at a population scale (see Section 2.1.1), and potentially some impacts at a national or regional scale (IUCN 2006b). Where they occur, allowing these negative consequences to continue is unacceptable from the viewpoint of lion conservation, particularly considering the species' deteriorating status (Bauer et al. 2016). However, it is also clear that trophy hunting is currently the reason for a large percentage of the lion estate being maintained as land for wildlife – it has been estimated that four times as much of that estate is in hunting areas than Parks (Packer 2015). A central dilemma is that imposing total import bans on lion trophies would, in the absence of alternative in-

[31] http://www.dailymaverick.co.za/opinionista/2016-08-23-african-nations-should-withdraw-from-cites/

centives to conserve lions, risk perverse consequences that may worsen the conservation of lions (as well as everything covered under their conservation umbrella). Principally, this might occur by reducing the economic incentives for wildlife-based land uses, which increases the likelihood of land conversion out of the lion estate and exacerbates the main threats to lions (namely the degradation of habitat, poaching of prey and conflict with people; IUCN 2006a, b).

With the intention of creating the strongest possible incentive for the trophy hunting industry to take responsibility for improving its practices and regulations in ways that maximise the benefits to lion conservation, one solution to this dilemma would be to impose stricter conditions linked to conservation gain for the issuance of any lion trophy import permits to the UK. There are, of course, already strict conditions in CITES as implemented by the EU CITES Scientific Authorities through the Scientific Review Group (SRG). CITES conditions require that the trophy lion had been hunted according to regulations that avoided a significant detrimental impact on the lion population from which it came, so evidence of this, and encouragement to enhance conservation, could be strengthened. These dual goals, recommended to the UK government, align with those of the US Fish and Wildlife Service, which deem that, amongst other conditions, the import of any lion trophy to the USA should be contingent upon the management of lions benefiting the species in the wild (US Fish and Wildlife Service 2015). Under this scenario, the UK acts directly by permitting the importation of lion trophies only if stringent conditions that benefit lion conservation are met, and acts indirectly by convincing other nations to adopt those same conditions.

The main positive conservation enhancement associated with trophy hunting is securing habitat for both lions and other wildlife; that benefit is likely to be significant to lion conservation only in larger areas. Therefore, this report recommends setting a minimum size for areas from which trophy imports can even be considered; as a practical threshold, we suggest 500 km^2 to ensure that it is delivering conservation enhancements[32].

4.3.2 Possible options for stricter conditions

Current CITES requirements are that trophies can be approved for import where, at a minimum, it is demonstrated that hunting has no detrimental impact on the sustainability of the lion popula-

[32] *500 km^2 is not a firm cut-off for all scenarios, but is a necessarily somewhat arbitrary judgment on the smallest area usually likely to enable lions to be self-sustaining and ecologically functional, and deliver meaningful conservation benefits for lions (and other wildlife) at the landscape scale.*

tion; however, insofar as trophy hunting has been associated with over-harvesting, and declines in lion numbers, it is clear either that these requirements are not always properly applied, or the evidence to meet them has been inadequate. A second requirement could be added, namely that trophy hunting delivers conservation enhancement. A fundamental element of that enhancement is the maintenance of ecologically functional areas of lion habitat.

Although not necessarily prerequisites for trophy importation, UK government should also encourage additional benefits to conservation, e.g. anti-poaching patrols and/or wider co-benefits such as contributions to community wellbeing. This responsible custodianship of the wildlife estate might be considered appropriate requirements of any responsible business that relies upon wildlife use, whether that is consumptive (such as trophy hunting) or non-consumptive (such as eco-tourism).

The criteria for whether a lion trophy could be imported into the UK should be that its hunting (a) was unlikely to cause detriment to the lion population from which it was taken and (b) contributes to lion conservation. Although in CITES terms the burden of proof rests with the CITES exporting authority, there is a strong case that the requirement should be made of the industry to prove that lion trophies are from populations where (a) lion offtake is strictly regulated to levels that minimise the risk of extirpation and (b) 500 km ^{2} or more of wildlife habitat is maintained within the hunting zone. These conditions should sit alongside other requirements of a high code of professional practice, ensuring for example that robust animal welfare standards are met.

However, lions are hunted from populations with different conservation status, and under widely different conditions, in countries facing variously punishing poverty and infrastructural challenges, so these general principles need to be tuned accordingly. We propose categorising hunting operations into three categories, with varying import conditions. We propose that the UK takes the lead in an international effort to categorise hunting operations according to the sustainability of their practice as set out below, and applies concomitant import regimes with an effective import ban from the least sustainable operations.

We strongly recommend a best-practice approach based on robust and on-going surveys of lion populations and long-term population trends and threats, to obtain precise data from which a safe offtake can be calculated, and on the consequences of trophy hunting and other threats. However, due to constraints such as funding, there is a need to consider other methods, at least in the short-term, for ensuring that offtake is not detrimental.

It is incumbent upon the hunting area management to demonstrate that its lion hunting operations are sustainably managed. We would recommend accepting these methods of demonstrating appropriate levels of sustainability:

- Monitoring data to show that lion populations are sustainably managed (this would be considered best practice)
- Data to show that the population is managed using age-restricted hunting, aiming for an ideal threshold of $\geqslant$7 year old males

4.3.2.1 Best-practice: Lion populations are sustainably managed, as determined by professional-standard science-based monitoring

In order to establish directly that trophy hunting of lions is sustainable, a prerequisite is that reliable, standardised, and independently verifiable surveys are conducted in the hunting area. Possible methods could include spoor counts (Funston et al. 2010), camera-trapping (Cusack et al. 2015) or by individual lion recognition depending on local circumstances. Once the lion population has been surveyed the information can be fed into a harvest rate model, such as that proposed by Caro et al. (2009), to calculate an appropriate, scientifically-based quota. Assuming the population is well managed and no external factors are jeopardising it, the harvest model should ensure that the hunted population increases or remains stable.

Within an appropriate monitoring system, successive surveys will reveal trends in the lion population, and should demonstrate sustainability. If it is increasing or stable within the hunting area (without causing negative impacts on any adjacent area), then there should be no grounds for significant concern that hunting is detrimental. Hunting areas that have achieved these 'ideal' conditions of an independently stable or increasing lion population would be eligible for best-practice hunting status, and could be advertised as such to responsible hunters.

4.3.2.2 Age-based harvesting

Two methods have been proposed for implementing age-based lion trophy hunting. One model would be to limit hunting to Creel et al.'s (2016) conservative prescription (i.e. only harvesting $\geqslant$7 year old males at a level not exceeding 0.5 males per 1,000 km^2 – unless there is clear scientific evidence that the population can sustain a higher offtake without supplementation – with resting periods. As described above, this should carry a low risk of population extirpation and

still keep land in the lion estate[33]).

Alternatively, an option would be the implementation and enforcement of an adaptive age-based quota system. Such systems have been trialled in Mozambique's Niassa National Reserve and adopted in Zimbabwe, with apparent benefits to lion conservation. Each hunted lion results in points being awarded to (or taken away from) the outfitter based on the age of the lion, with the aim of rewarding hunters for hunting older males (ideally of $\geqslant$7 years) and penalising them for hunting younger males.

An example of a possible points-based system (which may have to be adapted depending on the lion population) is shown in Appendix D.

4.3.2.3 Interim scenario

If a hunting block failed to qualify under the suggested criteria above, then the area would not be considered suitable for importing trophies into the UK until it qualified for one of them. Mindful of the risk of such land being lost from the lion estate, this disqualification might, at the discretion of the UK importing authorities, be postponed for a grace period of up to 3 years under very strict criteria and annual review by the national committee. For continuation of the grace period within those 3 years, the managers should demonstrate at each annual review that significant progress has been made towards implementing the necessary criteria. While it takes time for changes to take full effect, Zimbabwe has seen marked improvements with benefits for lion conservation within three years so that should be a sufficient period for change. During any grace period, lion trophy hunting should be limited to a minimum area and age-based quota, such as a maximum of 0.5 lions 1,000 km^{-2} aged $\geqslant$7 years, or similar precautionary figure calculated to be locally appropriate. Failure to meet the required conditions after the grace period would result in a moratorium on UK imports from the area until they are in place. In these circumstances, every effort should be made to ensure that the land was not lost from the lion estate. This scenario is intended to ensure minimal detrimental impact on the lion population during the grace period, while incentivising improved management that will benefit lion conservation.

[33] *When considering a precautionary off-take that will be sustainable we have followed Creel et al.'s (2016) simulation as a safe starting point. However, the number of male lions that can be hunted sustainably will obviously vary with their population density and this will certainly vary between populations and may vary in any one population at different times.*

4.3.2.4 Dealing with areas which do not meet the desired conditions

Trophy hunting areas whose management does not meet the conditions set out in the three systems described above would not usually be able to import their trophies into the UK. In the highly undesirable event that a hunted lion population is declining unsustainably, under any of these systems, and thus that hunting further lions would risk additive mortality and worsening the conservation of lions, then no import permit would normally be issued. Indeed, under circumstances where a hunted population is declining unsustainably best hunting practice would normally not countenance further hunting until the population was stable, and the strongest pressure should be applied to the operator to remedy the situation. However, we are mindful of a scenario that, although perhaps uncommon, could perversely damage lion conservation. That is, if the cessation of lion hunting caused the financial viability of the hunting operation to collapse and thereby the land to be converted to agriculture and lost, effectively irretrievably, from the wildlife estate. Where the risk of this outcome was imminent, the local auditing committee should look assiduously, on a case-by-case basis, for any interim steps to forestall the loss of land from the wildlife estate – this being the ultimate disbenefit to conservation. A judgement would have to be made, with lion conservation as the criterion, on whether a short, interim period of grace, perhaps involving a very low quota, was justifiable on the grounds of providing sufficient respite to enable the situation to be remedied and the lion population returned to a sustainable state and the area retained for wildlife.

4.3.3 Notes on scale and conditions of import

4.3.3.1 Recommended scale at which criteria are applied

The foregoing criteria should ideally be applied at ***the scale of the hunting area and not the national level***. This is because, while exports and imports are legally conducted at a national scale, allowing imports only from a country where all operators have implemented best-practice hunting would disincentivise good operators within a poorly-regulated country and would therefore risk damage to lion conservation. There is already precedent for this scale of operation – for example, the EU approved trophy imports from Niassa due its good management rather than the whole of Mozambique (Sigsworth, pers. comm.). The exporting country should, via an independent panel

of stakeholders, transparently assess its hunting areas and report (with requisite proof) which ones fulfil the criteria above, and the UK Government could determine the scale of imports depending on the extent of compliance.

4.3.3.2 Verification of hunting practices

Each lion-hunting country should have an independent, competent and inclusive committee that is tasked with regulating and enforcing hunting practices. Ideally committees of this sort would be overseen by an independent international organization such as International Organisation for Standardisation (ISO). Their remit should involve the following components, some of which have also been recommended by Di Minin et al. (2016):

i. Auditing to ensure that lion monitoring practices (where they are in place; e.g. for the gold standard scenario) meet the required standards

ii. Setting quotas where necessary, i.e. based on the results of the population monitoring (for the gold-standard blocks) or based on the adaptive points system

iii. Ensuring that minimal quotas (e.g. of 0.5 lions 1,000 km^{-2} or less for low-density areas) are adhered to, unless there is clear scientific evidence that the population can sustain a higher level

iv. Encouraging certification of hunting-block operators modelled after a well-defined system such as FSC, etc., and which should ideally require considerable investments by the operator in anti-poaching, community benefit programmes etc.

v. Facilitating training of Professional Hunters regarding field assessment of lion age (e.g. Miller et al. 2016) and helping set formal appropriate standards for lion hunts, particularly with regard to welfare concerns (e.g. demonstrating adequate evidence of competence in shooting and other necessary skills, rapid dispatch of wounded animals, using large-bore rifles, no night-hunting, etc.)

vi. Ensuring transparency of the process: there should be full disclosure to the public of results and reasons for block allocations (which should be allocated in order to maximise the funds available for conservation), results of lion surveys, results of trophy age verification trophy inspection, offtake levels and other relevant information, and all records (e.g. of samples for lion ageing) must be kept for any later inspection

vii. Ensuring compliance, so that the same criteria are imposed on all block holders, enabling independent observers to be placed without advance warning on

trophy hunts, and ensuring that trophies and permits are confiscated if illegal practices are discovered, and that operators who break the laws are barred from future hunting

viii. Verifying the age of trophy hunted animals before export. This should be based on the following information:

- *Hunt report forms confirming information such as the date and location of the hunt.* These forms are also required to be completed for blocks even if no successful lion hunt is completed in that area that year in order to encourage complete information and discourage underreporting.
- *Photos of the lion immediately postmortem*, to allow inspection of a range of indicators of age, e.g. mane development, facial markings and scars, nose and teeth colour. The photos must be stamped with the date and time or they would be considered ineligible.
- *X-rays of the upper premolar PM2 and examination the degree of pulp closure in that tooth*, as this has been shown to be a very accurate measure of lion age (White et al. 2016). Both the upper premolars should be presented to the inspection team to reduce the chance of fraud. Presentation of the skull will also allow wear on the premolars and canines to be easily judged – this could be an alternative method of age estimation if an X-ray is not possible, but all efforts should be made to obtain the X-rays. It would also be desirable to take and bank DNA from all hunted lions.

5. An overview: Framing trophy hunting in the context of wider lion conservation

Although many of the topics covered in this report are hotly debated – such as the amount of revenue generated by trophy hunting, or its replaceability with photo-tourism – some points are beyond debate. Key amongst those is that the lion – one of the world's most iconic species – has undergone severe declines in numbers and range over the past few decades. Lions now remain in only 8% of their historic range, with fewer wild lions now thought to exist in Africa than rhinos (Bauer et al. 2016). Nobody knows how many lions there were in Africa a century ago, but the widely quoted speculation that there were about 200,000 is a tenfold contrast with current estimates closer to 20,000 (Bauer et al. 2016).

African lion populations are likely to be to be declining everywhere, except in four southern countries (Botswana, Namibia, South Africa, and Zimbabwe; Bauer et al. 2015). The contrast between countries in southern Africa and the rest of the continent is related to their lower human population densities, better management budgets and the less damaging impacts on prey abundance and lion by-catch of unsustainable and increasingly commercialized bushmeat trade. Furthermore, Packer et al. (2013b) showed that presence of wildlife-proof fencing, which is more common in southern Africa, was an important determinant of short-term population trends. Awkwardly, the populations that seem to be declining fastest are also those that are least well-monitored (and probably have the least conservation effort), so inadequate data may be shrouding an even worse situation. However, Bauer et al.'s (2015) population models suggest that the chance of populations declining by half over the next two decades is 67% in West and Central Africa and 37% in East Africa. So it is indisputable that effective, range-wide lion conservation strategies are urgently needed to halt this precipitous decline.

The overarching priority is to secure and better manage existing populations of lions – although there is a pressing need for more surveys of lion populations to assess numbers and trends. Dickman et al. (in prep.) used the latest available data and concluded that there are only six remaining populations (Selous-Niassa, Serengeti-Mara, Kavango-Zambezi, Greater Limpopo, Katavi-Ruaha and Kgalagadi) with more than 1,000 lions. These 6 are amongst 60 priority areas where lions are far from secure, over half of them with fewer than 100 lions left. An apt conservation slogan, and call to arms, would therefore

be: *secure the six, and save the sixty.*

Rising to this challenge will require us to secure and better manage existing protected areas (which form the core of lion populations), establish and monitor lion presence and population trends across lion range, improve the economic security of local people to reduce the intensity of bushmeat poaching, and ensure that people have some power over wildlife on their land and receive sufficient economic benefits from their presence to outweigh any costs and incentivise their protection.

These steps cannot be taken by conservationists alone – they will require effective collaboration across a huge diversity of stakeholders, including protected area managers, development experts, economists, national and local governments, and those people who live with lions on their land every day. Most importantly, enacting real change at a range-wide scale will require a level of funding that is orders of magnitude higher than that allocated to wildlife conservation today. For example, Panthera et al. (2016) estimate that just effectively managing all protected areas within current lion range would require an annual budget of at least US$1.25 billion – and many lions live outside those protected areas, very many of them on trophy hunting concessions.

Especially because constellations of threats may interact, and because the impacts of each threat may often be difficult to measure, it is hard to be precise when ranking them, and the ranking anyway varies from place to place. Nonetheless, overall the major threats to lions are the loss and degradation of habitat, the loss of prey, and conflict with people over livestock, and those pressures are exacerbated when the lion populations being affected are small, isolated and poorly managed, as is often the case (IUCN 2006a, b; Henschel et al. 2014). Experts agree that – certainly at a national and regional scale – trophy hunting ranks low amongst the threats to lion populations (IUCN 2006a, b), and that it can, perhaps counter-intuitively, have positive impacts through habitat protection and funding national wildlife agencies (Di Minin et al. 2016; IUCN 2016). The fact that trophy hunting occurs in an area does not necessarily make it a threat to the lion population there, although it can be.

So, trophy hunting can be a locally important threat to lion conservation, and should be fiercely regulated to avoid this. A broader perspective, however, ranks trophy hunting generally not in the first division of threats to lion conservation. Scanning the horizon, the greatest threats over the next few decades are likely to descend from the increasing footprint of a human population set to double, or more, by 2050. With this perspective, the real challenge for the UK Government, and the community of those concerned for this iconic species

(and all the species for which it is an ambassador), is to develop holistic conservation strategies likely to require long-term partnerships with stakeholders across the world, chiefly the Governments and local people in countries that still manage lions.

5.1 Summary of lion trophy hunting in the context of conservation

So, finally to take stock, why is trophy hunting of lions a topic of concern to conservation? Because lions are charismatic top predators, already classified as threatened or endangered (depending on the area) by the IUCN and demonstrably declining fast in parts of their range, and trophy hunting is an obvious concern because it involves killing them. There are two categories of reasons why this may attract the attention of conservationists and wider society. First, the killing of individuals of a threatened species for sport may be ethically unacceptable to some people and for those that hold this as a moral absolute, trophy hunting of wild lions (and, obviously, farmed lions) will be ruled out. Second, for those who could countenance sport hunting of a threatened species, perhaps on utilitarian grounds of securing a greater good to conservation such as habitat protection (Macdonald et al. 2016b), the killing of lions nonetheless raises two obvious fears of over-harvest and thus unsustainability. First, lions are difficult to count and therefore harvests may be miscalculated and, anyway, there is an incentive to over-harvest for short-term profit, and documented evidence shows that this happens (sometimes with dire consequences that have drawn a comparison with strip-mining; Packer 2015). Trophy hunting is most straightforwardly[34] acceptable to conservation if it is demonstrably sustainable (it should also adhere to high standards of animal welfare), and demonstrating

[34] *The adverb 'straightforwardly' acceptable is not a descent into weasel words, but a caveat necessary to take account of argument in extremis with respect to the priority of retaining land in the lion estate and under wildlife use. The straightforward case is that trophy hunting is demonstrably sustainable, and that demonstration necessitates monitoring data, and therefore for trophy hunting to be acceptable there must be monitoring data and they must demonstrate sustainability. This should be the driving logic behind the regulation of trophy hunting as a potential contributor to lion conservation. However, and without relenting on the drive to demand high standards of trophy hunting, or other uses of wildlife, the logical possibility of an extreme possibility requires mention: even undesirably unsustainable trophy hunting may, in the short term, 'buy time' in keeping land in the lion estate and, irreversibly, out of agriculture, and this situation, while infuriating and lamentable, may be more tolerable than losing the land to wildlife.*

its sustainability requires adequate data on lion numbers and their ages, ergo trophy hunting is straightforwardly acceptable only where lion numbers are monitored – and there are direct and indirect methods of doing this.

The most strongly evidenced benefit of trophy hunting to lion conservation is that it gives lions monetary value, which can provide a marginal economic advantage to keeping some land under wildlife use that would otherwise more profitably be converted to other uses and thereby lost from the lion estate (at a time when this is already shrinking perilously). All else being equal, there might be no difference in the conservation outcome if lions are given the necessary monetary value by trophy hunting or by some other means (for example, some form of international payment to encourage coexistence; Dickman et al. 2011). However, all else is often not equal; killing animals that are members of complex societies where they will be survived by sentient companions capable of behavioural and psychological perturbation, may contribute to a mood in at least some sections of society that, even if sustainable and a benefit to conservation, hunting lions for sport is a recreation that is not compatible with 21st-century civilization. A plausible speculation is that this opinion will soon prevail (notwithstanding clear cultural differences between East and West, North and South). Insofar as this creates pressure for a ban on trophy hunting it also risks unintended consequences for lion conservation if it causes the marginal value of land previously retained under wildlife use for hunting to fall below that for non-wildlife uses (such as farming), and thus the lion estate to be diminished. Anticipating that possibility, there is an urgent imperative to find alternative means of giving those threatened parts of the lion estate sufficient monetary value to prevent their degradation. Indeed, the report strongly re-emphasises Bauer et al.'s (2015) conclusion that unless political and funding commitments are scaled up to address mounting levels of threat, lions may disappear from most of Africa.

It seems that public opinion, in many places, is strongly against trophy hunting, particularly of threatened species (Macdonald et al. 2016a). This creates pressure for a ban on trophy hunting, but also risks unintended consequences for lion conservation. This report acknowledges that where there is evidence of scientifically-based regulation that is strictly enforced, lion hunting can contribute to lion conservation, and that this constitutes a good reason to tolerate it at least on land that might otherwise be lost to the lion estate. However, societal pressure may stop this recreation; were this to happen before some alternative means of giving lions monetary value were in place (where photo-tourism cannot do so), there are grounds to be fearful of serious detriment to the lions' already deteriorating conservation status. In this regard, Macdonald et al. (2016a)

contrast the consequences of a jump versus a journey: a precipitate jump to ending lion trophy hunting might risk grave unintended consequences for the species' conservation, consequences that could be avoided by a carefully planned journey to that end. An obvious, and perhaps the only plausible, mechanism to achieve this would be some form of international payment to encourage coexistence with lions; to the nearest order of magnitude, and considering only the costs of substituting other land uses for trophy hunting, this could cost as much as the US$1.25 billion estimates by Panthera et al. (2016) adequately to safeguard current protected areas for lions. For perspective, and while mindful that society may face parallel expenses in funding custody of other global commons, the amount needed seems less daunting when we realise that US$12 billion is spent annually in Europe and the US on perfume alone[35]. Until such a mechanism is in place, the risk to lion conservation of a complete ban on trophy hunting is too great to take, but in the meantime the establishment of strictly enforced regulations to ensure that trophy hunting does benefit lion conservation is a priority.

[35] http://www.worldwatch.org/node/764

KWALATA SAFARIS, LTD.
Address, 6980 KATANGA ROAD LUSAKA
Operator email: kwalatapeter@yahoo.com

I. DESCRIPTION OF COMPANY AND CONCESSION

Kwalata Safari Company, Ltd. has been operating in Lower Lupande Concession since April 2002. The concession provides habitat for a range of species including buffalo, lion, hippo, kudu, leopard, elephant, impala, bushbuck, hyena, warthog, zebra, giraffe, and waterbuck. Our concession is about 1511 kilometer squared and is in the South Luangwa Safari Area. Lower Lupande is rated under Zambia Government Legislation as one of the Prime Hunting Blocks in Zambia due to the abundance of wild life and cats. We have a lease with the Wildlife Authority for seven years renewable which started in 2015 after the new allocations of hunting blocks in Zambia with the new Government.

The company is a partnership between Peter Chipman and Zaeed Patel and has been operational for more than fourteen years. We employ three professional hunters, four game trackers, ten anti-poaching scouts and eight camp staff (cooks, cleaning, miscellaneous). Altogether our operations support at least 100 dependents in local villages apart from the local employed camp staff and scouts.

We have a written concession plan with anti-poaching and community components.

II. ANTI-POACHING COMPONENT

Kwalata Safari Company maintains two five-man anti-poaching teams at an annual cost of over $ 25000. Each team is equipped with a four-by-four vehicle, a motorbike, uniforms and boots, tents, rations, and a satellite phone. Our teams closely cooperate with the Wildlife Authority to conduct almost daily patrols of the concession and the border of the South Luangwa National Park. We supply rations at least twice per month to the government game scouts to ensure they are sufficiently equipped for the patrols as well as transport support and more over and above the above mentioned amount per year.

Our contract with the local community requires that part of the revenues paid to the community be used to fund at least six community game scouts, and additionally we supply rations at least twice per month to these scouts.

We heavily patrol our area, conducting approximately one patrol per day by vehicle and foot. In the past year, our teams picked up about 1000 snares, 40 gin traps, and two poisoned licks. Removing snares protects the lion and wildlife population by reducing incidental snaring. Over the past year we arrested more than ten poachers, confiscated three bicycles and five muzzle loaders from them, as well as recovered 14 weapons total. We found two elephant carcasses each having tusks removed, the bones of one impala, some evidence of illegal logging, and a Leopard with a snare wound.

If needed, we subsidize the government game scouts. Every month we provide one week's rations to support a dozen Wildlife Authority scouts and contribute $ 500 in petrol to the Wildlife Authority.

We also send out road crews approximately every two weeks to check the condition of the roads in the concession, to ensure we are able to patrol effectively.



In the picture above wire snares recovered from poachers



In the picture above an elephant which was poached had its tusks removed



In the picture above a Leopard skin recovered from poachers by our vigilant game scouts.



In the picture above our Scouts being prepared to go on Patrols

In 2015 Kwalata Safari Company spent almost $ 57400 in our blocks on anti-poaching patrols, equipment, and assistance to the Wildlife Authority and community scouts, including by providing 6000 liters of diesel for patrol vehicles. We recorded 363 patrol days and well above 2000 patrol hours. And made over $ 4200 in payments of rewards. A breakdown of spending on anti-poaching is below.

Item	Spend (USD)	Notes
Scout salaries	18000	Directly paid and some subsidies to WA
Scout equipment	5000	Clothing, vehicles, rations, phones, tents, etc.
Diesel / petrol	7700	For scouts and WA
Rations for WA and community scouts	6500	
Micro light rental and fuel	16000	Including time donated to WA
Rewards	4200	For information and arrests
TOTAL	$ 57400	

Our concession agreement requires that we have an anti-poaching program/plan and report about it to the Wildlife Authority. The Wildlife Authority considers our contributions in determining whether to renew the concession.

III. COMMUNITY PARTICIPATION

A. Community Assistance Component

We make contributions to the two closest villages which are Malama and Kakumbi.

We pledge an annual contribution of at least $ 15000 in projects to each of two villages. And in return ask for a list of preferred projects of witch we develop a work-plan in consultation with village leaders and citizens to fund and supply projects and require a measure of community contribution to each project either through a council donation or more frequently, through donations of time by workers. In 2015 we funded and supplied the following projects at each village's choice:

Village	Projects	Amounts (USD)
Village 1	Renovations of schools	18100
Village 2	Designing and constructing village office	3100
	Funding youth sports league including transport	1900
	Providing new equipment for village game scouts	800
	Paying teacher salary and school fees for poor children	6100
	Digging new borehole and building pump station	3500
		15400
	TOTAL	$ 33500

In addition to these direct contributions, we pledge to distribute at least 50% of game meat harvested to the villages. The villages have the choice to eat the meat or sell it. In 2011 the value of this meat was $ 30000. 2012 the value was $ 33000. 2015 the value was $ 27500.

Our concession agreement requires we have a community assistance program/plan and report on the program to the Wildlife Authority. The Wildlife Authority considers these contributions in determining whether to renew our lease.

B. Conflict Control

We also take reports from villagers about problem animals and do our best to keep elephant out of community gardens during harvest. We also maintain an approximately $ 12000 fund of client donations which we use for community compensation. In 2015 we received 82 reports of problem animals and we made it through the entire season without a problem animal kill. We paid out $ 2650 in compensation for lost livestock and crops.

IV. HABITAT PROTECTION AND CONSERVATION DEVELOPMENT

We have enhanced water infrastructure for wildlife in our concession by maintaining four pans to increase water supply and carrying capacity of the concession which gives allot of Antelope Species for Lion/Leopard food chain and habitat for their sustainable and healthy survival.

V. OTHER INFORMATION

A. Prey Base

Kwalata Safari Company's anti-poaching efforts, water provision, and fire management have allowed the lion prey base in our concession to grow over the past five years. We estimate that our Buffalo and Plains Game populations have shown an increase of 15-20% per annum. In 2014 our Wildlife Authorities flew over the Game Management Areas in a large-mammal survey and counted more than 1000 buffalo on average.

B. Lion Population Tracking

Lion are notoriously difficult to survey or census. To track the lion population trend in our concession, Kwalata Safari Company maintains a lion sightings record in form of camera pictures taken as well as trail camera pictures, sightings, spoor and footprints on individual, groups and passing through cats. Because we keep tabs on the lion in our concession, we are assured that the regulated, limited off take is sustainable. Our wildlife Authorities have also provided us with a data recording sheet to use on all Lion/Leopard Safaris as off 2015 to take record of sightings and record the activities on the specific safari being done. We have a 100% success on all our hunts.

C. Lion Aging Approach

Kwalata Safari Company has been following an age-based policy for African lion trophies since 2015, when we adopted this Policy after a mutual agreement with our wildlife Authorities and to be conservative in estimating age.

As a result of this, Lions have been passed up by a number of potential Lion before allowing a client to harvest a specimen that we have any doubt is of on age. We also don't allow any client to shoot a lion of which there is any doubt on the age limit if the lion looks anything less than 5 years of age but rather try and shoot a lion that looks more the like of more than 6 years of age.

In 2016, we successfully harvested mature (aged six or older) male lion up to our quota (of two). We have been able to harvest our full quota this year because our selectivity has resulted in more lion reaching an advanced age.

D. ELEPHANT HUNTING

Our Wildlife Authorities have put up a policy not to Harvest any Elephant that has its tusks weighing less than 15 kilograms. In view of this our Professional Hunters are instructed to not harvest an Elephant with weight in tusks of less than 20 kilograms at a minimum and to be very selective when Hunting Elephant by ensuring that they comply with this agreement. The wildlife authorities have put up stringent measures to any Professional Hunter who goes against this rule which may even include withdrawing his Professional Hunting License.

E. U.S. Hunters

Most of our clients are from the United States. These hunters have a conservation ethic and usually contribute above their fees to anti-poaching or our community compensation fund or community assistance programs.

CONCLUSION

Kwalata Safari Company's regulated, confirm that our sustainable-use based hunting program enhances the survival of the Lion and Elephant and we recognize that the Cat and Elephant hunts bought and booked by our American Clients contribute a higher percentage of income in the Safari Hunting and it is our obligation to share these finances with the communities who have played an important role to conserve this resource. We also realize that these species are a renewable resource and as such we will endeavor to provide suitable conditions for the reproduction and sustainability of these species with the allowance of our American Clients to keep coming and hunting the different species in Africa.



Signed: _____

Operator Name: Kwalata Safaris © LTD

Title: DIRECTOR

KWALATA SAFARIS, LTD.
Address, 6980 KATANGA ROAD LUSAKA
Operator email: kwalatapeter@yahoo.com

I. DESCRIPTION OF COMPANY AND CONCESSION

Kwalata Safari Company, Ltd. has been operating in Lower Lupande Concession since April 2002. The concession provides habitat for a range of species including buffalo, lion, hippo, kudu, leopard, elephant, impala, bushbuck, hyena, warthog, zebra, giraffe, and waterbuck. Our concession is about 1511 kilometer squared and is in the South Luangwa Safari Area. Lower Lupande is rated under Zambia Government Legislation as one of the Prime Hunting Blocks in Zambia due to the abundance of wild life and cats. We have a lease with the Wildlife Authority for seven years renewable which started in 2015 after the new allocations of hunting blocks in Zambia with the new Government.

The company is a partnership between Peter Chipman and Zaeed Patel and has been operational for more than fourteen years. We employ three professional hunters, four game trackers, ten anti-poaching scouts and eight camp staff (cooks, cleaning, miscellaneous). Altogether our operations support at least 100 dependents in local villages apart from the local employed camp staff and scouts.

We have a written concession plan with anti-poaching and community components.

II. ANTI-POACHING COMPONENT

Kwalata Safari Company maintains two five-man anti-poaching teams at an annual cost of over $ 25000. Each team is equipped with a four-by-four vehicle, a motorbike, uniforms and boots, tents, rations, and a satellite phone. Our teams closely cooperate with the Wildlife Authority to conduct almost daily patrols of the concession and the border of the South Luangwa National Park. We supply rations at least twice per month to the government game scouts to ensure they are sufficiently equipped for the patrols as well as transport support and more over and above the above mentioned amount per year.

Our contract with the local community requires that part of the revenues paid to the community be used to fund at least six community game scouts, and additionally we supply rations at least twice per month to these scouts.

We heavily patrol our area, conducting approximately one patrol per day by vehicle and foot. In the past year, our teams picked up about 1000 snares, 40 gin traps, and two poisoned licks. Removing snares protects the lion and wildlife population by reducing incidental snaring. Over the past year we arrested more than ten poachers, confiscated three bicycles and five muzzle loaders from them, as well as recovered 14 weapons total. We found two elephant carcasses each having tusks removed, the bones of one impala, some evidence of illegal logging, and a Leopard with a snare wound.

If needed, we subsidize the government game scouts. Every month we provide one week's rations to support a dozen Wildlife Authority scouts and contribute $ 500 in petrol to the Wildlife Authority.

We also send out road crews approximately every two weeks to check the condition of the roads in the concession, to ensure we are able to patrol effectively.



In the picture above wire snares recovered from poachers



In the picture above an elephant which was poached had its tusks removed



In the picture above a Leopard skin recovered from poachers by our vigilant game scouts.



In the picture above our Scouts being prepared to go on Patrols

In 2015 Kwalata Safari Company spent almost $ 57400 in our blocks on anti-poaching patrols, equipment, and assistance to the Wildlife Authority and community scouts, including by providing 6000 liters of diesel for patrol vehicles. We recorded 363 patrol days and well above 2000 patrol hours. And made over $ 4200 in payments of rewards. A breakdown of spending on anti-poaching is below.

Item	Spend (USD)	Notes
Scout salaries	18000	Directly paid and some subsidies to WA
Scout equipment	5000	Clothing, vehicles, rations, phones, tents, etc.
Diesel / petrol	7700	For scouts and WA
Rations for WA and community scouts	6500	
Micro light rental and fuel	16000	Including time donated to WA
Rewards	4200	For information and arrests
TOTAL	$ 57400	

Our concession agreement requires that we have an anti-poaching program/plan and report about it to the Wildlife Authority. The Wildlife Authority considers our contributions in determining whether to renew the concession.

III. COMMUNITY PARTICIPATION

A. Community Assistance Component

We make contributions to the two closest villages which are Malama and Kakumbi.

We pledge an annual contribution of at least $ 15000 in projects to each of two villages. And in return ask for a list of preferred projects of witch we develop a work-plan in consultation with village leaders and citizens to fund and supply projects and require a measure of community contribution to each project either through a council donation or more frequently, through donations of time by workers. In 2015 we funded and supplied the following projects at each village's choice:

Village	Projects	Amounts (USD)
Village 1	Renovations of schools	18100
Village 2	Designing and constructing village office	3100
	Funding youth sports league including transport	1900
	Providing new equipment for village game scouts	800
	Paying teacher salary and school fees for poor children	6100
	Digging new borehole and building pump station	3500
		15400
	TOTAL	$ 33500

In addition to these direct contributions, we pledge to distribute at least 50% of game meat harvested to the villages. The villages have the choice to eat the meat or sell it. In 2011 the value of this meat was $ 30000. 2012 the value was $ 33000. 2015 the value was $ 27500.

Our concession agreement requires we have a community assistance program/plan and report on the program to the Wildlife Authority. The Wildlife Authority considers these contributions in determining whether to renew our lease.

B. Conflict Control

We also take reports from villagers about problem animals and do our best to keep elephant out of community gardens during harvest. We also maintain an approximately $ 12000 fund of client donations which we use for community compensation. In 2015 we received 82 reports of problem animals and we made it through the entire season without a problem animal kill. We paid out $ 2650 in compensation for lost livestock and crops.

IV. HABITAT PROTECTION AND CONSERVATION DEVELOPMENT

We have enhanced water infrastructure for wildlife in our concession by maintaining four pans to increase water supply and carrying capacity of the concession which gives allot of Antelope Species for Lion/Leopard food chain and habitat for their sustainable and healthy survival.

V. OTHER INFORMATION

A. Prey Base

Kwalata Safari Company's anti-poaching efforts, water provision, and fire management have allowed the lion prey base in our concession to grow over the past five years. We estimate that our Buffalo and Plains Game populations have shown an increase of 15-20% per annum. In 2014 our Wildlife Authorities flew over the Game Management Areas in a large-mammal survey and counted more than 1000 buffalo on average.

B. Lion Population Tracking

Lion are notoriously difficult to survey or census. To track the lion population trend in our concession, Kwalata Safari Company maintains a lion sightings record in form of camera pictures taken as well as trail camera pictures, sightings, spoor and footprints on individual, groups and passing through cats. Because we keep tabs on the lion in our concession, we are assured that the regulated, limited off take is sustainable. Our wildlife Authorities have also provided us with a data recording sheet to use on all Lion/Leopard Safaris as off 2015 to take record of sightings and record the activities on the specific safari being done. We have a 100% success on all our hunts.

C. Lion Aging Approach

Kwalata Safari Company has been following an age-based policy for African lion trophies since 2015, when we adopted this Policy after a mutual agreement with our wildlife Authorities and to be conservative in estimating age.

As a result of this, Lions have been passed up by a number of potential Lion before allowing a client to harvest a specimen that we have any doubt is of on age. We also don't allow any client to shoot a lion of which there is any doubt on the age limit if the lion looks anything less than 5 years of age but rather try and shoot a lion that looks more the like of more than 6 years of age.

In 2016, we successfully harvested mature (aged six or older) male lion up to our quota (of two). We have been able to harvest our full quota this year because our selectivity has resulted in more lion reaching an advanced age.

D. ELEPHANT HUNTING

Our Wildlife Authorities have put up a policy not to Harvest any Elephant that has its tusks weighing less than 15 kilograms. In view of this our Professional Hunters are instructed to not harvest an Elephant with weight in tusks of less than 20 kilograms at a minimum and to be very selective when Hunting Elephant by ensuring that they comply with this agreement. The wildlife authorities have put up stringent measures to any Professional Hunter who goes against this rule which may even include withdrawing his Professional Hunting License.

E. U.S. Hunters

Most of our clients are from the United States. These hunters have a conservation ethic and usually contribute above their fees to anti-poaching or our community compensation fund or community assistance programs.

CONCLUSION

Kwalata Safari Company's regulated, confirm that our sustainable-use based hunting program enhances the survival of the Lion and Elephant and we recognize that the Cat and Elephant hunts bought and booked by our American Clients contribute a higher percentage of income in the Safari Hunting and it is our obligation to share these finances with the communities who have played an important role to conserve this resource. We also realize that these species are a renewable resource and as such we will endeavor to provide suitable conditions for the reproduction and sustainability of these species with the allowance of our American Clients to keep coming and hunting the different species in Africa.



Signed: _____

Operator Name: Kwalata Safaris © LTD

Title: DIRECTOR

Fwd: Paper in review cited in Beyond Cecil docucment

Vannorman, Tim <tim_vannorman@fws.gov> Tue, Jan 3, 2017 at 9:38 AM
To: FWHQ DMA-BOP <fwhq_dma_bop@fws.gov>

All,

Some information on lions throughout Africa that Kathy has uncovered.

Tim

——— Forwarded message ———
From: **Moore, Kathleen** <kathleen_moore@fws.gov>
Date: Tue, Jan 3, 2017 at 8:51 AM
Subject: Re: Paper in review cited in Beyond Cecil docucment
To: Peter Lindsey <plindsey@panthera.org>
Cc: Michelle Gadd <michelle_gadd@fws.gov>, Tim Vannorman <tim_vannorman@fws.gov>

Thanks very much. Our office looks forward to seeing the document when you get word.

Can you also forward the affiliations of co-authors? Since that won't change it would be good to become familiar with those that i don't recognize.

Best,
Kathleen

On Mon, Jan 2, 2017 at 7:07 AM, Peter Lindsey <plindsey@panthera.org> wrote:

> Hi Kathleen,
>
> Here is the abstract of the paper.. As soon as it is accepted, I will send you the full version with all of the figures.
>
> **The performance of African protected areas for lions and their prey, determinants of success and key conservation threats**
>
> Lindsey, P.A. [1, 2†], Petracca, L. [1,3†], Funston, P.J. [1], Bauer, H. [4], Dickman, A. [4], Everatt, K. [5], Flyman, M. [6], Henschel, P. [1], Hinks, A. [4], Kasiki, S. [7], Loveridge, A.[4], Macdonald, D.W.[4], Mandisodza, R. [8], Mgoola, W. [9] Miller, S[10, 11]., Nazerali, S.[12], Siege, L. [13], Uiseb, K. [14], Hunter, L. [1]
>
> **Abstract**
>
> -
>
> Using surveys of experts associated with 186 sites across 24 countries, we assessed the effectiveness of African protected areas (PAs) at conserving lions and their prey, identified factors that influence conservation effectiveness, and identified patterns in the severity of various threats. Less than one third of sampled PAs conserve lions at ≥50% of their estimated carrying capacity (K), and less than half conserve lion prey species at ≥50% of K. Given adequate management, PAs could theoretically support up to 4x the total extant population of wild African lions (~83,000), providing a measurable benchmark for future conservation efforts. The performance of PAs shows marked geographic variation, and in several countries there is a need for a significant elevation in conservation effort. Bushmeat poaching was identified as the most serious threat to both lions and to wildlife in general. The severity of threats to wildlife in PAs and the performance of prey populations were best predicted by geographic-socioeconomic variables related to the size of PAs, whether

people were settled within PAs, human/livestock densities in neighbouring areas and national economic indicators. However, conservation outcomes for lions were best explained by management variables. PAs tended to be more effective for conserving lions and/or their prey where management budgets were higher, where photographic tourism was the primary land use, and, for prey, where fencing was present. Lions and prey fared less well relative to their estimated potential carrying capacities in poorer countries, where people were settled within PAs and where PAs were used for neither photographic tourism nor trophy hunting.

Regards,

Peter

From: "Moore, Kathleen" <kathleen_moore@fws.gov>
Date: Wednesday, 28 December 2016 at 13:04
To: Peter Lindsey <plindsey@panthera.org>
Cc: Michelle Gadd <michelle_gadd@fws.gov>, Tim Vannorman <tim_vannorman@fws.gov>
Subject: Re: Paper in review cited in Beyond Cecil docucment

Thank you Dr. Lindsey. Do you anticipate an acceptance date now that you have taken into account the peer review?

If you do not anticipate any more substantial changes to the document, it would be great to see it. I hesitate to quote anything just yet though until I get word from you that it has been accepted.

Thanks much,
Kathleen

On Fri, Dec 23, 2016 at 3:15 AM, Peter Lindsey <plindsey@panthera.org> wrote:

> Hi Kathleen
>
> That paper is about to be re-submitted to the journal, the changes that were requested by the reviewers having been made.
>
> It will thus hopefully be published soon. I will send it to you when it comes out
>
> In the meantime, I would be happy to provide you the nutshell elements relating to hunting in the meantime, if you would like?
>
> Best regards
>
> Peter
>
> **From:** Moore, Kathleen [mailto:kathleen_moore@fws.gov]
> **Sent:** Thursday, December 22, 2016 9:49 PM

To: Peter Lindsey <plindsey@panthera.org>
Cc: Michelle Gadd <michelle_gadd@fws.gov>; Tim Vannorman <tim_vannorman@fws.gov>
Subject: Paper in review cited in Beyond Cecil docucment

Hi Dr. Lindsay,

Hope this message finds you well. I was not able to make your acquaintance last you were in the DC area but I am part of Mr. Van Norman's team here in the Division of Management Authority..

As you are well aware, the U.S. Fish and Wildlife Service is tasked with reviewing the potential import from U.S. hunters who visit various African countries to harvest lions for the purpose of obtaining a personal sport hunted trophy. In reviewing various documents I came across the document mentioned above that cites an in review paper by you. Has this paper been accepted to a journal as yet? If so, could we please obtain a copy?

Thanks very much.

Best regards,

Kathleen

--

Kathleen Moore

Senior Biologist

USFWS/Division of Management Authority

Branch of Permits, MS: IA

5275 Leesburg Pike

Falls Church, VA 22041-3803

1-800-358-2104 (Phone)

Check out the new CITES species database at **www.speciesplus.net** to find out more information about how species are listed and protected under the Convention.

--
Kathleen Moore
USFWS/Division of Management Authority
Branch of Permits, MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803

> 1-800-358-2104 (Phone)
>
> ***Check out the new CITES species database at **www.speciesplus.net** to find out more information about how species are listed and protected under the Convention.***

–
Kathleen Moore
USFWS/Division of Management Authority
Branch of Permits, MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803
1-800-358-2104 (Phone)

Check out the new CITES species database at **www.speciesplus.net** to find out more information about how species are listed and protected under the Convention.

–
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

***Sign up** for our e-newsletter to learn how we're working around the globe to protect species and their habitats!*

Vargas, Darcy <darcy_vargas@fws.gov>

Enhancement information in support of PRTs 03367C, 93398B, etc. (Zambia lion and elephant imports)

Regina A. Lennox <regina.lennox@conservationforce.org> Fri, Jan 13, 2017 at 12:50 PM
To: "Vannorman, Tim" <tim_vannorman@fws.gov>, "Vargas, Darcy" <darcy_vargas@fws.gov>
Cc: "John J. Jackson, III" <cf@conservationforce.org>

Dear Tim and Darcy,

Attached please find three reports from safari hunting operators demonstrating enhancement. You will receive import permit applications for 2017 lion trophies taken in Zambia, for clients who hunted with these operators. We request that you consider the attached reports in making an enhancement finding for 2017, and in making an enhancement finding in for the 2016 applications that we previously submitted (Robert Hixson (elephant and lion), Amanda Henson (lion), Stephen Crooks (lion), and Lawrence Rudolph (lion)).

These operators are: Nyamvu Safaris, Ltd., Mopane Safaris, Ltd., and Muchinga Adventures, Ltd. (for which you also received a 2016 enhancement report). Together they protect thousands of square kilometers of wildlife habitat in Zambia. Nyamvu Safaris operates in a previously depleted area, but since 2005 it has created and restored the Nyamvu Game Reserve through anti-poaching, community engagement, water provision, and restocking. The Game Reserve now supports healthy populations of lion, leopard, elephant, and other species. Mopane Safaris operates in Luembe-West Petauke Concession, a "secondary" area that they are protecting and stewarding. The same is true for Muchinga Adventures. After operating and growing the wildlife population on another concession for ten years, the company took over Chifunda GMA, and expects to have the same success, for the benefit of the Chifunda rural communities.

Each operator has significantly invested in anti-poaching, community support, habitat protection, and water provision so as to encourage the growth of local wildlife. For example:

Nyamvu and Mopane Safaris invested a total of over $60,000 in anti-poaching in 2015. This includes scout salaries and equipment (~$39,450), donations of petrol and rations to government rangers and community scouts (~$17,385), and rewards to local villagers for information on poachers (~$4,805), among other investments. Mopane Safaris took over its concession in 2015, so its initial anti-poaching investment is high. Nyamvu Safaris has been protecting the game reserve for over ten years, and the amount it has paid out in rewards has decreased every year, as the poaching has declined as the local community becomes more involved in conservation. These companies recorded an average of 328 patrol days and 2,184 anti-poaching patrol hours. In 2016, Muchinga Safaris invested approximately $90,500 in anti-poaching, which includes $48,000 in salaries, $8,000 in rations, $13,500 in fuel, and $7,000 in rewards. Anti-poaching patrols are conducted 365 days of the year. In 2015, the company collected 94 snares, 28 muzzle loaders and 7 shotguns.

These companies also heavily support rural communities. All have committed to sharing at least 50% of game meat harvested with local villages (60%+ for Nyamvu and Mopane Safaris). For Mopane Safaris, the total value of game meat contributed in 2015 was $24,371. Each company spends over $20,000 annually in community support, including the building of schools, clinics, roads, renovations to the traditional leader's home, and more, with a focus on education and healthcare. Muchinga has also committed to helping the local community develop a tourist camp, and provided $5,000 for this project, which increased business for the community by more than 300% in 2016.

The companies together employ 133 full-time staff and several hundred seasonal staff, which supports more than 1,000 local dependents. Each company maintains a conflict fund to compensate villagers damaged by elephant, lion, and other species. In 2015, Mopane Safaris paid $1,000 in compensation for damage to maize fields and $2,500 to the family of a person killed by an elephant. In 2016, Muchinga paid for the funeral of a person killed by a buffalo, and compensated farmers who lost livestock to a leopard, which avoided the leopard being controlled as a problem animal. The companies' community support, employment, and compensation programs link the livelihoods and benefits for local villagers to the conservation and protection of wildlife, and help to increase tolerance and ultimately, wildlife populations in these areas.

These companies rely on the revenue from licensed, regulated hunting to pay for their anti-poaching and community investment. For example, Muchinga Adventures relies on lion and elephant hunts for more than half its operating revenue. The companies all hunt sustainably. For instance, Nyamvu Game Reserve was not hunted for the first three years to allow game species to build up. All three companies have implemented an age restriction of six years for lion.

Only five lion have been hunted in the Nyamvu Game Reserve in the past 11 years. Muchinga Adventures was allocated a quota of one lion for 2016, but because the lion was aged and found to be over six years by the DNPW, the company has been allocated a second lion for the 2017 season (at almost 5,000 km2, the concession can sustainably support two lion on quota). As another example, both Nyamvu and Mopane Safaris have implemented size limits above-and-beyond Zambia's national requirement that elephant trophies exceed 15kg. The companies penalize their professional hunters if they harvest elephant with tusks below 20kg.

Notably, all three companies rely on U.S. hunters as clients. The companies and local villagers benefit from the additional donations and contributions made by these U.S. citizens, including anti-poaching donations and damage compensation donations.

Please let us know if you have questions about this information, and please consider it in making enhancement findings for lion and elephant imports from Zambia.

Best wishes,
Regina

Regina A. Lennox
Conservation Force
3240 S I-10 Service Road W, Suite 200
Metairie, Louisiana 70001 USA
504-837-1233 (office)
919-452-8652 (cell)
regina.lennox@conservationforce.org

---

3 attachments

MOPANE SAFARIS-REPORT FOR LION CONSERVATION.pdf
349K

NYAMVU SAFARIS-REPORT FOR LION CONSERVATION - Copy.pdf
577K

Muchinga Adventures Lion Enhancement Report 2017.pdf
155K

MOPANE SAFARIS, LTD.
Address, 515 FRANCISTOWN ROAD LIVINGSTONE
Operator email: karimtd@yahoo.com

I. DESCRIPTION OF COMPANY AND CONCESSION

Mopane Safaris, Ltd. has been operating in Luembe-West Petauke Concession since April 2015. The concession provides habitat for a range of species including lion, kudu, leopard, buffalo, and elephant. The concession is in Eastern Province of Zambia. The Area is along the Luangwa River and is about 3227 square kilo meters in connection and conjunction with Nyamu Game Reserve our other area. The Area is classified as Secondary Hunting Area. Mopane Safaris has entered into a Ten Year Lease agreement with the wildlife Authority and is renewable subject to conducting successful conservation records of the Ecological system.

Our company is a Limited Company whose Directors are Mr. Saeed Omar Abdul Karim and Mr. Chishimba Mumba. This concession was acquired in April 2015. In view of this Mopane Safaris has one resident Professional Hunter who also provides the functions and duties of a Camp Manager. Other employees include, four game trackers, twelve anti-poaching scouts, and six camp staff (cooks, cleaning, miscellaneous). We estimate a total of about 215 people to be direct beneficiaries from Mopane Safaris employees. These beneficiaries come from the local community.

We very much welcome the donations that are made by some clients from the United States of America as these go a long way in improving the quality of life in these rural communities of Zambia. In most circumstances these communities do not have an economic activity which can assist them raise money for school fees and medication. The only activities which they engage themselves in is farming which is done at subsistence level to only provide for their families. This therefore follows that Safari Hunting provides some economic benefit to these communities as it enable the employees to raise some money to send their children to school, buy School necessities and meet some basic healthcare requirements.

Safari hunting therefore helps not only meet some financial needs of these communities but also prevents them from Illegal Hunting Activities which have adverse effects on the population of the animals. It therefore follows that most of the revenue for Safari Hunting is derived from Hunting of Cats and Elephant. With this in mind Mopane Safaris, the Community and the Wildlife Authorities have an enormous task to prevent the Cats from going into extinction by providing a more robust anti–poaching system to prevent the extinction of cats in these concessions.

II. ANTI-POACHING COMPONENT

Mopane Safaris maintains four groups of anti-poaching teams. Each team consists of three men per team and is equipped with a 4x4 Land cruiser, uniforms and boots, tents, rations, and a satellite phone. The patrols are done in conjunction with the Wildlife Scouts. We supply rations at least twice per month to both the government game scouts and our village scouts to ensure they are sufficiently equipped for the patrols.



Fig I. Director and Resident Professional Hunter of Mopane Safaris Mr.Karim (Center) planning the Anti-Poaching Patrols with a wildlife officer and a member from the community.

Fig ii. In the Picture below some Ivory Tusks recovered from Poachers and weapons used for poaching.



In 2015, Mopane Safaris spent almost $ 30900 in Luembe-West Petauke Consession on anti-poaching patrols, equipment, and assistance to the Wildlife Authority and community scouts, including by providing 1450 liters of diesel for patrol vehicles. We recorded 328 patrol days and well above 1968 patrol hours. We also made over $ 2005 in payments of rewards to leads helping in the abduction of poachers. A breakdown of spending on anti-poaching is below.

Item	Spend (USD)	Notes
Scout salaries	11900	Directly paid and some subsidies to WA
Scout equipment	12450	Clothing, vehicles, rations, phones, tents, etc.
Diesel / petrol	1885	For scouts and WA
Rations for WA and community scouts	7800	
Rewards	2005	For information and arrests
TOTAL	$ 36040	

The concession agreement has a clause which requires Mopane Safaris to submit Annual reports on the Anti-Poaching Activities and patrols done in each particular year to the Wildlife Authorities. This report will be taken into account in 2025 whether to renew the concession or not.

III. COMMUNITY PARTICIPATION

A. Community Assistance Component

We make contributions to the community Resource Boards of about $ 25900 annually as per agreement which was entered into 2015 by Mopane Safaris, the Community and the Wildlife Authorities.

In addition to these direct contributions, we pledge to distribute at least 60% of game meat harvested to the villages. In 2015 the value was $ 24371.



Fig iii. Resident Professional Hunter and Director attending a community Meeting.

B. Conflict Control

We usually have reports of problem Animals mainly Elephants destroying crops for villagers and Human Animal conflict from Lions. $ 12000 has been set aside for compensation purposes when we have such occurrences. In 2015 we paid $ 1000 in compensation to maize fields that were damaged by Elephants to grain fields for Villagers. We further compensated a family whose member was attacked and killed by an Elephant and was one of our Village Scouts who had gone out of camp and on returning to camp the incident occurred. The total cost for compensation and funeral arrangements was $ 2500

IV. HABITAT PROTECTION AND CONSERVATION DEVELOPMENT

We have developed the water infrastructure for the exclusive use of wildlife in our concession. The infrastructure developed so far is natural pans which costs approximately $5000 to maintain in 2015 and 2016 respectively. The increased water supply increases the carrying capacity of the concession and the lion's prey base due to more game residing in the concession by finding water resource. The concession is along the Luangwa River and this makes it have smaller streams flowing in the concession creating more water points for animals. As a result we have a lot of Game in our concession which attracts Lion, Elephant and Leopard.

V. OTHER INFORMATION

A. Prey Base

Mopane Safaris in Luembe-West Petauke is still monitoring the population growth of the Lion, Leopard, Elephant and other species which will result from efforts done so far such as anti-poaching efforts, water provision, and fire management. Mopane Safaris will further engage the wildlife Authorities in monitoring the resources on the ground by position cameras in strategic Areas so as to monitor the Activities of the Game and Cats. Luembe is a secondary Area and as such we have applied more concerted efforts aimed at mitigating the impact of poaching that had characterized the Area for the years when we were not operating in the Area.

We also engaged the wildlife authorities to regulate resident Hunting by proposing that resident Hunting be temporarily stopped for five years so as to give room for animals to breed so as to improve the numbers in the Eco system in Luembe Game Management Area.

B. Lion Population Tracking

Lion is not easy to track and as such we are still developing tools which we will use to study the population of Lon in our Area. As at now we use Lion tracks and foot prints. Sightings by individuals and just the a few cameras which we used this year to monitor the size and age for Lion and Leopard.

C. Lion Aging Approach

Like other Safari Companies we have been following an age-based policy for African lion trophies since 2015, after adopting a mutual aging agreement with our wildlife Authorities, and to be conservative in estimating age.

A number of potential Lion Trophy were not hunted this year because of our company policy and selectiveness.

Our approach as a company from 2015 until 2025 when our concession will be due for renewal is to hunt Lion which has reached an advanced and mature age only of 6 years and above.

D. Elephant

Elephant Hunting in Luembe is also one of the High Income earners. Mopane Safaris is alive to the fact that Ivory is of high value on the world market and is on high demand in particular the Far East. Mopane Safaris therefore has put up a robust Anti-Poaching program to protect this rare species. In view of this we have a policy as company not to harvest any Elephant with Tusks weighing below 20 kilograms. We recognize the fact that it may be difficult to judge but we expect the Professional Hunters to exercise caution and use their judgment before allowing a client to hunt one. Professional Hunters have been given an allowable allowance of 1 kg so as not to go below the recommended threshold by the wildlife authorities of 15 Kilograms as a minimum shoot able size Elephant.

E. U.S. Hunters

Most of our clients are from the United States. These hunters have a conservation ethic and usually contribute above their fees to anti-poaching of our community compensation fund or community assistance programs.

CONCLUSION

Mopane Safaris regulated, sustainable-use based hunting program enhances the survival of the Lion, Leopard and Elephant and we recognize that the Cat and Elephant hunts bought and booked by our American Clients contribute a higher percentage of income in the Safari Hunting and it is our obligation to share these finances with the communities who have played an important role to conserve this resource. We also realize that these species are a renewable resource and as such we will endeavor to provide suitable conditions for the reproduction and sustainability of these species with the allowance of our American Clients to keep coming and hunting the different species in Africa.

Signed: _____

Operator Name: Saeed Karim

Title: Director

ZAMBIA LION ENHANCEMENT REPORT – CHIFUNDA GMA, NORTH LUANGWA

MUCHINGA ADVENTURES, LTD.
PO BOX 390003, LUMUMBA RD, LUSAKA ZAMBIA – CHIFUNDA GMA
JOHN AND LAURA DU PLOOY – jcrserviceszambia@gmail.com or
info@muchingahuntingsafaris.com

DECEMBER 2016

I. DESCRIPTION OF COMPANY AND CONCESSION

Muchinga Adventures Ltd (the company) has been operating in Chifunda GMA since March 2015. The concession is 4900 square kilometres in size and provides a habitat for baboon, buffalo, chobe bushbuck, common duiker, crocodile, grysbok, hippo, hyaena, cookson wildeebst, zebra, kudu, impala, puku, wild dog, elephant, leopard, lion and various other plains game and carnivore species. The concession is in the north Luangwa and has 70km of river frontage with the North Luangwa National Park. The area is a natural buffer zone for the national park where Frankfurt Zoological Society operates and protects the rhino. The lease is issued in partnership with the Chifunda GMA community, known as the Chifunda Community Resource Board, and the Zambia Wildlife Authority (ZAWA), now the newly named Department of National Parks and Wildlife (DNPW). This is our third lease agreement with ZAWA/DNPW, having operated in the adjacent concessions - Chanjuzi GMA and Nyaminga GMA from 2003 to 2012.

Muchinga Adventures Ltd was formed in 1993 and is a family owned and operated business. The du Plooy family have been in Zambia since the 1880's. The company is responsible for the full time employment of four full time professional hunters and several part time professional hunters, forty five camp staff members embracing trackers, skinners, cooks, waiters and general workers. Our operations support forty scouts and a further one hundred and thirty people gain employment through jobs that cover the airstrip, opening roads, creating fire breaks, infrastructure development and annual camp building. There are 2143 families in the Game Management Area with more than 7,000 children, many of whom have lost one or both parents. Our employment significantly contributes to the support of the rural community and supports more than seven hundred dependents.

As part of the Muchinga Adventures lease proposal there is a written concession plan that covers community and anti poaching responsibilities, Muchinga Adventures Ltd always exceed these commitments.

II. ANTI-POACHING

Muchinga Adventures Ltd is committed to a financial obligation each year towards law enforcement. Food rations have been supplied covering corn meal, cooking oil, fish, beans, sugar and salt. This allows for a further six patrols a month to be conducted in the Game Management Area. Each team is equipped with uniforms, boots and food rations. The company is committed to providing 210 litres of fuel per month to assist with resource monitoring of the wildlife, movement of the fishermen and spot checks at water sources throughout the Game Management Area. John du Plooy, the managing Director of Muchinga Adventures Ltd, is a senior honorary wildlife police officer and works closely with the Park

Ranger to monitor the activities in the concession. John is based in the concession for six months each year, with daily movements through the GMA monitoring unusual activity.

Frankfurt Zoological Society (FZS) already have a presence in the region due to the rhino project in the national park. Muchinga Adventures works closely with the DNPW, the community and FSZ,. Rather than doubling up on what FZS are doing they are invited to attend community meetings at the start of each safari season to discuss the next twelve months.

Last year it was identified that the scout's living conditions were not at a satisfactory level, this was creating hardship especially in the rainy season and resulting in a loss of skilled labour to the area. Muchinga Adventures provided roofs to forty houses for the scouts in the Game Management Area. This provided local employment to the community through labour as well as improving conditions to the scouts and their families.

In 2015 the anti poaching efforts resulted in 94 wire snares, 28 muzzle loading firearms and 7 home made shotguns being seized. Two wounded elephant were found dead with ivory removed, two lions were snared (one male and one female in two different locations), The human animal conflict is probably the biggest concern, with a child killed by a leopard in 2015. Almost annually people are being mauled or killed by lion, elephant and buffalo. Elephant and buffalo are constantly destroying crops, tolerance to this is due only to the revenue being received by the community through safari hunting. The joint and consistently intense effort by DNPW, the community, Frankfurt Zoological Society and Muchinga Adventures Ltd is keeping poaching to a minimum in this game management area.

The community benefit financially from the revenue of the hunting with a share in the funds raised. They get 50% of the trophy fee and 20% of the concession fee. This is in addition to other commitments from the company. The community fund the employment for up to thirty village scouts from this revenue. With the agreement of the community areas have been zoned for fishing to limit movement, disturbance to the habitat and encroachment in the concession. Muchinga Adventures endeavor to drive each road in the area every week to ensure that it is maintained and passable for anti poaching efforts. Abnormal activity is reported to the scouts for further investigations. Fire breaks are maintained to protect the habitat for the wildlife and for the safety of the scouts who may be on foot patrols. Anti poaching patrols are done 365 days of the year in Chifunda GMA.

Our anti poaching and conservation commitment both in 2016 and for 2017 covers:

1. Food rations to increase the six full patrols each month
2. Fresh meat as a protein source to the scouts
3. Fuel for resource monitoring
4. Money to conduct village sweeps
5. Rewards for information leading to the arrest and conviction of poachers
6. Rewards for the handing in or seizure of illegal firearms
7. Rewards for the handing in of snares to remove them from circulation

2015 SUMMARY OF ANTI POACHING FINANCES IN CHIFUNDA GMA

Item	Spend (USD)	Notes
Community revenue	48,000	Hunting revenue used for scout salaries
Food rations	8,000	Increases patrols by six per month

Diesel / petrol	12,000	Resource monitoring and anti poaching
Rewards	5,000	Between snares, illegal firearms and information
Infrastructure development, fire management and road maintenance	15,000	Includes employment
TOTAL	$88,000	

2016 SUMMARY OF ANTI POACHING FINANCES IN CHIFUNDA GMA

Item	Spend (USD)	Notes
Community revenue	48,000	Hunting revenue used for scout salaries
Food rations/ Anti poaching funds	8,000	Increases patrols by six per month
Diesel / petrol	13,500	Resource monitoring and anti poaching
Rewards	7,000	Between snares, illegal firearms and information
Infrastructure development, fire management and road maintenance	14,000	Includes employment
TOTAL	$90,500	

Muchinga Adventures Ltd is annually reviewed by DNPW and any prospects of a future lease agreement are contingent on our current performance in wildlife protection and community obligations.

III. COMMUNITY PARTICIPATION

A. Community Assistance Component

The concession has approximately 15,000 people resident in the block. There are seven VAGS with five main villages in the concession. Each VAG has its own headman and the concession falls under the jurisdiction of HRH Chief Chifunda. The Community Resource Board are elected to handle the decisions for the Game Management Area residents. They directly receive 20% of the concession fee and 50% of the Government trophy fees.

Muchinga Adventures Ltd are obligated to a US$20,500 annual payment for the community to use in projects of their choosing. The emphasis being on community welfare, wildlife conservation, education and medical care.

In addition to this Muchinga Adventures Ltd has committed to developing a business for the community. They have a community camp that is based at the crossing from North Luangwa National Park which is ideal for any travellers crossing from Mpika to Chama or Lundazi. The commitment is to rebuild the bush camp to an international standard, provide training of the camp staff and management so that they can realize a long term and sustainable financial return. US$5000 was given to the community to refurbish parts of the camp and their business has increased more than 300% in 2016.

There are projects/ assistance that are on going and are extra to our obligations and these are:

1. Toilets at the clinic (2016)

2. The employment of a teacher – salary for 12 months (2016)
3. A scholarship for a deserving academic achieving student or adult in the field of education, medical care/medicine or wildlife/environmental conservation – awarded to Mr Chilembo from the Chifunda GMA community for an undergraduate degree in wildlife (2016)
4. Paid for the community meeting twice a year, this builds bridges and trust with the community who are involved in decisions that affect them directly. This includes Muchinga Adventures reporting the monies paid through hunting which they directly benefit from and to allow for financial transparency to all community members.
5. Employment of a liaison officer to help with communications between DNPW, the community and our company

More than 50% of the edible meat harvested is delivered to the community through the hunting season.

Muchinga Adventures Ltd is providing assistance with the community in their application for secondary school classrooms. The closest secondary school is more than 50km from the village and therefore most children do not receive education beyond grade 7.

Muchinga Adventures Ltd relationship with DNPW and the community is a collaborative one based on respect for our partners in the industry. DNPW determines whether to allow a future lease based on the performance of the company in the current lease, Muchinga Adventures Ltd are monitored by an annual review.

B. Conflict Control

The Managing Director is a Senior Honorary wildlife Police Officer, he is in a position to provide assistance whenever required on the ground. Control and putting down of the problem animals is done by National Parks and Wildlife. Reports of wounded animals sighted are done by radio, which all parties have. The community use fireworks bangers and loud noises to chase the animals from their fields. Education of the community members is done through discussions at the community meetings to disperse to each village member. Understanding the financial contribution by hunting and in that each community member benefits on a rotation basis of the fresh meat harvested has significantly led to increased tolerance of the wildlife. In 2016 the company paid for the funeral of a village member killed by a buffalo that had been wounded by lions. The company also paid compensation to farmers who lost livestock to a leopard with cubs, this resulted in the leopard not being controlled as a problem animal as allowed under the Wildlife Act.

IV. HABITAT PROTECTION AND CONSERVATION DEVELOPMENT

During hunting herd disturbance of the buffalo is kept to a minimum to encourage breeding and to encourage the lion not to look for alternate food sources close to the villages.

Fires are controlled and done with the community and the wildlife department to ensure that habitats are conserved so as not to put pressure on the wildlife during the dry season. Fire breaks are maintained, movement of people in the GMA is strictly monitored for a number of reasons including the prevention of unplanned fires.

There is no logging or mining in this concession. The community have chosen not to explore the revenue options of these industries whilst they have the hunting revenue.

The community have committed to not increasing the number of fields they have, thereby preventing further loss of habitat for the wildlife.

V. OTHER INFORMATION

A. Prey Base

In our former hunting block over a period of ten years we more than doubled the buffalo numbers to 700 strong in a single herd through anti poaching and hunting off take controls. We are using this same method and approach in Chifunda. Extra incentives to the scouts for removing illegal firearms and snares have been introduced. Buffalo are the largest food source for the lion and there are an estimated 4000 buffalo in Chifunda.

B. Lion Population Tracking

Lion are notoriously difficult to survey or census. To track the lion population trend in our concession we are bringing in the use of trail cameras, GPS units and sightings of the lion, spoor and footprints recorded by ZAWA, ourselves and the community. Conflict situations will also be studied in order to find solutions that help reduce these.

C. Lion Aging Approach

Our company was involved in the lion aging project by Dr Paula White from when it was started and we are constantly involved in educating our professional hunters in identifying age appropriate lion. Our company policy is to not harvest a lion below the age of 6 years old and to have a conservative visual attitude towards the aging of the lion. This is in the employment contract of each professional hunter. No pride lions will be harvested so as to reduce the incidents of cub mortality and disruption to the population of lion. We are committed to attending workshops to help with lion aging, constant education of our employees and contributing to scientific research of lion.

We have had clients that have seen lion but not taken one due to being selective. We have voluntarily reduced our lion quotas when we feel that this has been required even when we were allowed more lion on quota. In one of our hunting blocks, Tondwa GMA, we removed lion, leopard, buffalo, hippo, waterbuck and hartebeest from the quota as it was felt that hunting these would be detrimental to these species. Our company has a responsible attitude to stewardship, conservation and wildlife management.

In Chifunda GMA trail cameras were used to collect data on both lion and leopard during 2016. The initial quota was one lion for 2016. All data and biological samples for the lion were submitted to Department of National Parks and Wildlife. A second lion on quota was allocated after data was examined by DNPW and determined to be of six years or older. The extra lion allocation was based on scientific data with the size of the Chifunda being 4900 square kilometres. The Trophy Hunting of African Lions: Scale, Current Management Practices and Factors Undermining Sustainability (Lindsey) supports a lion harvest rate that does not exceed 0.5 lion per 1000km. in accordance with this widely cited study Chifunda GMA can sustain an off take of two lions annually.

D. Lion Hunting Revenue

Lion and elephant are our highest-value species. Revenue from these is expected to be more than 50% of our income. This will significantly help us in being able to meet our obligations to the community, to the anti poaching projects and to the protection of these species and their habitat. In our concession proposal we committed to the second highest financial hunting commitment in Zambia to our partners. We believe in a partnership where the community, the wildlife authority, the country and the wildlife all need to benefit from the relationship in a sustainable manner.

E. U.S. Hunters

Most of our clients (75%) are from the United States. These hunters have a conservation ethic and usually contribute above their fees to anti-poaching and our community projects. They are members of associations that expect and support ethical hunting practices. They support our conservative approach to the hunting of lion. US hunters being allowed to import Zambian lion into USA will significantly benefit and contribute to the welfare and long term sustainability of the lion species in Zambia.

CONCLUSION

Muchinga Adventures Ltd is committed to the long term, sustainable and ethical practice of hunting lion. Our involvement in this practice allows us to improve the habitat of the lion, improving the attitude of the community in tolerance towards lion. Our anti poaching practices protect and enhance the lion in the concession, growing their numbers of prey and reducing down snare encounters. The community see a real benefit from partnering in the hunting industry, we answer to them and the Wildlife Authority for our performance towards anti poaching and community obligations. Their involvement and recognition of the value of hunting has made them want to protect their wildlife and be pro active in reducing animal – human conflicts.

Without hunting and the revenue that is earned from the harvesting of the animals the community will turn the land into farming land, removing habitat and kill or poison the wildlife. Poverty and malnutrition are very real problems in rural Zambia. Without a value to the community the wildlife will be the losers as people try to find a way to feed their families.

We believe that lion hunting is a crucial and necessary part of conserving the whole of Chifunda GMA.

Signed: _____

John du Plooy

Operator Name: MUCHINGA ADVENTURES LTD

Title: MANAGING DIRECTOR

ATTACHMENTS

No.	Title	Time Period
1	Map of concession	
2	Company annual reports to the Wildlife Authority	2015
3	Company concession, anti-poaching, community assistance, or other written plan(s) This is the proposal put forward in our bid	2015 - 2022
4	Annual report for Chifunda GMA to Wildife Department	2015
6	Food rations to scouts	2015
7	Supportive letters/acknowledgements from village or district leaders	2015
8	Meetings with village/district leaders - their participation in deciding how to use donations or contributions from hunting	2015
10	Supportive letters/acknowledgements	2015
11	Company Lion Aging Policy	2015
13	Photographs of anti-poaching patrols, snares, etc.	2015
14	Photographs of community projects and game meat distributions	2015
15	Photographs of habitat enhancement	2015
16	Company annual report to the Wildlife Authority	2016
17	Support to the scouts and anti poaching in 2016	2016
18	Trail camera photos of lion in Chifunda 2016	2016
19	Scholarship for tertiary education for Chifunda GMA	2016
20	Financial breakdown of Chifunda in 2016. This increase was the addition of lion and elephant to the quota	2016
21	Payment of a school teacher for the community	2016
22	Employment 2016	2016
23	Meetings with the village/district leaders – their participation in deciding how to use donations or contributions from hunting	2016
24	Supportive letters/ acknowledgement	2016
25	Chifunda end of year Annual report	2016
26	Community support	2016
27	Education	2016
28	Employment	2016
29	Community Letter to Minister of Arts and Tourism	2016
30	Community Letter to President	2016
31	Lion and leopard submission to DNPW	2016
32	Lion trail camera	2016
33	Meat distribution	2016
34	Meetings in community	2016
35	Otmar lion data	2016
36	Chebanenko lion data	2016
37	Payments	2016

NYAMVU SAFARIS, LTD.
Address, 6980 KATANGA ROAD LUSAKA
Operator email: ZAID137@HOTMAIL.COM

I. DESCRIPTION OF COMPANY AND CONCESSION

Nyamvu Safaris, Ltd. has been operating Nyamvu Game Reserve since April 2005. The Game Reserve provides habitat for a range of species including lion, kudu, leopard, buffalo, and elephant and is also a None Fenced Game Reserve but open and wild like all other hunting blocks in Zambia. The Game Reserve is in Nyimba District in Eastern Province of Zambia. The Area is along the Luangwa River. Nyamvu Safaris has entered into a Long term project with the Wildlife Authorities to try and develop a Game Reserve for Animals for a period of Ninety Nine years.

The Director of Nyamvu Safaris is Mr. Zaeed Patel. Nyamvu has permanent employees who work throughout the year and are on two year contracts that are renewable. The camp has a resident Professional Hunter and a camp Manager. Other employees include four game trackers, nine anti-poaching scouts, and six camp staff (cooks, cleaning, miscellaneous). We estimate a total of about 113 people to be direct beneficiaries from Nyamvu Safaris employees. These beneficiaries come from the local community.

When Nyamvu Game Reserve was acquired in 2005 the Area was completely depleted such that even seeing an Impala was almost impossible. It had to take frantic efforts by Mr. Zaeed Patel to begin the Anti-Poaching Patrols and then creating water points for animals to access water easily. Slowly the animals started coming back to Nyamvu Game Reserve and as we speak today after 10 years of progressive anti-poaching and creation of suitable conditions for Animals Nyamvu is now home to most of the wild species of Southern Africa including Elephant, Lion and Leopard. The director of Nyamvu has even carried out a restocking exercise of Sable Antelope which originally was not there. We can confirm that Nyamvu now has enough sable that can even be included on Safari Quota to be hunted. The restocking exercise is not only limited to sable only but other species as well.

Among the many efforts done to improve the number of animals in Nyamvu include provision of salt Leaks, provision of Maize Bran, creation of Dams for easy accessibility of water are among the many efforts done to create suitable conditions for Animals to stay in Nyamvu.

We further wish to put it on record that Nyamvu Game reserve is an Area where the director has invested heavily to make it what it is today. The Area was not hunted for about three years from 2005 when it was acquired to about 2008. In all these years the director was merely investing in Anti-poaching patrols, creation of water points among other things to attract game. This is the kind of effort that was invested in this None Fenced Game Reserve to ensure that we have enough stocks of animals.

Safari Hunting was therefore introduced to help with the conservation and income generation for the area and for the help of re-building. In order to make the community benefit from such animals it was agreed that some revenue can be derived from selling these animals on Safari and the revenue can be used to improve the welfare of the surrounding communities.

We can confirm that Schools, Clinics, Bridges, Grave Roads have been built in the surrounding communities of Nyamvu Game Reserve through the revenues raised from Safari Hunting. The chief has equally had a fair share of some benefits through the construction and periodical renovations of the chief's palace and grading of the road which leads to the palace. Nyamvu further purchased Banana Boats that are used by villagers in the community to cross the Luangwa River when trying to access the other side of the River. School Children, Community health workers are among the beneficiaries who use the Banana boat to cross the Luangwa River.

II. ANTI-POACHING COMPONENT

Nyamvu Safaris maintains three groups of anti-poaching teams. Each team consists of three men per team and is equipped with a 4x4 Land cruiser, uniforms and boots, tents, rations, and a satellite phone. The patrols are done in conjunction with the Wildlife Scouts. We supply rations at least twice per month to both the government game scouts and our village scouts to ensure they are sufficiently equipped for the patrols.

Nyamvu Safaris spends about $ 26000 on average per annum to carry out Anti-poaching patrols in the Game Reserve. A total of between 300 and 350 days is recorded per annum. 3000 liters of diesel are used on average per annum which is consumed by 2400 hours of patrol hours. The amount spent on payments for rewards after abducting poachers has been steadily decreasing from 2005 although an average of about 2800 dollars is spent per annum in rewards. A breakdown of spending on anti-poaching is below.

Item	Spend (USD)	Notes
Scout salaries	5650	Directly paid and some subsidies to WA
Scout equipment	9450	Clothing, vehicles, rations, phones, tents, etc.
Diesel / petrol	3900	For scouts and WA
Rations for WA and community scouts	3800	
Rewards	2800	For information and arrests
TOTAL	$ 25600	

In the Picture Below two poachers that were apprehended by our Vigilant Scouts.



COMMUNITY PARTICIPATION

A. Community Assistance Component

The agreement that Nyamvu Game Reserve has with the community does not specify what amounts need to be contributed to the community. However on Average, Nyamvu contributes about $ 20000 per annum.

In addition to these direct contributions, we pledge to distribute at least 60% of game meat harvested to the villages.



A hammer mill donated to the community by Nyamvu Safaris

B. Conflict Control

Our problematic animals are mainly the Lions and Elephant. Attached are extracts from the media which confirm Lions attacking Human Beings in Nyimba District of Eastern province where Nyamvu Game Reserve is situated. Management of Nyamvu Safaris has set aside a fund which is used to compensate victims of such unfortunate circumstances. The fund is usually 5000 dollars but can be adjusted depending on the number of such occurrences in a particular year.

IV. HABITAT PROTECTION AND CONSERVATION DEVELOPMENT

We have developed the water infrastructure for the exclusive use of wildlife in our concession. The infrastructure developed so far is natural pans which costs approximately $5000 to maintain per annum. The increased water supply increases the carrying capacity of the concession and the lion's prey base due to more game residing in the Game Reserve by finding water resource. This usually attracts Lion and Leopard to come and hunt in the game Reserve.

V. OTHER INFORMATION

A. Prey Base

Nyamvu Safaris has been monitoring the population growth of the Lion and Leopard which is a result from efforts done so far such as anti-poaching efforts, water provision, and fire management.Nyamvu Safaris will further engage the wildlife Authorities in Monitoring the resources on the ground by position cameras in strategic Areas so as to monitor the Activities of the Lion and Leopard.

B. Lion Population Tracking

Lion is not easy to track and as such we are still developing tools which we will use to study the population of Lon in our Area. As at now we use Lion tracks and foot prints. Sightings by individuals and just the a few cameras which we use to monitor the size and age for Lion and Leopard when Hunting.

C. Elephant Hunting

Our area is endowed with some very good Elephant hunting and due to the long term conservation plan produces good quality tusks now of between 50 and 60 pounds. Our well-coordinated anti-poaching system has made poaching of Elephant in Nyamvu very difficult. The community has also assisted management at Nyamvu by bringing reports of members of the community that have links with suspected poachers and stringent measures have been taking which include imprisonment for those that were found guilty of poaching. Through our various anti–poaching awareness programs with the community we have managed to make the community assist to guard this natural resource jealously. Nyamvu Safaris maintains a policy of not taking any Elephant whose tusks are weighing 20 kilograms and below.

E. Lion Aging Approach

We use the Lion aging approach when conducting Safari Hunting for Lion. Earlier on we mentioned of Human Animal conflicts mainly with Lions. This can be managed by removing the older Lions in the system through Safari Hunting. It has always been a Policy for Nyamvu Safaris not to harvests any Lions or Leopard which are not old enough to have outlived their useful life. In view of this approach not more than five Lions have been taken in Nyamvu game Reserve from the time Safari Hunting was introduced.

F. U.S. Hunters

It is of no doubt that this is the most sought after market with regards to Safari Hunting in Zambia. Nyamvu Safaris has had a number of clients donating equipment and in some instances funds for Anti –poaching programs. This can confirm to you that these hunters are not only after fulfilling their interests but to also allow the community to benefit through a conservative based approach to Safari Hunting.

CONCLUSION

Nyamvu Safaris can proudly confirm that the project which it started in 2005 has been a success looking at the way the numbers of wildlife has increased in our game reserve. We recognize that the Cat and Elephant hunts bought and booked by our American Clients contribute a higher percentage of income in the Safari Hunting and it is our obligation to share these finances with the communities who have played an important role to conserve this resource. We also realize that these species are a renewable resource and as such we will endeavor to provide suitable conditions for the reproduction and sustainability of these species with the allowance of our American Clients to keep coming and hunting the different species in Africa.

Signed: _____

Operator Name: Zaeed Patel

Title: Director



Journal of Sustainable Tourism

ISSN: 0966-9582 (Print) 1747-7646 (Online) Journal homepage: http://www.tandfonline.com/loi/rsus20

Local opinions on trophy hunting in Kyrgyzstan

Ingeborg Nordbø, Bakyt Turdumambetov & Bilgehan Gulcan

To cite this article: Ingeborg Nordbø, Bakyt Turdumambetov & Bilgehan Gulcan (2017): Local opinions on trophy hunting in Kyrgyzstan, Journal of Sustainable Tourism, DOI: 10.1080/09669582.2017.1319843

To link to this article: http://dx.doi.org/10.1080/09669582.2017.1319843

Published online: 30 May 2017.

Submit your article to this journal

Article views: 109

View related articles

View Crossmark data

Full Terms & Conditions of access and use can be found at
http://www.tandfonline.com/action/journalInformation?journalCode=rsus20

Download by: [119.161.99.146] Date: 07 June 2017, At: 21:46

JOURNAL OF SUSTAINABLE TOURISM, 2017
https://doi.org/10.1080/09669582.2017.1319843

Routledge
Taylor & Francis Group

Check for updates

Local opinions on trophy hunting in Kyrgyzstan

Ingeborg Nordbø[a], Bakyt Turdumambetov[b] and Bilgehan Gulcan[c]

[a]Department of Business and IT, University College of Southeast Norway, Hallvard Eikas Plass, Telemark, Norway;
[b]Department of Travel Management and Tourism Guidance, Kyrgyz Turkish Manas University, Bishkek, Kyrgyzstan;
[c]Department of Tourism Management, Faculty of Tourism, Gazi University, Ankara, Turkey

ABSTRACT

As traditional international trophy hunting destinations are becoming less accessible due to hunting restrictions and regulations, new destinations are entering the scene, such as the Republic of Kyrgyzstan, located in Central Asia. Kyrgyzstan has grown to be one of the top destinations for international trophy hunting of argali *Ovis ammon* and ibex *Capra sibirica*, both of which are in danger of extinction. Empirically, the article draws on a case study from the largest region in Kyrgyzstan, At-Bashy, and 395 questionnaires with local inhabitants from 5 villages, and 1 interview with an international trophy hunting tour operator. In this article, the impacts of trophy hunting as a tourism practice in a rural context is discussed in terms of its sustainability and through the opinions of the local inhabitants. In sum, the negative impacts of trophy hunting in At-Bashy seem to overrule the positive ones, and in its current form it is not sustainable. The local inhabitants report about a decrease in argali and ibex during the last years; they receive basically no economic benefits from hunting tourism; and not surprisingly, 70% of the population rejects the further development of the industry in its current shape.

ARTICLE HISTORY
Received 7 January 2016
Accepted 11 April 2017

KEYWORDS
Trophy hunting; rural tourism; Kyrgyzstan; sustainability; local opinions

Introduction

As a number of the more traditional trophy hunting destinations are becoming less accessible due to factors such as hunting restrictions, loss of wildlife and political instability, other destinations are experiencing expansion (Lindsey, Roulet, & Romañach, 2007) and new destinations are emerging. One of the newer destinations is the Republic of Kyrgyzstan, located in Central Asia. In the post-Soviet time, Kyrgyzstan has grown to be one of the top destinations for trophy hunting of argali *Ovis ammon* (Marco Polo) and ibex *Capra sibirica* (Koshkarev, 2002; Kronenberg, 2014; Mallon, 2013; Turdumambetov, 2011).

The reports of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) reveal that Russia and several Central Asian countries are popular destinations for American and European hunters seeking trophies of various species (Mallon, 2013; Parry-Jones, 2013; Vaisman, Mundy-Taylor, & Kecse-Nagy, 2013). Argali and ibex rams are popular among trophy hunters due to their impressive and distinctive horns.

Argali is listed in the *Red book* of the International Union for Conservation of Nature and Natural Resources (IUCN) in the category of "nearly threatened" (IUCN, 2016) as well as in the *Red book of Kyrgyzstan* (State Agency on Environment Protection and Forestry, 2006, p. 517). As such, argali hunting in Kyrgyzstan should be forbidden. Despite this, Kyrgyzstan, as a trophy hunting destination, is

CONTACT Ingeborg Nordbø ingeborg.m.nordbo@usn.no

© 2017 Informa UK Limited, trading as Taylor & Francis Group

experiencing growing demand and increased hunting due to the easy access to hunting permits as a result of corruption (Koshkarev, 2002) and the relative cheapness of the destination (Turdumambetov, 2011).

A number of researchers argue that trophy hunting is to be understood as a tourist activity (Baker, 1997b; Leader-Williams, Kayera, & Overton, 1996; MacKay & Campbell, 2004; Novelli & Humavindu, 2005). Higginbottom (2004) argues that trophy hunting is a form of hunting tourism, which in turn is one of the four main forms of wildlife tourism. According to the IUCN, trophy hunting has the following four features (IUCN, 2012, p. 2):

(1) it is part of a system of measures (programmes) implemented under the control of a governmental body, local community, non-governmental organization or other legal structure;
(2) it is performed by hunters who pay a high price for the right to hunt for a representative of the animal with "trophy features";
(3) it is characterized by small seizures;
(4) usually, but not necessarily, it is performed by hunters from other places.

In this article, trophy hunting is understood as "a paid service provided to tourists whose main travel motive is to hunt animals with outstanding features". Outstanding features, or trophies, can be game animals themselves as well as their derivatives, such as horns, skulls, hides, canines and others.

Through a case study of the At-Bashy region in Kyrgyzstan, the impacts of trophy hunting as a tourism practice are discussed in terms of sustainability and through the opinions of the local inhabitants. At-Bashy is the largest region in Kyrgyzstan and has the longest borderline with China; for historical reasons it is the area in Kyrgyzstan where most trophy hunting takes place. The urgency to conduct research in this geographical area is mentioned in the work by Heinen, Shukurov, and Sadykova (2001). In general in Central Asia and in particular in Kyrgyzstan, there are no research works on the sociocultural aspects of the sustainability of hunting tourism or even on the sustainability of tourism development as such (Lu & Nepal, 2009). The research undertaken will thus add to the existing research on the sustainability of tourism both through its use of data from an under-researched geographical area and through its holistic approach to the study of impacts, focusing not only on the environmental or economic aspects of trophy hunting but also on the sociocultural ones.

Trophy hunting

To identify possible points of reference for the empirical part of our research and identify research gaps related to trophy hunting in Kyrgyzstan, a review of the relevant literature on wildlife and hunting tourism was undertaken (see Table 1).

The review shows that trophy hunting is a contested and sensitive issue with a number of negative impacts reported in the international literature. Only a small part of the money from trophy hunting actually goes to local communities (Delibes-Mateos et al., 2014; Economists at Large, 2013; International Fund for Animal Welfare [IFAW], 2016; Leader-Williams et al., 1996; Lindsey, Havemann et al., 2013; Lindsey et al., 2007; Lovelock, 2008; Stein, Fuller, Damery, Sievert, & Marker, 2010; Turdumambetov, 2011). The targets are large, majestic alpha males in their prime, a counter-evolutionary tactic that exacerbates populations (Caro, Young, Cauldwell, & Brown, 2009; IUCN, 2016; Koshkarev, 2002; Lewis & Alpert, 1997; Shukurov, 2013); many trophy animals are threatened and dwindling. Studies show that hunting leads to steep population declines (Bashqawi, 2014; Deere, 2011; Dowsley, 2009; Gressier, 2014; Harris & Pletscher, 2002; Heffelfinger, Geist, & Wishart, 2013; Heinen et al., 2001; Knezevic, 2009; Koshkarev, 2002; Leader-Williams et al., 2005; Lindsey, Balme et al., 2013; Mahoney & Jackson, 2013; Marchand et al., 2014; Maroney, 2005; McGranahan, 2011; Naevdal, Olaussen, & Skonhoft, 2012; Singh & Milner-Gulland, 2011). Trophy hunting also sets a bad precedent: often only rich foreigners can hunt in places like Central Asia and Africa, making trophy hunting appear reminiscent of colonialism; it is motivated by conspicuous consumption and dominance,

Table 1. Selected literature on trophy hunting tourism.

Characteristic	Source	Study regions
Ecological dimension	Baker (1997a);	Southern and Eastern Africa
	Bashqawi (2014);	Namibia
	Caro et al. (2009);	Tanzania
	Deere (2011);	South Africa
	Dowsley (2009);	Canada
	Gressier (2014);	Botswana
	Harris and Pletscher (2002);	Western China
	Heffelfinger et al. (2013);	North America (Canada, USA)
	Heinen et al. (2001);	Kyrgyzstan
	Knezevic (2009);	North America (Canada)
	Koshkarev (2002);	Kyrgyzstan
	Leader-Williams et al. (2005);	South Africa and Namibia
	Lindsey et al. (2013a);	African Savannas
	Mahoney and Jackson (2013);	North America (Canada, USA)
	Marchand et al. (2014);	France
	Maroney (2005);	Mongolia
	McGranahan (2011);	Namibia
	Naevdal et al. (2012);	Scandinavia (Norway)
	Reis (2009);	New Zealand
	Singh and Milner-Gulland (2011)	Central Asia (Kazakhstan, Uzbekistan, and Russia)
Economic dimension	Baker (1997b);	Eastern and Southern Africa
	Delibes-Mateos et al. (2014);	Spain
	Economists at Large (2013);	Southern and Eastern Africa
	Kronenberg (2014);	Kyrgyzstan
	Leader-Williams et al. (1996);	Tanzania
	League against Cruel Sports (2004);	South and sub-Saharan Africa
	Lemelin et al. (2012);	Canada
	Lindsey et al. (2007);	Sub-Saharan Africa
	Lindsey et al. (2013b);	Namibia
	Lovelock (2008);	Europe, North America, Africa, India, Arabia, and Oceania
	Stein et al. (2010);	Namibia
	Turdumambetov (2011)	Kyrgyzstan
Sociocultural dimension	Braden (2014);	Russia
	Cohen (2014);	Not specified
	MacKay and Campbell (2004);	Canada
	Matilainen and Keskinarkaus (2010);	Iceland, Finland, Scotland, and Sweden
	Nygård and Uthardt (2011);	Finland
	Puhakka et al. (2009);	Finland
	Puhakka et al. (2014);	Finland
	Radder (2005);	South Africa
	Yasuda (2012)	Cameroon

reducing beauty to possession (League against Cruel Sports, 2004). Poachers have been known to exploit trophy hunting loopholes to launder illegal wildlife products en route to the black market and so on (Braden, 2014; IFAW, 2016; Koshkarev, 2002; Leader-Williams et al., 2005; Lewis & Alpert, 1997; Lindsey, Balme et al., 2013). Additionally, many people simply consider that it is unethical to kill an animal just for fun (Cohen, 2014; Hofer, 2002; IFAW, 2016; Matilainen & Keskinarkaus, 2010; Reis, 2009).

The literature also highlights that there is a need for further studies of the institutional dimension of trophy hunting (Puhakka, Cottrell, & Siikamäki, 2014), with an emphasis on the perception of the providers of trophy hunting services, governmental officials, and the transition to eco- and cultural tourism in the destination (Lemelin, Johnston, Dawson, Stewart, & Mattina, 2012).

Identified research topics and gaps

In the international literature, the environmental aspects of trophy hunting in Kyrgyzstan are to be found in the works by Heinen et al. (2001), Koshkarov (2002) and Werner (2003). The environmental

aspects are also discussed in three reports by the Secretariat of the CITES (Mallon, 2013; Parry-Jones, 2013; Vaisman et al., 2013) and in several small analytical works by Shukurov (2012, 2013, 2015a, 2015b) and Turdumambetov (2011). The main conclusion from the CITES reports is that, when it is well managed, trophy hunting can contribute to the conservation of biodiversity and local livelihoods in Kyrgyzstan (Mallon, 2013; Parry-Jones, 2013; Vaisman et al., 2013) but that, in its present state, the industry is not sustainable. Koshkarev (2002) presents quite a detailed analysis of trophy hunting for the argali in Kyrgyzstan from 1990 to 2000, the main conclusion of which is: "In 10 years, i.e. 1990–2000, the relative number of adult males decreased 3–5-fold, trophy ones 12–18-fold. Today the hunting economies face an acute shortage of 'currency goods' as there are almost no elite males" (p. 30, own translation). Furthermore, with respect to the statistics, Shukurov (2012) notes that "the number of the main object of 'currency hunting' – argali (Marco Polo sheep) – dropped 4 times from 15 thousand in 1995 to less than 4 thousand in 2009. In 2009, the number of ibex dropped from 66 thousand to 31 thousand – 2 times" (p. 1, own translation). Therefore, some authors suggest either imposing a moratorium on hunting (Shukurov, 2015a) or using the argali and ibex in segments of ecotourism such as photo hunting and video hunting (Turdumambetov, 2011).

Although the trophy hunting in Kyrgyzstan has become exceptional in post-Soviet Kyrgyzstan, as formerly argued, no official data on the revenues from the industry exist. According to the estimations of Turdumambetov (2011), the annual government revenue from trophy hunting only on Argali ranges from 900,000 to 1,500,000 USD.[1] In a more recent work, Kronenberg (2014) estimates the government revenue from trophy hunting of Argali to be 1,660,000 USD. No statistics are available regarding the ibex. In terms of the economic benefits for the local population in Kyrgyzstan, the experts from CITES conclude in their reports that "most of the existing operations are commercially based, especially in regard to Argali, and relatively few benefits reach local communities" (Mallon, 2013, p. 29). The Law of the Kyrgyz Republic on hunting and hunting economy (2014) states that the local authorities should receive 25% of the income from hunting, but nothing is mentioned about payback to the local residents inhabiting the hunting grounds.

The literature review showed that only four articles touch upon aspects of trophy hunting in Kyrgyzstan and only with reference to ecological and economic impacts, while no studies examine aspects related to social responsibility or host communities. The effects of trophy hunting on local communities and sociocultural aspects have, in general, received little attention from the research community (Liu, 2003; Magis, 2010; Matilainen & Keskinarkaus, 2010; Nygård & Uthardt, 2011). In terms of hunting tourism, it must be noted that social sustainability, in all of its meanings, is most likely to be one of the most critical and complex issues to handle. A key question is "sustainability for whom?" Different social actors have their own values and goals, which might not be compatible with the objectives of another group (Matilainen & Keskinarkaus, 2010, p. 53).

For any form of tourism to be sustainable, the UNEP and UNWTO (2005) argue that it must take full account of its current and future economic, social and environmental impacts and that it must address not only the needs of the environment, the visitors, and the industry but also the needs of the host communities. In line with this, McKenzie (2004) highlights that any form of wildlife tourism must be not only economically sound and environmentally safe but also socially responsible. According to Keskinarkaus and Matilainen (2010, p. 5), social sustainability refers to a development that reinforces individuals' control of their own lives and the results of a socially sustainable development are distributed equitably. For the latter to occur, the local inhabitants should at least be in favour of the hunting. Second, it also means ensuring that at least some of the profits from the exploitation benefit the local residents (Baker, 1997a; Harris & Pletscher, 2002; Hofer, 2002; Lewis & Alpert, 1997; Puhakka, Sarkki, Cottrell, & Siikamaki, 2009; Shackleton, 1997). Ideally, money generated from license fees should be given directly to local communities to pay for local salaries and monitoring, research and management of the target populations (Lewis & Alpert, 1997; Shackleton, 1997).

Some researchers prefer to use the term "sociocultural dimension" (or "social–cultural dimension") instead of social sustainability (Nygård & Uthardt, 2011; Puhakka et al., 2009, 2014), the social–cultural dimension being considered to refer to "human capital and quality of life" (Puhakka

Table 2. Possible opportunities and threats to the social sustainability of hunting tourism (Nygård & Uthardt, 2011, p. 387).

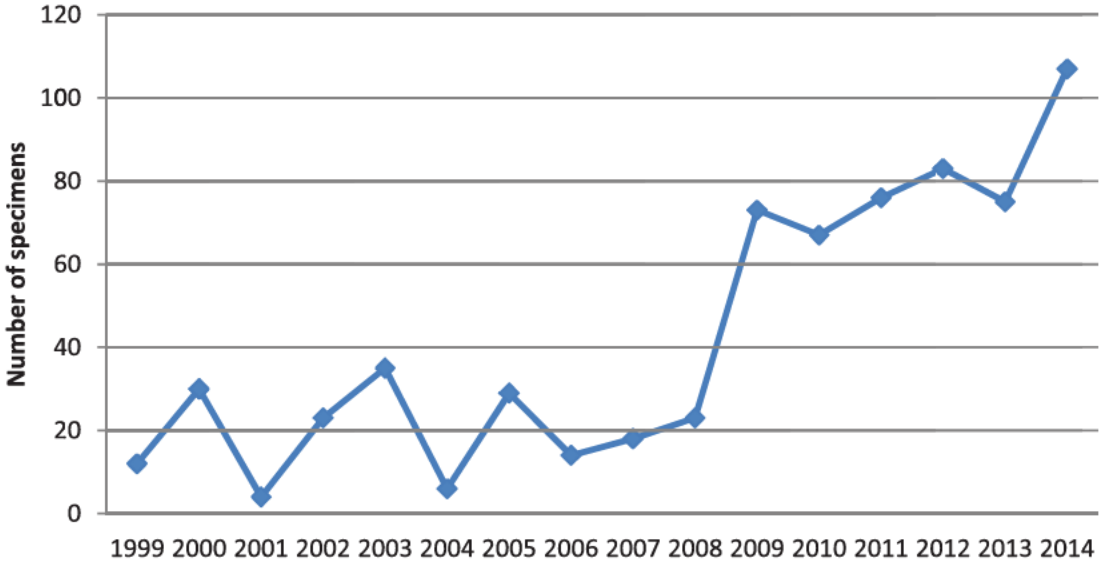
	Dimensions of social sustainability		
	Participation	Distribution	Cultural sustainability
Opportunity	Equal and democratic empowerment of local communities and stakeholders	Equitable distribution of benefits and burdens from tourism	Local stimulation through greater exchange of persons, ideas, and experiences
Threat	Exclusion or reducing certain stakeholders to submission	Unequal or unfair distribution of benefits and burdens from tourism	Cultural clashes or violations of local traditions, values, or practices

et al., 2014, p. 482). Nygård and Uthardt (2011) build on the work of Puhakka et al. (2009), in which the social sustainability of nature-based tourism can be analysed from three perspectives: participation, distribution, and cultural sustainability. Their work (as presented in Table 2) was used as a point of reference in the study undertaken of the sociocultural aspects of trophy hunting in Kyrgyzstan.

Trophy hunting in Kyrgyzstan

Until 1989 there was no trophy hunting in Kyrgyzstan, especially not on the border with China, where the Soviet Union (Kyrgyzstan) and China had disputed areas. The giant borderland, which is 1300 km long, 50–100 km wide, and approximately 100,000 km^2, was heavily protected throughout the 70 years of Soviet rule. Prior to the collapse of the Soviet Union, at least 70% of argali, ibex, snow leopards (*Uncia uncial*) and other species were concentrated on the borderland (Koshkarev, 2002). Due to its "disputed area" status, even communist party bosses were not allowed to hunt there. As a result, the nature remained pristine and the habitat and breeding conditions of the mentioned species were good. However, after the collapse of the Soviet Union, Kyrgyzstan became increasingly popular as a trophy hunting destination, as shown in Figure 1, which presents the increasing demand for argali in Kyrgyzstan between 1999 and 2014.

In Kyrgyzstan, all the hunting ground (including all the highlands inhabited by trophy animals) belongs to the Government, and, according to Article 11 of the recent Law of the Kyrgyz Republic on



Source: CITES (2016).
* On Ibex no data exist, except for 2014 (when, according to official sourcces, 346 specimen were hunted).

Figure 1. International demand for argali trophy hunting in Kyrgyzstan (1999–2014).



Figure 2. Location of the At-Bashy region in Kyrgyzstan.

hunting and hunting economy, the right to conduct hunting is provided to legal entities (companies) for a period of 15 years. The grounds to organize hunting cover almost 70% of the territory of Kyrgyzstan (Natural Resources Department, 2016b), while in contrast the entire network of specially protected natural territories occupies only 6% (World Bank, 2016). The trophy hunting tour operators (mostly from the capital region) organize travel to different parts of the country, although the areas alongside the Chinese border are the most frequented. They also often cooperate with inbound trophy hunting operators from other countries. The Kyrgyz Government also gives hunting permits to local inhabitants, and the numbers of local hunters have doubled on a national basis during the last 10 years. In At-Bashy, where our study was conducted, only five local inhabitants hold the right to hunt (Natural Resources Department, 2016a). They are not, however, part of the trophy hunting industry, since the purpose of their hunting is not trophies but meat for their livelihood and unlike the trophy hunters, they do not participate in organized tours.

Study area

The At-Bashy region is situated in south eastern Kyrgyzstan (Figure 2) and is a distinct and sparsely populated rural area. Its territory is surrounded by mountain ranges. The difference in absolute values in the height of the mountains varies from 3000 to 5982 m; in the studied valley, the range varies from 2000 to 3800 m.

In 2009, the district had a population of 49,238 (National Statistical Committee of the Kyrgyz Republic (NSC), 2010). The population density is 2.6 people per square kilometre, the area encompasses 19,000 sq. km, and there are 19 villages in the district. At-Bashy is the most sparsely populated, poorest, and one of a few mono-ethnic districts in the country (NSC, 2010). The undertaken study shows that more than one-third of the people who answered the question on their annual income reported it to be under 1000 USD (32.2% could not give an exact answer regarding their income). The primary economic activity in the area is livestock and farming through self-sufficient households and a semi-nomadic way of life, in which almost all households are engaged in the seasonal movement of their livestock between fixed alpine summer pastures and winter pastures in the valleys and lowlands. The moving starts in the spring and usually finishes at the end of the autumn.

Of the total employed population in the At-Bashy district, 75% are employed in agriculture, 8% in the field of school education, 3.5% in the health sector (rural hospitals and clinics), 3% in state administration and 2.9% in the sphere of small and medium-sized businesses (trade, repair of motor vehicles, household appliances and others). The unemployment rate is 6.8% (NSC, 2010, p. 147, 158). The poverty rate was 43.8% in 2013 (of the total population), that is, people who earn less than 27,768.5 KGS per year (576 USD, according to the average exchange rate for 2013). The average per capita income in 2013 amounted to 36,845.5 KGS, which is equal to 764 USD (NSC, 2014, p. 90).

Methodology

The empirical part of the article consists of 395 questionnaires gathered from the local inhabitants of the At-Bashy district in March 2014 and 1 interview with a trophy hunting tour operator conducted in June 2013. Regarding the survey of the local inhabitants, it was necessary to have a sample of at least 381 people according to the Krejcie and Morgan table (Krejcie & Morgan, 1970), because the total population of the study area is about 50,000. In total, 400 questionnaires were prepared with 19 questions and 7 independent variables: gender, age, number of children, education, work, annual income and income from hunting. Of the questions, 17 contained closed alternatives and an open space for further comments and 2 were open questions, that is, without predefined choices. A trial was conducted from 29 January to 1 February 2014, during which 25 questionnaires were distributed to 3 villages: Acha-Kaiyndy, At-Bashy and Kara-Suu. Subsequently, 23 questionnaires were returned (2 people could not return them in time). This test then allowed us to optimize the questionnaire.

After the optimization of the questionnaire, at the end of March 2014, we travelled to the study area with 400 questionnaires (each consisting of 6 A4 pages) and 400 pens as motivation presents for the respondents (Ahlheim, Börger, & Frör, 2013). Our very small incentive in the form of a pen helped considerably in eliciting sincere and reliable answers. To understand how a pen really can be appreciated that much, it is necessary to recognize the local area and the degree of poverty that exists there. As formerly argued, At-Bashy is the poorest region in Kyrgyzstan, and Kyrgyzstan is itself a poor country. Furthermore, our interviewers said that a small gift like a pen was important in obtaining sincere and precise answers. This can be explained by the following factors: a pen is still the most widely used instrument among the educated people in rural areas like At-Bashy, where there is a serious lack of computers, so educated people and office workers were glad to receive a pen. As for respondents with no higher education degree who work mainly on farms, the Central Asian mentality dictates that attention is more important than the gift itself. In rural areas, which are mainly poor, even such a small incentive as a pen might play an important part in acquiring genuine answers. School students in poor countries still mainly use pens instead of modern gadgets or computers; thus, it is a small but pleasant bonus to the family budget. The pens were quite big, and they carried the logo of one of the most popular universities in Kyrgyzstan and Central Asia, Manas University. Perhaps this helped in persuading the respondents that the interview was important.

To be able to conduct the study within the given time frame, we recruited seven local residents (four of whom were school teachers with higher education and three of whom had experience of interviewing gained through work with international health and agriculture organizations). They all received special 3-hour-long training on interviewing for the study and helped in handing out and gathering the questionnaires in the villages and in clearing up any ambiguities. The questionnaires were anonymous, a point that was highlighted in the training of the interviewers. Thanks to the prompt and diligent work of the interviewers, 395 or 98.75% of the questionnaires were returned. In total, 32.9% of the respondents have a yearly family income under 1000 USD, 30.4% from 1000 to 3500 USD and only 4.6% above 3500 USD. A total of 32.2% of the respondents did not know their annual income, which might be related to several factors: first, the question was an open-ended one in which they were asked to give an approximately exact number; second, a number of the local inhabitants practice self-sufficiency and do not have a yearly or monthly salary as a reference base; third, not all students and women had information about the earnings of their families (husbands);

and, finally, generally people in Central Asia do not like to share information about their earnings. The respondents' average age is 41.3, with a median of 42, and the standard deviation of their age is 23.1 years. Regarding gender, 50.4% of the respondents are men and 49.6% are women. In general, the study shows that among the respondents the women have the highest education (among the males 15.7% have no school education beyond secondary school, while for women the number is 7.4%).

Given the rather low income of the majority of the respondents (32.9% are within the extreme poverty group according to the measurement by the UN), it might seem odd that so many of the respondents have a university education. This factor has to be understood within the wider socio-historic context of the country: first of all the legacy from Soviet Union times when education was free and when several of the jobs in rural areas would require a university degree; furthermore, during Soviet rule a degree was a determinant of success, and because of that education is still highly valued and quite affordable in Kyrgyzstan. In the understanding of Kyrgyz people, a person might need some sort of title or degree regardless of whether they use it in their daily lives. For many people, lacking a higher education is considered as a disadvantage. Thus, whenever a young man or a girl graduates from a high school, he or she applies to the university, sometimes even without taking care of future employment prospects and choosing degrees that will never be used. Second, many women have a degree in pedagogy, because teaching is the most widespread job among women in rural areas.

The frequency analysis technique and cross-tabulations with χ^2 test analyses were performed with the Statistical Package for the Social Sciences (IBM SPSS Statistics), Version 20.

Findings

Hunting bases and numbers of game animals: controversies and disputes

Due to the way in which trophy hunting is organized in Kyrgyzstan (as formerly argued), information from the interview with the trophy hunting tour operator and personal knowledge about the At-Bashy region (one of the researchers was born in the region), it was assumed that most of the local inhabitants would not know that they lived in an international trophy hunting destination. However, concerning the question of whether they think that At-Bashy is well known for receiving international trophy hunters, more than 62% of the respondents agree and only 12% disagree. A question was also included regarding whether the respondents know about any "hunting bases", infrastructure for trophy hunting, in the nearby areas. The results show that only 22.5% of the respondents know about such infrastructure. This finding is a little surprising given the fact that researchers report an increasing number of such installations to cater for the growing demand from trophy hunters. Turdumambetov (2011) argues that at least 20 such hunting bases exist in the At-Bashy region and maybe as many as 40. Kronenberg (2014, p. 258) argues that the actual number might even be 80. If we compare those who think that At-Bashy receives international trophy hunters with those who are also aware of the existing hunting infrastructure, we see that the percentage rises slightly (to 30.2%). Among those who do not know that their region is famous for receiving international trophy hunters, 14.2% still know about the existing hunting infrastructure. The study thus shows that the local inhabitants think that the region of At-Bashy is well known for receiving international trophy hunters; however, rather few of the respondents know about any specific hunting bases installed in the nearby mountains.

The fact that so few of the local inhabitants know about any hunting bases might indicate that the trophy hunting industry in Kyrgyzstan is rather closed and distant from the everyday life of the local inhabitants in terms of involvement and information. The group of people who are most informed are the farmers, who, due to their semi-nomadic lifestyle, are more able to observe such installations near their summer pastures.

The respondents were asked whether they had observed any significant decrease in the numbers of argali or ibex during the last years and whether they had witnessed it on their own or more

Table 3. Residents' opinions on the reduction in the number of argali and ibex (%).

	NR	Yes, I have observed it myself	Yes, I have heard of it from other people	No
Gender ($\chi^2 = 15.906$, $df = 2$, $p < 0.000$)				
Male	199	37.7	47.2	15.1
Female	196	20.4	65.3	14.3
Education ($\chi^2 = 15.531$, $df = 8$, $p < 0.050$)				
University	184	26.6	59.8	13.6
Technical school	93	21.5	62.4	16.1
High school	25	32.0	64.0	4.0
School	91	40.7	40.7	18.7
Other	2	50.0	50.0	
Income from trophy hunting ($\chi^2 = 9.318$, $df = 4$, $p < 0.054$)				
Yes	4	50.0	50.0	
No	364	29.1	57.4	13.5
I don't know	27	25.9	40.7	33.3

Question: Have you observed any reduction in the number of argali and/or ibex during the last years?
Note. *N* is the number of respondents in each row category. The attitudinal distribution is displayed as percentages within each row. Only significant (at least on the 0.50 level) relationships are reported.

indirectly through the talk of others (elderly people in their village, grandparents, neighbours, etc.). As shown in Table 3 more than 85% of the respondents, 337 people, had noticed a significant decrease, and of these 34% reported that they had witnessed the decrease directly themselves, while 66% had noticed it indirectly. The decreasing population issue was studied more thoroughly using the cross-tabulations with the χ^2 test.

The effect of age, number of children, job and annual income is not significant, while gender and education correlate strongly with the opinion of a decreasing population of animals. The correlation with gender is very strong ($p < 0.000$), and in this respect it is interesting to note that, while 65.3% of females have heard about the decline in populations through others and only 20.4% have observed it themselves, the percentages among the men are quite different: 37.7% of males had observed the decline themselves, while 40.7% had heard about it from others. The respondents who reported having earnings from hunting, though there were only four of them, confirmed that the number of argali and ibex has decreased. As regards education, which is also quite strongly related, the respondents with higher education and students are clearly more concerned about the decreasing population of animals, though most of them had noticed a decrease indirectly, via information from others.

The people of At-Bashy have for centuries lived a semi-nomadic lifestyle, spending several months of the year in the habitat of the argali and ibex and thus having close visual contact with these animals. Hence, the local inhabitants reporting significant decreases in the population of argali and ibex, either through their own observation or as heard through others (elderly people of the area, farmers, etc.) is an important finding. The issue of the decreasing population of argali and ibex is, however, a disputed one. Although a number of researchers, in line with the observations from the local population, report a sharp decline in the numbers (Koshkarev, 2002; Shukurov, 2015a), governmental sources, such as the Kyrgyz State Agency for Environment Protection and Forestry, claim that the situation is stable or that there has even been an increase. For instance, according to the official government sources, the number of argali increased from 4700 to 10,375 between 2008 and 2013 and the number of ibex from 34,778 to 40,825 (NSC, 2013, p. 33). Shukurov (2015a) argues, "according to messages from different places the numbers of argali and ibex have shrunk and in some areas they have disappeared. Nevertheless, the state agency continues to report the growth of their populations, even if tiny, but growth!" (own translation). The respondents with higher education in our study (among them a number of school teachers) and students are the ones who are most concerned about the decreasing population of the argali and ibex. It is assumed that this is likely to be related to them having more information about environmental problems and a broader outlook in general. Over time their attention towards the issue will grow, and they will pressure the authorities to respond.

External tour operators and economic leakage

Only 14% of the respondents think that the regional authorities have any income from trophy hunting, but 46% of these respondents think that the income is considerable. The cross-tabulations of the χ^2 test show that occupation is significantly ($p < 0.017$) related to the respondents' view on this question. Among the respondents working in the regional authorities, 46% think that the regional authorities receive an income from trophy hunting. This is quite a high percentage compared with the other occupations (among the respondents working in the police, for instance, the percentage is only 15.1%).

When we consider whether the respondents think that their village or community has any income from trophy hunting, 56.5% do not think so, 9.9% think that it has, and the rest do not know. Performing the cross-tabulations with the χ^2 test, we find that gender and occupation are strongly related to the opinion of the respondents (Table 4).

Three times more females than males do not think that their community or village obtain any economic benefits from trophy hunting. Those who work in the private sector (66.1%) or in a governmental agency (66%), followed by retired people (65%) and people in the police (65%), are the most reluctant to think that their village or community has any income from hunting tourism. The ones who are more likely to think that the community receives an income are the farmers (20%) and the entrepreneurs (18%). The effects of age, education level and income from hunting tourism are insignificant. The respondents were also asked whether anyone from their community or village worked in trophy hunting, and 31.6% of the respondents confirmed this, 37.3% answered negatively and 31.1% did not know.

Economically, trophy hunting is apparently not a lucrative business for At-Bashy and its inhabitants. Only four people reported having any income from trophy hunting, and the respondents who think that the regional authorities or their local community or village gain anything from the activity are generally few. In terms of income for the regional authorities, it is interesting to note that almost 50% of the people working there believe that trophy hunting contributes to the budget income of their work institution. Nevertheless, most of the revenue from trophy hunting is part of the shadow economy of Kyrgyzstan, and most of the profits are gained by the tour operators and a few local or regional officials related to these companies. Thus, the benefits for local communities are inconsequential.

In relation to the question about "hunting bases", we also included a question about whether the local inhabitants know about any tour operators that organize hunting tours for foreign people. The fact that we focused on "foreign people" was due to our former knowledge and the information that

Table 4. Residents' opinions on whether the community/village has any income from trophy hunting (%).

	NR	Yes	No	Don't know
Gender ($\chi^2 = 13.432$, $df = 2$, $p < 0.001$)				
Male	199	14.6	57.8	27.6
Female	196	5.1	55.1	39.8
Occupation ($\chi^2 = 38.700$, $df = 18$, $p < 0.003$)				
Police	31		64.5	35.5
Farmer	63	20.6	60.3	19.0
Student	30	13.3	53.3	33.3
Private sector	56	3.6	66.1	30.4
Public sector/state administration	47	6.4	66.0	27.7
Entrepreneur	11	18.2	54.5	27.3
School teacher	66	7.6	51.5	40.9
Unemployed or housewife	45	11.1	31.1	57.8
Retired	23	4.3	65.2	30.4
Unknown	23	17.4	52.2	30.4

Question: To your knowledge, does your village or community receive any income from trophy hunting?
Note. *N* is the number of respondents in each row category. The attitudinal distribution is displayed as percentages within each row. Only significant (at least on the 0.50 level) relationships are reported.

Table 5. Residents' knowledge about trophy hunting tour operators (%).

	NR	Yes, I know	No, I don't know	I can't answer
Gender ($\chi^2 = 12.941$, $df = 2$, $p < 0.002$)				
Male	199	25.1	66.8	8.0
Female	196	11.2	78.1	10.7
Education ($\chi^2 = 15.670$, $df = 8$, $p < 0.047$)				
University	184	18.5	71.7	9.8
Technical school	93	16.1	79.6	4.3
High school	25	4.0	80.0	16.0
School	91	23.1	65.9	11.0
Other	2	50.0		50.0
Occupation ($\chi^2 = 41.388$, $df = 18$, $p < 0.001$)				
Police	31	12.9	80.6	6.5
Farmer	63	38.1	54.0	7.9
Private sector	56	23.2	71.4	5.4
Public sector/state administration	47	17.0	78.7	4.3
Entrepreneur	11	36.4	63.6	
School teacher	66	7.6	81.8	10.6
Unemployed or housewife	45	8.9	71.1	20.0
Retired	23	8.7	82.6	8.7
Student	30	10.0	73.3	16.7
Unknown	23	21.7	69.6	8.7
Annual income ($\chi^2 = 21.293$, $df = 10$, $p < 0.019$)				
Under 1000 USD	130	14.6	76.2	9.2
1001–2000 USD	65	21.5	69.2	9.2
2001–3500 USD	55	21.8	69.1	9.1
3501–6500 USD	13	53.8	38.5	7.7
6501 USD and over	5	60.0	40.0	
Can't answer	127	13.4	76.4	10.2

Question: Do you know of any tour operator(s) that organize(s) trips for international trophy hunters?
Note. *N* is the number of respondents in each row category. The attitudinal distribution is displayed as percentages within each row. Only significant (at least on the 0.50 level) relationships are reported.

we had obtained from the interview with the tour operator in Bishkek. Surprisingly enough, 72 (18.2%) of the respondents answered positively.

The cross-tabulations with the χ^2 test show that again there is a strong connection between the gender ($p < 0.002$) and occupation ($p < 0.001$) and the knowledge of the local population about the tour operators (Table 5). The effects of the education level and annual income are also significant. After farmers, the next most aware group is entrepreneurs (36.4%), then private sector employees (23.2%), and, finally, officials (17%).

Two other questions were also included to gain more information about the tour operators among those who answered "yes" to the above question. The first follow-up question thus dealt with the geographical origin of the owners and had the following closed alternatives: "businessmen from Bishkek", "businessmen from At-Bashy" and "others." An open comment space, as with the other "closed" questions, was provided at the end of the questionnaire. Of the 72 respondents who confirmed that they know about trophy hunting tour operators, 29% stated that they think they are businessmen from Bishkek (the capital), while 58% believe that they are local businessmen from At-Bashy. For the second follow-up question, in which the respondents were asked to give exact names of possible owners of the tour companies, 16 people provided exact names, which all pointed to the same person. Clearly, the farmers are better informed than the other respondents, as, among those who wrote down an exact name, 38% were farmers.

A search on the Internet showed that this person was a region-level official who had worked for many years in environment protection in the above-mentioned state agency and who had even received a medal from the President of Kyrgyzstan for the merit of environment protection. This case is a good indication of the level of challenge in Kyrgyzstan, where former state employees move into private enterprise, selling what they were previously employed to protect. According to Turdumambetov (2011), it is hard or almost impossible to achieve good governance of the use of natural

resources and environmental protection throughout the post-Soviet area in general and in Kyrgyzstan in particular, because of the level of corruption, which in Kyrgyzstan is described as being in a deplorable state (Braden, 2014; Transparency International, 2014).

The widespread violation of environmental laws by the local population, state officials, and organizers of hunting tours in Kyrgyzstan is a significant challenge, and some authors argue that it is partially a consequence of trophy hunting's development (Koshkarev, 2002; Turdumambetov, 2011). However, the case might be as much the other way around; corruption leads to uncontrolled and unregulated development and unsustainable praxis. It is worth noting that foreign hunters might have no information about the violation of environmental regulations.

Traditional lifestyle, elitism and the lack of support for further development

The study also included a question regarding who the respondents, according to their observation, think are the people who are most likely to hunt for argali or ibex, with the following possible answers: "foreign tourists", "rich Kyrgyz people", "border guards", "local people" and "others." A field for qualitative comments was also provided. Among the respondents who answered that they know about tour operators, 45.3% think that rich Kyrgyz people hunt the most for argali and ibex, while foreigners are in the second place, accounting for 25% of the answers. The local inhabitants are in the third place, with 10% of the responses. Among the farmers, who were the segment that most often provided a concrete name for tour operators, the corresponding percentages are 47.6% (rich Kyrgyz people), 33.3% (foreign tourists) and 4.8% (local people).

The questionnaire also included an open question about the symbolic value of the argali and ibex to the local people: "What do argali and ibex mean to you in your life?" Though 35% of those polled answered abstractedly that those animals have the highest value in their lives, 26% mentioned exactly that they have environmental value, 7% noted their particular importance for the future generation, and 12% associated them with the beauty of the mountain landscapes. Another 3.5% of the respondents believe that they are a Kyrgyz "brand", meaning that argali and ibex are symbolic animals for Kyrgyz people. Until the twenty-first century, the traditions and culture of the Kyrgyz people were tightly interwoven with the wildlife of the country, and biodiversity was at the heart of the spiritual development of the nation, resulting from its origins as a nomadic society. A close relationship with and understanding of nature were an integral part of the culture of the Kyrgyz nation. Formerly, cultural traditions and folklore did not encourage local inhabitants to kill animals like argali, ibex, deer and snow leopards (Aitpaeva, 2006). When the respondents thus described the argali and ibex as the animals that have "the highest value" to them, it may be due to the fact that they are often described in local folklore as holy animals.

To evaluate any changes in this tradition, we therefore also asked whether any of the respondents have a stuffed head of either of the two animals in their home. A total of 92% of the respondents did not have a stuffed argali or the head of an ibex with horns at home, as is normal in Western countries among trophy hunters, while 6% confirmed that they have, and 8% of the respondents who do not currently have a stuffed argali or ibex answered that they would like to have such a head on the wall in the future. A more thorough analysis of the question using the cross-tabulations with the χ^2 test showed that the local inhabitants' education level is strongly related ($p < 0.004$) to their wish to have a stuffed argali or ibex head at home in the future; the less educated the individual, the higher is the desire. Those who earn money from hunting tourism are three times more prone to want to have a trophy than the other categories, but again this represents only four people.

Only 13.9% of the respondents think that trophy hunting for argali and ibex is performed legally (possible answers were "yes", "no" and "don't know"). Among those who are employed in areas that would normally involve the regulation of the hunting, we see that the percentage varies significantly ($p < 0.126$). Among the local police, 0% think that the hunting is legal, while as many as 68% do not know; among the district officers, 23% think that it is legal, while 43.2% do not know. A total of 65.8% of the respondents do not support the further development of trophy hunting in At-Bashy,

and 4.8% of the respondents support it only if it takes place in accordance with the laws and if the local inhabitants will gain benefits from it. An analysis of this question using the cross-tabulations with the χ^2 test showed that there is a strong correlation ($p < 0.001$) between whether the respondents think that the hunting is legal or not and their opinion regarding future development. Among those who think that it is illegal, 72.3% do not support any further development. Age has a significant ($p < 0.000$) bearing on the opinion of local inhabitants with reference to further development, and especially younger people are against it. The number of children and level of education ($p < 0.000$, $p < 0.0045$) have a strong bearing as well, those with fewer children and higher education being more negative. Entrepreneurs and government officials view the further development quite positively, as well as those few who actually report receiving an income from trophy hunting.

Conclusion

The body of literature on tourism's impacts highlight that, in general and specifically when it comes to rural areas, most tourism developments have been implemented without considering the potential impacts. Such is the case of trophy hunting, as observed from the review of the international research literature on the topic and as seen through this case study of trophy hunting in Kyrgyzstan. Furthermore, the UNEP and UNWTO definition of sustainable tourism highlights that, for tourism to be sustainable, it must address the needs of the environment, the visitors and the industry, and the host communities. Clearly, in our case only the industry's and the visitors' needs seem to have been met, not the needs of the local communities in the area where the trophy hunting takes place.

With reference to the theoretical framework put forward in terms of the sociocultural sustainability of hunting tourism, we could argue that it seems from the study that on average the members of the local population are not very informed about the development of trophy hunting in their area, and they lack the basic information necessary to take part in any decision-making processes. Even the local authorities cannot influence the development of trophy hunting, again mainly because of the lack of information. In Kyrgyzstan, all the decisions concerning the development of trophy hunting are initiated by the central government and local authorities; in the best case, they only execute them, while, in the worst case, they only observe the activities of tour operators from the outside.

Trophy hunting was, as argued, not a common activity in the tradition of the Kyrgyz people in general or in the At-Bashy region prior to the collapse of the Soviet Union. Correspondingly, few of the respondents have a stuffed head of argali or ibex on the wall of their home. Although nine respondents stated that they would like to have such a trophy in the future, the results are not significant. The majority of the trophy hunters, according to the local inhabitants, are wealthy Kyrgyz people assimilating rich Western traditions and not foreign trophy hunters as we assumed at the beginning of the research. However, since it has not been possible to talk directly with more than one tour operator and acquire information about their clients, and the local inhabitants are not, as seen from the research, particularly well informed about the trophy hunting taking place in their region, we cannot really draw any conclusions at this point. The study addresses the urgency of the problem: it is a problem if people in positions of influence are seen to make a lot of money from trophy hunting while the local population in the destination area continues to suffer from poverty.

In sum, the negative impacts of trophy hunting seem to overrule the positive ones in At-Bashy, and in its current form it is not sustainable. Although there is a perception, especially among officials, that trophy hunting generates significant revenues that could contribute to the conservation of the species and improve local livelihoods, such is not the case in the At-Bashy region or in Kyrgyzstan in general at the present. It is thus not surprising to find that the majority of local inhabitants (up to 70%) do not support the further development of trophy hunting in their area. To gain the support of local inhabitants for trophy hunting, the Government should make the decision-making process more transparent and tour operators should share the benefits with the local inhabitants. The environmental NGOs, which have seats in the capital, should also be more active in the region to monitor the activity. Furthermore, a (temporary) moratorium on trophy hunting should be put in place; first,

to allow for a proper evaluation of the situation; second, to avoid the local population's discontent growing into a conflict; and, finally, to assure enough time for the implementation of the necessary protective and inclusive measures.

Our study shows that more research needs to be directed to investigating the trophy hunting industry in Kyrgyzstan in general and the tour operators and their customers specifically. However, due to issues of corruption and trophy hunting being part of the shadow economy of Kyrgyzstan, as discussed, this might prove to be difficult.

The questionnaires in the undertaken study were distributed in 5 out of 19 villages, which could be seen as a limitation. However, we wanted to gain a representative sample at the regional level according to the Krejcie and Morgan table (Krejcie & Morgan, 1970) and within the given time frame and budget. A total of 56.5% (27,835) of the population of the At-Bashy region lives in these chosen villages, and we do not expect that answers from the other villages would differ significantly.

Looking back, we also see that it would have been useful to include other questions or to have elaborated further on some of the questions to obtain more specific information. At the beginning of the research, we planned to interview Kyrgyz trophy hunting tour operators first to provide background information for the development of the questionnaire. However, after the first interview with a tour operator in the capital area that provided trophy hunting tours to our region, it became clear that the tour operators would be unlikely to provide reliable information unless we camouflaged our study, pretending to be a possible business partner or suchlike, which we did not consider to be ethical. Even this single interview was difficult, because the tour operator clearly did not welcome scholars studying the activity (the respondent avoided and even refused to answer a number of the more sensitive questions). At that point we were aware that trophy hunting in Kyrgyzstan might be a sensitive issue, but the degree of the sensitivity of the activity that became evident during our study surprised us.

Note

1. Annually, the government issues between 60 and 100 licenses for argali hunting, and one license costs about 15,000 USD (Turdumambetov, 2011).

Acknowledgments

We especially thank the participants and interviewers of this study. We gratefully acknowledge Adilet Amalkanov, Atyrkul Mambetakunova, Azamat Nurdinov, Balyibubu Kadyralieva, Bolot Matakov, Duyshobubu Albanova, Nurjan Amankulova, Usonakun Turdumambetov, and Gordon Campbell for their assistance with the survey/interviews.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

Norwegian Centre for International Cooperation in Education (SIU) [Project no CPEA-2011/10017].

Notes on contributors

Ingeborg Nordbø is an associate professor at the Department of Economics and IT at The University College of southeast Norway, and is the leader of the research group on sustainable tourism. She received the PhD degree in tourism/entrepreneurship and the MSc degree in international economics and business administration from the University of Aalborg, Denmark, and has specialized in tourism development, sustainability and entrepreneurship in rural areas. She has worked as an advisor and manager of various projects within tourism and local community development and in a number of international settings, such as Denmark, Chile, Guatemala, Kyrgyzstan, China and Norway.

Bakyt Turdumambetov is Head of the Department of Travel Management and Tourism Guidance, Kyrgyz Turkish Manas University. He received the PhD degree in economics from the National Academy of Sciences of the Kyrgyz Republic. He is the author of the monograph *Challenges and Perspectives of Tourism Development in Mountainous Conditions of the Kyrgyz Republic* (2005, in Russian) and the co-author of the first manual in Central Asia for the course of "Ecotourism" (2006, in Russian). His current research interests cover international hunting tourism and equestrian and halal tourism potential in Kyrgyzstan.

Bilgehan Gülcan is an associate professor at the Department of Tourism Management in the Faculty of Tourism at Gazi University, Turkey. He received the PhD degree in education of tourism and hotel management and the MSc degree in tourism and hotel management from Gazi University, Turkey, and has specialized in tourism marketing, tourism education and alternative tourism. He has worked as a head of department and director of the Tourism and Hospitality Management Higher School in Kyrgyz Turkish Manas University for five years. He has conducted and participated in several international and national projects, especially in tourism education and tourism development in Turkey and Kyrgyzstan. His current research interest is tourism in Central Asia.

References

Ahlheim, M., Börger, T., & Frör, O. (2013). The effects of extrinsic incentives on respondent behaviour in contingent valuation studies. *Journal of Environmental Economics and Policy*, *2*(1), 45–70. doi:10.1080/21606544.2012.754612

Aitpaeva, G. (2006). The triad of crime, punishment, and forgiveness in the Kyrgyz epic Kojojash. *Journal of Folklore Research, 43*(2), 109–128. Retrieved from http://www.jstor.org/stable/3814869

Baker, J. E. (1997a). Trophy hunting as a sustainable use of wildlife resources in Southern and Eastern Africa. *Journal of Sustainable Tourism, 5*(4), 306–321. doi:10.1080/09669589708667294

Baker, J. E. (1997b). Development of a model system for touristic hunting revenue collection and allocation. *Tourism Management, 18*(5), 273–286. doi:10.1016/S0261-5177(97)00016-2

Bashqawi, N. (2014). *Kill to conserve: Ethical implications of trophy hunting conservation measures* (2014 Honors Council of the Illinois Region Papers, Paper 5). Retrieved from http://dc.cod.edu/hcir2014/5

Braden, K. (2014). Illegal recreational hunting in Russia: The role of social norms and elite violators. *Eurasian Geography and Economics*, *55*(5), 457–490. doi:10.1080/15387216.2015.1020320

Caro, T. M., Young, C. R., Cauldwell, A. E., & Brown, D. D. E. (2009). Animal breeding systems and big game hunting: Models and application. *Biological Conservation, 142*, 909–929. doi:10.1016/j.biocon.2008.12.018

Cohen, E. (2014). Recreational hunting: Ethics, experiences and commoditization. *Tourism Recreation Research, 39*(1), 3–17. doi:10.1080/02508281.2014.11081323

Deere, N. J. (2011). Exploitation or conservation? Can the hunting tourism industry in Africa be sustainable? *Environment, 53*(4), 20–32. doi:10.1080/00139157.2011.588550

Delibes-Mateos, M., Giergiczny, M., Caro, J., Viñuela, J., Riera, P., & Arroyo, B. (2014). Does hunters' willingness to pay match the best hunting options for biodiversity conservation? A choice experiment application for small-game hunting in Spain. *Biological Conservation, 177*, 36–42.

Dowsley, M. (2009). Inuit-organised polar bear sport hunting in Nunavut territory, Canada. *Journal of Ecotourism, 8*(2), 161–175. doi:10.1080/14724040802696049

Economists at Large. (2013). *The $200 million question: How much does trophy hunting really contribute to African communities*? (Report for the African Lion Coalition, prepared by Economists at Large). Melbourne. Retrieved from http://www.ifaw.org/united-states/resource-centre/how-much-does-trophy-hunting-contribute-african-communities

Gressier, C., (2014). An elephant in the room: Okavango safari hunting as ecotourism? *Ethnos, 79*(2), 193–214. doi:10.1080/00141844.2012.723016

Harris, R., & Pletscher, D. (2002). Incentives toward conservation of argali *Ovis ammon*: A case study of trophy hunting in Western China. *Oryx, 36*(4), 373–381.

Heffelfinger, J. R., Geist, V., & Wishart, W. (2013). The role of hunting in North American wildlife conservation. *International Journal of Environmental Studies, 70*(3), 399–413. doi:10.1080/00207233.2013.800383

Heinen, J. T., Shukurov, E., & Sadykova, C. (2001). Legislative and policy initiatives in biodiversity conservation in Kyrgyzstan. *Post-Soviet Geography and Economics, 42*(7), 519–543. doi:10.1080/10889388.2001.10641185

Higginbottom, K. (Ed.). (2004). *Wildlife tourism: Impact, management and planning*. Common Ground Publishing. Retrieved from http://sustain.pata.org/wp-content/uploads/2014/12/WildlifeTourism-impacts.pdf

Hofer, D. (2002). *The lion's share of the hunt. Trophy hunting and conservation – A review of the legal Eurasian tourist hunting market and trophy trade under CITES*. Brussels: TRAFFIC Europe.

IFAW. (2016). Killing for trophies: An analysis of global trophy hunting trade. Retrieved from http://www.ifaw.org/sites/default/files/IFAW_TrophyHuntingReport_US_v2.pdf

IUCN. (2012). *IUCN SSC guiding principles on trophy hunting as a tool for creating conservation incentives*. Version 1.0. Gland: IUCN. Retrieved from https://cmsdata.iucn.org/downloads/iucn_ssc_guiding_principles_on_trophy_hunting_ver1_09aug2012.pdf

IUCN. (2016). The IUCN red list of threatened species. Version 2016-1. Retrieved from www.iucnredlist.org.

Keskinarkaus, S., & Matilainen, A., (2010). Social sustainability of hunting tourism in Finland. In A. Matilainen, & S. Keskinarkaus (Eds.), *The social sustainability of hunting tourism in Northern Europe* (pp. 29–56). Seinäjoki: Ruralia Institute.

Knezevic, I. (2009). Hunting and environmentalism: Conflict or misperceptions? *Human Dimensions of Wildlife, 14*(1), 12–20. doi:10.1080/10871200802562372

Koshkarev, E. (2002). Валютные бараны и министерские волки Киргизии [Currency sheep and ministerial wolves of Kyrgyzstan]. *Охрана дикой природы, 1*(24), 26–32. Retrieved from http://www.biodiversity.ru/publications/odp/archive/24/koshkarev.html.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*, 607–610. doi:10.1177/001316447003000308

Kronenberg, J. (2014). Viable alternatives for large-scale unsustainable projects in developing countries: The case of the Kumtor gold mine in Kyrgyzstan. *Sustainable Development, 22*, 253–264.

Law of the Kyrgyz Republic. (2014). About hunting and the hunting economy. Retrieved from http://cis-legislation.com/document.fwx?rgn=66249

Leader-Williams, N., Kayera, J. A., & Overton, G. L. (Eds.). (1996). *Tourist hunting in Tanzania*. Gland; Cambridge: IUCN.

Leader-Williams, N., Milledge, S., Adcock, K., Brooks, M., Conway, A., Knight, M., … Teferi, T. (2005). Trophy hunting of black rhino Diceros bicornis: Proposals to ensure its future sustainability. *Journal of International Wildlife Law & Policy, 8*(1), 1–11. doi:10.1080/13880290590913705

League against Cruel Sports. (2004). The myth of trophy hunting as conservation. Retrieved from http://www.league.org.uk/~/media/Files/LACS/Reference-material/League-Against-Cruel-Sports-2004-The-Myth-of-Trophy-Hunting-as-Conservation.pdf

Lemelin, R. H., Johnston, M. E., Dawson, J., Stewart, E. S., & Mattina, C., (2012). From hunting and fishing to cultural tourism and ecotourism: Examining the transitioning tourism industry in Nunavik. *Polar Journal, 2*(1), 39–60. doi:10.1080/2154896X.2012.679559

Lewis, D., & Alpert, P. (1997). Trophy hunting and wildlife conservation in Zambia. *Conservation Biology, 11*, 59–68.

Lindsey, P., Balme, G., Becker, M., Begg, C., Bento, C., Bocchino, C., … Zisadza, P. (2013). The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. *Biological Conservation, 160*, 80–96.

Lindsey, P., Havemann, C., Lines, R., Price, A., Retief, T., Rhebergen, T., … Romañach, S. (2013). Benefits of wildlife-based land uses on private lands in Namibia and limitations affecting their development. *Fauna & Flora International, Oryx, 47*(1), 41–53. doi:10.1017/S0030605311001049

Lindsey, P. A., Roulet, P. A., & Romañach, S. S. (2007). Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. *Biological Conservation, 134*, 455–469.

Liu, Z. (2003). Sustainable tourism development: A critique. *Journal of Sustainable Tourism, 11*, 459–475.

Lovelock, B. A. (Ed.). (2008). *Tourism and the consumption of wildlife: Hunting, shooting and sportfishing*. London: Routledge.

Lu, J., & Nepal, S. K. (2009). Sustainable tourism research: An analysis of papers published in the Journal of Sustainable Tourism. *Journal of Sustainable Tourism, 17*(1), 5–16. doi:10.1080/09669580802582480

MacKay, K. J., & Campbell, J. M. (2004). An examination of residents' support for hunting as a tourism product. *Tourism Management, 25*, 443–452.

Magis, K. (2010). Community resilience: An indicator of social sustainability. *Society and Natural Resources, 23*, 401–416.

Mahoney, S. P., & Jackson, J. J. III. (2013). Enshrining hunting as a foundation for conservation – The North American model. *International Journal of Environmental Studies, 70*(3), 448–459. doi:10.1080/00207233.2013.801178

Mallon, D. (2013). *Trophy hunting of CITES-listed species in Central Asia*. Geneva: Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Marchand, P., Garel, M., Bourgoin, G., Dubray, D., Maillard, D., & Loison, A. (2014). Impacts of tourism and hunting on a large herbivore's spatio-temporal behavior in and around a French protected area. *Biological Conservation, 177*, 1–11. doi:10.1016/j.biocon.2014.05.022

Maroney, R. L. (2005). Conservation of argali *Ovis ammon* in western Mongolia and the Altai-Sayan. *Biological Conservation, 121*, 231–241.

Matilainen, A., & Keskinarkaus, S. (Eds.). (2010). *The social sustainability of hunting tourism in Northern Europe*. Seinäjoki: Ruralia Institute.

McGranahan, D. A. (2011). Identifying ecological sustainability assessment factors for ecotourism and trophy hunting operations on private rangeland in Namibia. *Journal of Sustainable Tourism, 19*(1), 115–131. doi:10.1080/09669582.2010.497219

McKenzie, S. (2004). *Social sustainability: Towards some definitions* (Hawke Research Institute Working Paper Series No. 27). South Australia: Hawke Research Institute University of South Australia Magill.

Naevdal, E., Olaussen, J. O., & Skonhoft, A. (2012). A bioeconomic model of trophy hunting. *Ecological Economics, 73*, 194–205. doi:10.1016/j.ecolecon.2011.10.026

National Statistical Committee of the Kyrgyz Republic (NSC). (2010). *Перепись населения и жилищного фонда Кыргызской Республики 2009. Книга 3 (в таблицах). Регионы Кыргызстана:Нарынская область*; [Population

and housing census 2009. Book 3 (in tables). Provinces of Kyrgyzstan: Naryn Province]. Bishkek. Retrieved from http://www.stat.kg/ru/publications/

National Statistical Committee of the Kyrgyz Republic (NSC). (2013). *Окружающая среда в Кыргызской Республике: 2008–2012* [The environment in the Kyrgyz Republic: 2008–2012]. Bishkek. Retrieved from http://stat.kg/images/stories/OS%202008-2012.pdf.

National Statistical Committee of the Kyrgyz Republic (NSC). (2014). *Уровень жизни населения Кыргызской Республики, 2009–2013* [The standard of living of the population of the Kyrgyz Republic, 2009–2013]. Bishkek. Retrieved from http://stat.kg/media/publicationarchive/9d4cf3cb-1107-4074-b6d1-e7fdf6ff662f.pdf

Natural Resources Department. (2016a). Information on the users of hunting grounds in the territory of the Kyrgyz Republic. Retrieved from http://fauna.kg/images/ohotpolz_kr.doc.

Natural Resources Department (2016b). Map of hunting farms of the Kyrgyz Republic. Retrieved from http://ohota.hostzi.com/.

Novelli, M., & Humavindu M. N. (2005). Wildlife tourism – Wildlife use vs local gain: Trophy hunting in Namibia. In M. Novelli (Ed.), *Niche tourism: Contemporary issues, trends and cases* (pp. 171–182). Oxford: Butterworth-Heinemann Ltd.

Nygård, M., & Uthardt, L. (2011). Opportunity or threat? Finnish hunters' attitudes to hunting tourism. *Journal of Sustainable Tourism, 19*(3), 383–401. doi:10.1080/09669582.2010.524701

Parry-Jones, R. (2013). *Framework for CITES non-detriment findings for hunting trophies with a focus on Argali Ovis ammon*. Geneva: Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Puhakka, R., Cottrell, S., & Siikamäki, P. (2014). Sustainability perspectives on Oulanka National Park, Finland: Mixed methods in tourism research. *Journal of Sustainable Tourism, 22*(3), 480–505. doi:10.1080/09669582.2013.839690

Puhakka, R., Sarkki, S., Cottrell, S. P., & Siikamaki, P. (2009). Local discourses and international initiatives: Sociocultural sustainability of tourism in Oulanka National Park, Finland. *Journal of Sustainable Tourism, 17*(5), 529–549.

Radder, L. (2005). Motives of international trophy hunters. *Annals of Tourism Research, 32*(4), 1141–1144.

Reis, A. C. (2009). More than the kill: Hunters' relationships with landscape and prey. *Current Issues in Tourism, 12*(5–6), 573–587. doi:10.1080/13683500903042881

Shackleton, D.M. (Ed.). (1997). *Wild sheep and goats and their relatives. Status survey and conservation action plan for Caprinae*. Gland; Cambridge: IUCN.

Shukurov, E. (2012). *Фарс* [Slapstick]. Retrieved from http://analitika.akipress.org/news:4750.

Shukurov, E. (2013). *На большей части Кыргызстана положение архара и теке катастрофическое* [Argali and ibex's situation is disastrous in most of Kyrgyzstan]. Retrieved from http://analitika.akipress.org/news:4938.

Shukurov, E. (2015a). *О необходимости введения моратория на охоту* [The need for a moratorium on hunting]. Retrieved from http://analitika.akipress.org/news:5220.

Shukurov, E. (2015b). *Продать на органы* [Sell organs]. Retrieved from http://analitika.akipress.org/news:5183.

Singh, N. J., & Milner-Gulland, E. J. (2011). Monitoring ungulates in Central Asia: Current constraints and future potentials. *Oryx, 45*, 38–49.

State Agency on Environment Protection and Forestry under the Government of Kyrgyz Republic. Institute for Biology and Pedology of National Academy of Sciences of Kyrgyz Republic. (2006). *Red data book of Kyrgyz Republic* (2nd ed.). Ecological Movement "Aleine" of Kyrgyzstan Bishkek. Bishkek. Retrieved from http://nature.gov.kg/images/files/redbook/RB_KG_500-527.pdf

Stein, A. B., Fuller, T. K., Damery, D. T., Sievert, L., & Marker, L. L., (2010). Farm management and economic analyses of leopard conservation in north-central Namibia. *Animal Conservation, 13*, 419–427. doi:10.1111/j.1469-1795.2010.00364.x

Transparency International. (2014). Corruption perceptions index 2014: Results. Retrieved from https://www.transparency.org/cpi2014/results

Turdumambetov, B., (2011). *Особенности национальной охоты* [Specifics of national hunting]. Retrieved from http://analitika.akipress.org/news:2001.

UNEP and UNWTO. (2005). *Making tourism more sustainable – A guide for policy makers*. Paris: UNEP and Madrid: UNWTO. Retrieved from http://www.unep.fr/shared/publications/pdf/DTIx0592xPA-TourismPolicyEN.pdf.

Vaisman, A., Mundy-Taylor, V., & Kecse-Nagy, K., (2013). *Wildlife trade in the Eurasian Customs Union and in selected Central Asian countries*. Geneva: Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Werner, C. (2003). The new Silk Road: Mediators and tourism development in Central Asia. *Ethnology, 42*(2), 141–159. Retrieved from http://www.jstor.org/stable/3773779

World Bank. (2016). Terrestrial protected areas (% of total land area): Overview per country. Retrieved from http://data.worldbank.org/indicator/ER.LND.PTLD.ZS?end=2014&name_desc=false&start=2014&view=map.

Yasuda, A. (2012). *Is sport hunting a breakthrough wildlife conservation strategy for Africa*? (Field Actions Science Reports, Vol. *6*). Retrieved from http://factsreports.revues.org/1362

CONSERVATION FORCE
A FORCE FOR WILDLIFE CONSERVATION

† BARON BERTRAND DES CLERS, PH.D.
† JAMES G. TEER, PH.D.
† BART O'GARA, PH.D.

BOARD OF DIRECTORS:

JOHN J. JACKSON, III, J.D.
PHILIPPE CHARDONNET, D.V.M.
GERHARD DAMM
BERT KLINEBURGER
DON LINDSAY
SHANE MAHONEY
DALE TOWELL, PH.D.

September 12, 2016

Mr. Timothy Van Norman
Chief, Branch of Permits
U.S. Fish and Wildlife Service
5275 Leesburg Pike
Falls Church, Virginia 22041-3803

SEP 20 2016

RE: Zambia Lion Import Permits for 2016

Dear Chief Van Norman:

Enclosed please find documents in support of three applications for permits to import the sport-hunted trophies of African lion (*P. l. melanochaita*) from Zambia. In evaluating these applications, please consider the information submitted here and the information previously submitted by Conservation Force, Zambia's Department of National Parks and Wildlife (including but not limited to the Non-Detriment Finding and Annexes sent on May 9), and others. The permit applicants are listed at the end of this letter.

This information demonstrates that Zambia's hunting program enhances the survival of lion in the wild for two main reasons: (1) it is well-managed, scientifically-based, and sustainable; and (2) it addresses the three primary threats to lion (*e.g.*, loss of habitat and prey base, and human-lion conflicts) identified by the U.S. Fish and Wildlife Service because hunting revenues provide critical incentives for landholders to protect and recover lion. Due to these benefits, we respectfully request you make a positive enhancement finding and issue these permits.

I. Zambia's conservation hunting program is well-managed, sustainable, and scientifically-based.

A. The hunting program is governed by an effectively and adaptively implemented Conservation Strategy and Action Plan.

Lion in Zambia are adaptively managed and hunted under a "Conservation Strategy and Action Plan for the Africa Lion" ("Action Plan").[1] The Action Plan is the result of a participatory workshop involving scientists, NGOs, private sector representatives, and other stakeholders.[2] The Action Plan recognizes that lion have "immense ecological and socio-economic significance" in Zambia, including due to revenues generated by licensed, regulated tourist safari hunting.[3] The Action Plan expresses "the conviction ... that healthy lion populations can support sustainable trophy hunting and subsequently contribute to socio-economic development of rural populations as an incentive for rural communities to tolerate and help conserve the African lion." It identifies "science-based ... areas of focus [that] include promotion of age-based harvesting

[1] Zambia Wildlife Authority (ZAWA), now the Department of National Parks and Wildlife (DNPW), Conservation Strategy and Action Plan for the African Lion (Feb. 2009) (*Action Plan*).
[2] *Id.*
[3] *Id.*, p. vii; Ministry of Tourism and Arts/DNPW, Enhancement and Non Detriment Findings for African Lion Sport Hunting in Zambia (*NDF*), p. 8.

3240 S I-10 Service Rd. W, Suite 200, Metairie, Louisiana 70001-6911, USA
Telephone: (504) 837-1233 • Fax (504) 837-1145 • E-mail: jjj@conservationforce.org
www.conservationforce.org

of lions and setting of hunting quotas based on empirical biological data in addition to the on-going collection of trophy measurements."[4]

The Action Plan identifies objectives and targets, and activities to achieve these. It incorporates deadlines to measure progress towards achieving the objectives and targets.[5]

The Action Plan was adopted in 2009 and is expected to "guide lion conservation in Zambia for the next ten years or more."[6] Since the Plan's approval, Zambia has moved forward to implement research programs, improve lion monitoring, enhance community benefits to reduce human-lion conflict, implement an aging program, consolidate data in a Conservation Unit, and increase ecological staff, among other things – all activities identified in the Action Plan.[7]

The Action Plan was adaptively reviewed and supplemented in 2016, when the Department of National Parks and Wildlife ("DNPW," formerly the Zambia Wildlife Authority, "ZAWA") adopted new regulations to govern lion hunting.[8]

B. Zambia's lion hunting program was updated in 2016 to ensure sustainability of the offtakes and to incorporate scientifically-recognized best practices.

Zambia's lion hunting program was suspended from 2013 to 2015 to better organize the hunting industry and assess the status of the lion population. The government lifted this suspension in 2016, based on the following.

> First, the 2009 Lion Conservation Strategy was recently supplemented through adoption of new guidelines on hunting of lion which implement an age-based harvest system. Second, in 2015 major legal reforms occurred in the wildlife sector with the adoption of the Zambia Wildlife Act No. 14. The reforms give new impetus to the structure of wildlife conservation in the country. And third, after consultation with scientists and stakeholders, **the government concluded that a limited offtake is sustainable and not detrimental to the survival of Zambia's lion. The government further concluded that sport hunting of lion in Zambia generates significant benefits for lion conservation and rural livelihoods.**
>
> Zambia's updated approach to lion management and hunting is based on three pillars: a) a conservative, precautionary quota, well below one of the recommended thresholds for sustainability, b) an age–based harvest limit and strong monitoring of lion offtakes, and c) significant and direct community benefits. The implementation of these pillars ensures a low, sustainable level of offtake. The considerable revenues generated by this low level of offtake are of crucial importance for conservation of the species, especially as they are used to benefit local communities and incentivize tolerance and continued conservation. Zambia's rural communities requested that the 2013-2015 suspension be lifted due to the detrimental impact on their livelihoods and increased human-livestock-lion conflict

---

[4] *Action Plan*, p. viii.
[5] *E.g., id.*, p. 7-9 ("Research and Management" objective, specific actions include reviewing lion quota setting and trophy hunting practices, preparing a field manual identifying key ecological parameters for lion research, etc.); p. 9 ("Mitigation of Human-Lion Conflicts" objective and actions).
[6] *Id.*, p. 1.
[7] *NDF*, p. 8-9.
[8] *Id.*, p. 9.

without hunting revenues. Based on this, we are confident that lion in Zambia are better protected when they are sustainably utilised than when a hunting moratorium removes all value and causes them to be regarded as nothing but a nuisance species.[9]

Zambia's hunting guidelines were developed by DNPW and revised through a participatory stakeholder workshop in April 2016. Through the workshop stakeholders (including hunting operators) were given the opportunity to comment on the updated guidelines and were trained in lion aging. The guidelines include:

- Adopting a low, precautionary total offtake quota (24 lion for 2016 across an area of over 80,000 km^2 (approximately 1 lion per 3,333 km^2, allocated only to Prime and Secondary Concessions))
- Setting quotas based on scientific studies, field observations, hunting records, and other sources, and through a participatory process
- Adaptively managing quotas based on conditions and compliance with the aging program[10]
- Requiring consistent return of hunting and trophy data forms to monitor trends in hunting effort, hunt success, trophy size, lion and prey population status, and other indicators
- Adopting an age-based approach to lion hunting, with the target age of a minimum of 5 years and the preferred age of 6 years
- Banning the use of sound baits
- Banning the setting of baits within 1 km of a National Park
- Banning the hunting of female lions and "canned" hunting
- Increasing the length of lion hunts to a 16 day minimum and establishing a daily conservation fee of $150 per hunter and $100 per observer, with the revenues to be dedicated to lion monitoring
- Ensuring transparent procedures for the award of concessions, including community involvement in the negotiation of lease agreements[11]

These updates align with the approved management practices identified by the Fish and Wildlife Service in the Final Rule listing the African lion under the Endangered Species Act. *E.g.*, 80 Fed. Reg. 80000, 80018 (Dec. 23, 2015). Zambia's updated lion management and hunting program is clearly "well-managed."

Zambia's updated quota-setting process, adaptive management of quotas, and age-based approach to lion hunting deserve special mention. In 2015, Zambia updated its quota system to generally allow a quota of 1.0 lion per 1,000 km^2 in Prime (wildlife dense) GMAs and 0.5 lion per 1,000 km^2 in Secondary (healthy but less wildlife dense) GMAs. For 2016 specifically, the total quota was set at an extremely precautionary 24

---

[9] P. Zyambo, Cover Letter to T. Van Norman (May 5, 2016) (*Cover Letter*), p. 2 (emphasis added); *NDF*, p. 26, 50.
[10] ZAWA was already reducing the quota in 2012, to ensure sustainability of lion offtakes. "[T]he trend during the period 2005-2012 was towards a low offtake quota. This was attributable to two factors: (1) a decrease in allocated quota by ZAWA (now DNPW), and (2) greater selectivity by hunters engaged in the voluntary age-based trophy selection program." ZAWA imposed the hunting moratorium from 2013-2015 to allow lion populations to fully recover before reopening hunting in 2016. *NDF*, p. 20, 23.
[11] *Id.*, p. 26-27.

lion, essentially one per Primary and Secondary GMA. In future years the quota will be adaptively adjusted based on "points" from the age-based approach.[12]

Under the age-based approach, harvested lion must be at least five years old or older, and no lion under age five will be issued an export permit. In addition, a professional hunter or hunting operator will benefit from harvesting lion over age six by allocation of "points" that may lead to an increased future quota, and will be penalized for harvesting lion under age five by losing "points," and possibly through suspension of his or her license.[13]

Compliance with the quota allocation and aging system is monitored through mandatory reports (sighting forms and trophy record forms), and by direct monitoring by DNPW Wildlife Officers who must accompany hunters on all hunts.[14] Carefully tracking the lion offtake will allow DNPW to adjust the quotas up or down as necessary and ensure the offtakes are sustainable.

C. **Using the best-available information Zambia's Scientific Authority concluded that hunting is not detrimental to the survival of the lion and in fact benefits the lion.**

Licensed, regulated lion hunting in Zambia is authorized under national law, the guidelines (incorporated into a Statutory Instrument to have the force of law), and a Non-Detriment Finding made in May 2016. In this finding, DNPW, the CITES Scientific Authority concluded:

> ... [T]rophy hunting is one of the components that the Zambian government is using in its wildlife conservation strategies because of the high level off [*sic*] benefits, tangible and intangible, that it can produce. Safari Operators are in need of a good and healthy wildlife population in order for the sector to be viable. To achieve that, they are supporting the government in actions not only to increase protection of habitats and wildlife, but also in community development.
>
> The new management approach to lion hunting in Zambia is based on three pillars: (i) a conservative, precautionary quota, well below one of the recommended thresholds for sustainability, (ii) an age–based harvest limit and strong monitoring of lion offtakes, and (iii) significant and direct community benefits. This will ensure that lion hunting in Zambia is sustainable and does not negatively affect the population. ...
>
> The CITES Scientific Authority of Zambia has considered the population of lion in Zambia; the quota-setting system and current precautionary quota (of only 24 lions); the newly implemented age-based harvest policy; the limited offtake; the adaptive management of lions; and the substantial revenues generated for DNPW operations, anti-poaching, and community development. The Scientific Authority has considered the current threats to lion, including loss of habitat and human-lion conflicts, and potential of safari hunting to mitigate those threats.
>
> Upon considering these factors and in accordance with Article IV of CITES and Res. Conf. 16.7, the Scientific Authority concludes that the low level of off-takes generated by safari

[12] *NDF*, p. 22-26.
[13] *Id.*, p. 22-26.
[14] *Id.*, p. 25, 30.

> hunting is not detrimental to the survival of the lion in Zambia and the amount of revenue generated by this low level of off-take is of crucial importance for the conservation of the species because of the benefits it provides to rural communities. Safari hunting provides a net benefit to the species, does not pose a threat to the species, and is not a detriment to the survival of the species. In fact, the Scientific Authority of Zambia finds the regulated safari hunting of lion in Zambia enhances the survival of the species. The newly-developed lion management system, Statutory Instruments and hunting reforms employ an adaptive management approach thereby ensuring long-term sustainability, health and enjoyment of Zambia's wild lion populations.[15]

The Scientific Authority backed up this conclusion with a detailed assessment of Zambia's lion population (pp. 1-5, 14-15), the laws and regulations governing hunting (pp. 5-9), the quota-setting process and new age-based approach (pp. 16-32), the benefits generated by lion hunting including community assistance (pp. 33-34, 43-49), and more. In this Enhancement and Non Detriment Finding, DNPW also responded to all questions posed by the Fish and Wildlife Service in the February 2016 letter and questionnaire (pp. 63-65).

II. Zambia's lion hunting and conservation program address the three main threats to lion.

A. Sport-hunting in Zambia extends the available protected lion range and incentivizes the use of communal and private land as habitat.

Zambia has three primary types of Protected Areas: National Parks, Game Management Areas ("GMAs"), and Game Ranches. National Parks are strictly protected and managed by DNPW. GMAs and Open Game Ranches are multi-use areas where the wildlife belongs to the state, but management is devolved to the landholder. GMAs and Open Game Ranches serve as buffer zones around National Parks. Sustainable use (primarily licensed, regulated hunting) is permitted in these areas, and so is human settlement, farming, and livestock raising in areas designated by the area's land-use plan.[16] Lion hunting takes place in hunting blocks buffering National Parks in the Luangwa, Kafue, and Lower Zambezi ecosystems and in Open Game Ranches in these areas.[17]

Open Game Ranches are unfenced privately-managed wildlife areas. "Game ranching has evolved in the last ten years as one of the best conservation success stories ... thanks to partnerships between private investors and local communities most of these areas have been rehabilitated and re-colonised by wildlife, including lion." Wildlife may move freely among the ranches, GMAs, and National Parks, which maintains habitat connectivity. DNPW is encouraging further growth of Open Game Ranches because of the anti-poaching, re-stocking, and community benefits they generate.[18]

The 36 GMAs cover 177,404 km^2 and the 17 Open Game Ranches cover more than 2,500 km^2. This is close to three times the size of Zambia's National Parks (~64,000 km^2).[19] According to a recent survey, the GMAs

---

[15] *NDF*, p. 50.
[16] *Id.*, p. 16, 35.
[17] *Id.*, p. 16.
[18] *Id.*, p. 16-17 (example of Kaindu Community/Royal Kafue partnership); *see also* J. Wojciehowski, Zambia, Royal Kafue, and the Kaindu Natural Resources Trust, Africa Hunting Gazette; Kaindu Natural Resources Trust, 2012 Safari Hunting Report.
[19] *NDF*, p. 16, 33.

support more of the lion's main prey (buffalo and wildebeest) than in the National Parks.[20] This suggests anti-poaching and management efforts in the GMAs and Open Game Ranches are paying off and providing the prey base for healthy lion populations.

B. Licensed, regulated hunting provides significant anti-poaching support to protect the lion's prey base and generates significant conservation incentives to benefit rural communities and reduce human-wildlife conflict.

Hunting revenues and hunting operators are a significant source of anti-poaching in Zambia. DNPW oversees anti-poaching and wildlife law enforcement in Zambia. Hunting fees cover approximately one-third of DNPW's budget, enough to cover operational expenses,[21] which includes anti-poaching.

DNPW's anti-poaching unit is the Wildlife Law Enforcement Unit, which currently employs 1,250 Wildlife Officers. The Zambian government has committed to employing an additional 1,450 Wildlife Officers in the next three years (600 this year). The Unit ran over 10,500 anti-poaching patrols in 2015, involving an average of 5,878 staff per quarter and 237,028 patrol days.[22]

Second, hunting operators are "at the forefront in the fight against poaching in Game Management Areas through their financial and logistical support to Community Resources Boards (CRBs)."[23] Animal fees are evenly split between DNPW and communities, and the communities receive 20% of concession fees. "[O]f the 50% [of trophy fees] taken by communities, ... 20% [goes to] community scout salaries and resource protection."[24] Approximately 750 community game scouts are currently employed across the GMAs "with a total monthly wage bill of ZMW 359,779.50 (USD 38,853.13)."[25] This is a significant contribution to anti-poaching because it increases local people's direct involvement in wildlife protection.

Third, the concession agreements obligate hunting operators to provide equipment and logistical support to Wildlife Officers and community scouts on patrols, to assist in snare removal and anti-poaching during the course of hunts and tracking, and to assist in the arrests of poachers or encroachers, etc.[26]

Finally, hunting operators help reduce poaching by providing benefits to rural communities which increase their conservation incentives and tolerance of lion and other wildlife. These benefits are defined by the concession agreements, Zambian law, and are also provided voluntarily.

In GMAs, the community receives half of all animal fees (half of $4,200 per lion) and 20% of the concession fees.[27] Under the "Guideline on the Use of Community Funds Accrued from Wildlife Management," 45% of the community's share is then directed to wildlife management, resource protection, and anti-poaching

---

[20] *Id.*, p. 42.
[21] *Id.*, p. 34, 38, 49.
[22] *Id.*, p. 10; *see also* p. 10-14 (in the 2012-2015 period, over 6,650 poachers were arrested, 74,000 kg of bushmeat were recovered, 662 home-made shotguns were recovered, 784 machined shotguns were recovered, over 31,000 snares were picked up, and more. Notably, the number of arrests climbed and the amount of bushmeat climbed in the period when the hunting moratorium was in place.).
[23] *Id.*, p. 13.
[24] *Id.*, p. 7; *see also* p. 33 (50% of animal fees dedicated to DNPW used for conservation including (but not limited to) support to law enforcement, anti-poaching, poaching prosecutions, and resource monitoring).
[25] *Id.*, p. 44.
[26] *Id.*, p. 27-28.
[27] *Id.*, p. 7, 45.

patrols, and 35% is directed to community projects like construction of clinics, roads, schools, and wells.[28] This directly links a successful safari hunt with improved community livelihoods and encourages tolerance.

Concession agreements will also typically require the operator to provide financial assistance and services to local communities. For example, an operator may agree to pay teachers' salaries, build classrooms, or improve the village's water infrastructure. The table below "illustrates the annual financial obligations of operators in the allocated blocks for the duration of their respective concession agreements."[29]

GMA	Status	Community Obligation	Law Enforcement	Infrastructure Development	Resource Monitoring
Chiawa	Secondary	130,000.00	50,000.00	100,000.00	50,000.00
Kasonso Busanga	Prime	300,000.00	50,000.00	50,000.00	10,000.00
Lumimba	Prime	310,000.00	187,750.00	140,625.00	36,500.00
Lunga Luswishi	Secondary	300,000.00	165,000.00	100,000.00	55,000.00
Lupande	Prime	580,000.00	127,000.00	100,000.00	30,000.00
Mulobezi	Secondary	120,000.00	110,000.00	125,000.00	25,000.00
Mumbwa	Prime	345,000.00	90,000.00	50,000.00	50,000.00
Mukungule	Secondary	100,000.00	50,000.00	20,000.00	20,000.00
Munyamadzi	Prime	425,000.00	165,000.00	117,000.00	110,000.00
Musalangu	Prime	335,035.00	150,000.00	100,000.00	34,500.00
Nkala	Prime	200,000.00	75,000.00	25,000.00	25,000.00
Sichifulo	Secondary	120,000.00	118,000.00	60,000.00	30,000.00
West Petauke	Prime	150,000.00	90,000.00	100,000.00	27,000.00
Total		3,415,035.00	1,427,750.00	1,087,625.00	503,000.00

Source: DNPW

Operators also voluntarily support communities. They hire locally and often provide housing or food for their staff. They donate vehicles, parts, construction materials, food, books, and more. They may commit to providing additional monies to the communities, because reduced human-wildlife conflict benefits the quality of the local wildlife populations.[30]

For example: Muchinga Adventures operates a 4,900 km^2 concession in the Chifunda GMA that creates a natural buffer for the North Luangwa National Park. Their lease "is issued in partnership with the Chifunda GMA community" and DNPW. They employ 4 professional hunters, 45 camp staff, 40 scouts, and over 130 additional seasonal workers. Muchinga estimates that their hunting company supports 700 dependents in the Chifunda GMA.[31]

Muchinga provides rations, fuel, and equipment to sustain six additional anti-poaching patrols per month. They coordinate anti-poaching with DNPW, the Community Resource Board, and the Frankfurt Zoological Society, which funds a rhino protection project in Luangwa National Park. Muchinga always contributes

[28] *Id.*, p. 7, 45.
[29] *Id.*, p. 28.
[30] *Id.*, p. 28-29; *see generally* Muchinga Adventures, Ltd., Enhancement Report (2016) (*Muchinga Report*); Kaindu Natural Resources Trust, 2012 Safari Hunting Report; J. Wojcihowski, Royal Kafue and the Kaindu Natural Resources Trust, Africa Hunting Gazette; Conservation Imperative, Video, The Fate of the African Lion: Zambia (2015), available at http://theconservationimperative.com/?p=118.
[31] *Muchinga Report*, p. 1; J. du Plooy Letter to ZAWA Director General (Dec. 1, 2015) and attached photos.

more to anti-poaching than the lease requires. For instance, last year they improved the scouts' living quarters by providing roofs to forty houses in the GMA.[32]

Due to daily patrols in the GMA supported by food, fuel, and equipment from Muchinga; a rewards system for anti-poaching information paid for by Muchinga; and the Frankfurt Zoological Society's presence in the National Park, poaching is "kept to a minimum" in the GMA.[33] However, "human animal conflict is probably the biggest concern. Last year a leopard killed a child. Almost annually people are being mauled or killed by lion."[34] To address this, Muchinga established a robust community assistance program.

This program includes $20,500 each year for the community to use in projects of their choosing. On top of this payment, Muchinga is also helping the community develop an up-to-date tourist lodge to provide long-term funding. Muchinga is helping rebuild a bush camp and to train community members in tourism and business skills. Muchinga has also taken on four additional projects (above the $20,5000 payment): (1) providing toilets at the clinic; (2) paying for a teacher's salary; (3) providing a scholarship to cover school fees for one student; and (4) paying for a community meeting twice each year. Due to the benefits they receive from tourist safari hunting through Muchinga, the community has committed to maintaining their current number of fields and to refraining from logging or mining, which prevents loss or degradation of the current habitat.[35]

Similarly, the Royal Kafue private-community joint venture, an Open Game Ranch in the Kafue ecosystem, has benefited the Kaindu community, which retains significant shareholding in the community and, from the first hunt alone, generated ZK25,000,000 to be dedicated to social services.[36]

Similarly, after direct negoiations with the Chikwa community in the Chikwa GMA, Ivory Safaris is obligated to annually contribute ZMK: 145,000 in community payments, 90,000 in anti-poaching plus at least 24,000 for resource monitoring; 80,000 in infrastructure development; 15,000 in fire management; and 50% of game meat harvested. Ivory Safaris also makes voluntary contributions, including a Land Cruiser.[37]

Hunting operators are also mandated by Zambian law to provide at least 50% of game meat harvested to local communities. A study of three GMAs found operators consistently exceeded the required 50%, and provided an average of >6,000 kg per GMA per year. The authors estimated operators across the GMAs could provide ~130 tons of much-needed protein annually.[38] "During the hunting moratorium (2013-2014), this supply of meat was halted, adversely affecting rural communities previously reliant on this food source."[39]

---

[32] *Muchinga Report*, p. 2.
[33] *Id.*, p. 2-3 (documenting a total anti-poaching contribution of $88,000 including $48,000 in community revenue/ funding for scout salaries, $8,000 to supplement six patrols, $12,000 in fuel, $5,000 in rewards, and $15,000 in infrastructure improvements.
[34] *Id.*, p. 2.
[35] *Id.*, p. 3, 4.
[36] Kaindu Natural Resources Trust, 2012 Safari Hunting Report; J. Wojcihowski, Royal Kafue and the Kaindu Natural Resources Trust, Africa Hunting Gazette; Conservation Imperative, Video, The Fate of the African Lion: Zambia (2015), available at http://theconservationimperative.com/?p=118.
[37] Ivory Safaris, Ltd., 2015 Annual Report (Mar. 21, 2015), p. 4, 7, 9.
[38] *NDF*, p. 27-28; P. White and J. Belant, Provisioning of Game Meat to Rural Communities as a Benefit of Sport Hunting in Zambia, PLoS One 10(2) (2015).
[39] *NDF*, p. 34.

C. Revenue from licensed, regulated hunting is used for conservation and maintaining viable lion populations.

The revenue generated from licensed, regulated tourist safari hunting, and particularly from U.S. citizens, contributes greatly to lion conservation and habitat protection in Zambia. Lion are one of the three highest value species. Lion fees alone accounted for 6.5% of total fees paid to ZAWA in 2012. Lion hunts comprise a significant portion of a safari operator's income as well; for example, lion and elephant hunts together make up more than half of Muchinga's turnover; for Royal Kafue, one lion hunt provided the company's income in 2012.[40] Lion hunts also typically generate additional revenue because they are part of a package with other species, which also require animal fees (as well as daily fees, other taxes and fees, etc.).[41]

ZAWA (now DNPW) used these revenues for wildlife management and conservation, including salaries for Wildlife Officers, prosecutions of poachers, monitoring/surveying, and staff training. Salaries account for approximately 72% of ZAWA/DNPW's average annual expenditures.[42]

Fee revenues were also distributed to the communities. Over ZK34 million were distributed, as required by the law and lease agreements, between 2010 and 2015.

Most hunters in Zambia are U.S. citizens. Seventy-five percent of Muchinga's clientele is American, as is most of Royal Kafue's, including their very first client. Thus, revenues generated from U.S. hunters support wildlife conservation, anti-poaching, and community incentives. These revenues and benefits are linked to wildlife protection and conservation. When the benefits are reduced or removed, the rate of poaching and conflict increases. During the hunting moratorium, human-lion conflict incidents increased, and so did the number of "problem" lions that had to be controlled.[43]

Conclusion

The Final Rule identified three primary threats to lion: loss of habitat, loss of prey base, and human-lion conflict. As shown here and in the submitted information, licensed, regulated tourist safari hunting helps to reduce or remediate these threats. It provides a reason to preserve thousands of kilometers of habitat for lion and prey species in Zambia. It provides incentives to preserve new habitat in Open Game Ranches. It is a primary source of funds for anti-poaching, including the fee revenue shared to pay community game scouts salaries. And most of all, licensed, regulated hunting provides substantial benefits to Zambia's rural communities. As the Minister of Environment told the *New York Times*, during the suspension on hunting, "'[w]e had a lot of complaints from local communities.'" One of the main reasons why Zambia lifted the suspension was to restart the flow of benefits to communities.[44]

Licensed, regulated hunting can greatly reduce human-wildlife conflict. In so doing, it can actually reduce offtakes of lion – especially when lion hunting is well-managed, monitored, and sustainable. Zambia's up-to-date lion hunting program is all of these things.

---

[40] *Muchinga Report*, p. 5; Kaindu Natural Resources Trust, 2012 Safari Hunting Report; Conservation Imperative, The Fate of the African Lion: Zambia (2015), available at http://theconservationimperative.com/?p=118.
[41] *NDF*, p. 47; *Muchinga Report*, p. 5.
[42] *NDF*, p. 48.
[43] *Id.*, p. 38.
[44] N. Onishi, A Hunting Ban Saps a Village's Livelihood, The New York Times (Sept. 12, 2015).

[1]Department of Biology, Colorado State University, 1878 Campus Delivery, Fort Collins, CO 80523, USA
[2]Kellogg Biological Station, Michigan State University, Hickory Corners, MI 49060, USA
[3]Graduate Degree Program in Ecology, Colorado State University, Fort Collins, CO 80523, USA

*Correspondence: justin.havird@colostate.edu (J.C. Havird).

http://dx.doi.org/10.1016/j.tree.2015.11.012

References
1. Whiteley, A.R. et al. (2015) Genetic rescue to the rescue. Trends Ecol. Evol. 30, 42–49
2. Frankham, R. (2015) Genetic rescue of small inbred populations: meta-analysis reveals large and consistent benefits of gene flow. Mol. Ecol. 24, 2610–2618
3. Waller, D.M. (2015) Genetic rescue: a safe or risky bet? Mol. Ecol. 24, 2595–2597
4. Tallmon, D.A. et al. (2004) The alluring simplicity and complex reality of genetic rescue. Trends Ecol. Evol. 19, 489–496
5. Frankham, R. et al. (2011) Predicting the probability of outbreeding depression. Conserv. Biol. 25, 465–475
6. Gemmell, N.J. and Allendorf, F.W. (2001) Mitochondrial mutations may decrease population viability. Trends Ecol. Evol. 16, 115–117
7. Gemmell, N.J. et al. (2004) Mother's curse: the effect of mtDNA on individual fitness and population viability. Trends Ecol. Evol. 19, 238–244
8. Reinhardt, K. et al. (2013) Medicine. Mitochondrial replacement, evolution, and the clinic. Science 341, 1345–1346
9. Burton, R.S. et al. (2013) Cytonuclear genomic interactions and hybrid breakdown. Annu. Rev. Ecol. Evol. Syst. 44, 281–302
10. Zajitschek, S.R.K. et al. (2009) Demographic costs of inbreeding revealed by sex-specific genetic rescue effects. BMC Evol. Biol. 9, 289
11. Hwang, A.S. et al. (2012) Long-term experimental hybrid swarms between nearly incompatible Tigriopus californicus populations: persistent fitness problems and assimilation by the superior population. Conserv. Genet. 13, 567–579
12. Johnson, W.E. et al. (2010) Genetic restoration of the Florida panther. Science 329, 1641–1645

Science & Society

Banning Trophy Hunting Will Exacerbate Biodiversity Loss

Enrico Di Minin,[1,2,*] Nigel Leader-Williams,[3] and Corey J.A. Bradshaw[4,5]

International pressure to ban trophy hunting is increasing. However, we argue that trophy hunting can be an important conservation tool, provided it can be done in a controlled manner to benefit biodiversity conservation and local people. Where political and governance structures are adequate, trophy hunting can help address the ongoing loss of species.

International Outrage over Trophy Hunting in Africa

An American hunter killed a charismatic male lion (*Panthera leo*) called Cecil in Zimbabwe in July 2015. This sparked international outrage, mainly via a storm of social and other media. Several alleged aspects of the hunt itself, such as baiting close to national park boundaries, were done illegally and apparently against the spirit and ethical norms of well-managed trophy hunts. Online outrage had also been sparked earlier in 2015 by the legal hunt of a Critically Endangered male black rhino (*Diceros bicornis*). This hunt was sanctioned by the Namibian Government via an auctioned permit that cost the hunter US$350 000 for the privilege. This outrage arose even though the male was considered 'surplus' to the national black rhino management plan, and the revenue generated from the hunt was to be reinvested into a conservation trust fund to the wider good of conservation in Namibia. These two high-profile hunts and the ensuing public backlash against the ethics and conduct of trophy hunting in general have led to proposals to ban the practice throughout Africa. Furthermore, some commercial passenger and cargo airlines have decided to stop, or may soon stop, the transport of trophies of hunted animals shot legally and sustainably by foreign tourists, irrespective of international conventions, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and national laws that allow trophy hunting.

Hunting Industry in Sub-Saharan Africa

Trophy hunting strongly contributes to the conservation enterprise in sub-Saharan Africa, where large areas support important terrestrial biodiversity that is currently allocated to trophy hunting use (Table 1). While most of the hunted individuals (e.g., 96% in South Africa in 2012) [1] are often from more common and less valuable species (Table 1), most of the trophy hunting revenue is generated from a few species carrying valuable trophies, particularly the charismatic 'Big Five' (lion leopard *Panthera pardus*; elephant *Loxodonta africana*; buffalo *Syncerus caffer*; and black or white rhinoceros *Ceratotherium simum*) [2]. Out of the US$68 million of gross revenue generated from trophy hunting in South Africa in 2012, over US$28 million (at least 41%) was generated from the Big Five alone (i.e., $5 635 625 from 635 buffaloes; $1 194 600 from 33 elephants; $647 500 from 37 leopards; $15 270 750 from 617 lions, $300 000 from one black rhinoceros; and $5 355 000 from 63 white rhinoceroses) [1]. Southern African countries and Tanzania exported most of the Big Five trophies between 2009 and 2013 (Figure 1). At the same time, two countries that do not typically attract many tourists (the Central African Republic, currently undergoing a conflict, and Cameroon, where poaching pressure is high) allowed trophy hunting of big cats and elephants, respectively, over the same period (Figure 1).

Concerns about Trophy Hunting

Overall, land allocated to trophy hunting has the potential to assist countries to achieve biodiversity conservation goals [3]. However, the contribution of hunting to conservation is often contentious for various reasons. There can be uncertainty over the sustainability of offtake rates and their potential impact on wildlife populations [4]. This concern arises because quotas and offtakes are not often based on scientific assessments. Furthermore, restrictions on the age of hunted

Table 1. Hunting Contribution to Biodiversity Conservation and National Economies in Sub-Saharan Countries

Country	Area Covered by Game Ranches (% of Total Land Area)[a]	Terrestrial Protected Areas (% of Total Land Area)[b]	Top 3 Most Exported Trophies in 2012[c,d]	Annual Revenue (US$ million)[e]
South Africa	13.1	6.2	impala, warthog, kudu	68.0[f]
Tanzania	26.4	32.2	leopard, hippopotamus, elephant	56.3[g]
Botswana	23.0	37.2	elephant, leopard, lechwe	40.0[g]
Namibia	11.4	43.2	zebra, chacma baboon, leopard	28.5[h]
Zimbabwe	16.6	27.2	elephant, leopard, chacma baboon	15.8[g]
Mozambique	10.5	17.6	Nile crocodile, elephant, hippopotamus	5.0[g]
Zambia	21.3	37.8	lechwe, hippopotamus, leopard	3.6[g]
Total	-	-	-	217.2

[a][13].
[b]World Bank (http://data.worldbank.org/indicator/ER.LND.PTLD.ZS).
[c]CITES trade database (http://trade.cites.org/).
[d]Chacma baboon (*Papio ursinus*), elephant (*Loxodonta africana*), hippopotamus (*Hippopotamus amphibius*), impala (*Aepyceros melampus*), greater kudu (*Tragelaphus strepsiceros*), lechwe (*Kobus leche*), leopard (*Panthera pardus*), Nile crocodile (*Crocodylus niloticus*), warthog (*Phacochoerus africanus*), zebra (*Equus quagga*).
[e]Data not adjusted for inflation.
[f][1].
[g][6] (data for 2008 for Botswana, Tanzania and Mozambique, 2007 for Zimbabwe, and 2002 for Zambia).
[h]African Indaba (http://www.africanindaba.com/wp-content/uploads/2014/03/AfricanIndabaVol3-4.pdf).

individuals are not often implemented [5]. In addition, the contribution of some forms of trophy hunting to conservation is debatable. This is particularly the case for 'canned lion hunting', where future targets are bred and raised in captivity and kept in confined enclosures until shot, to ensure that hunters are guaranteed a kill. In South Africa, which is by far the largest exporter of lion trophies across sub-Saharan Africa (Figure 1), 80% of the trophies between 2009 and 2013 were from lions raised in captivity or ranched. The ethics of canned hunting are dubious, and this abhorrent practice requires reform before it brings down ethically practiced hunting.

The profitability of their respective hunting industries is hard to compare across sub-Saharan countries [5]. Nevertheless, it is known that the gross annual revenue generated by the hunting industry comprises tens of millions of US$ in countries such as South Africa, Tanzania, and Botswana (Table 1). Despite this, the amount of accrued revenue allocated to conservation authorities that could in principle be reinvested in improved management appears to be limited. In Tanzania, for example, the accrued revenue allocated to the Wildlife Division in 2008 amounted to 22% (US$12 353 180) of the gross revenue generated by hunting in that year [5]. The remainder of the revenue went to the private sector.

Another limitation is that revenue generated from trophy hunting currently provides few benefits to local communities sharing habitats with biodiversity [6,7]. In Namibia, however, revenue generated from trophy hunting has encouraged local community participation in conservation, which in turn has resulted in substantial increases in the abundance of many wildlife species and in the total area of land falling under community protection through conservancies [6]. It is less clear in other African countries what proportions of hunting-permit revenue are directed to community-development projects, whether they are payments to community-based organizations, or payments to communities for concession fees, resource fees, or payments for welfare and education. Finally, legal controls over biological, ethical, and financial aspects of the hunting industry can be more easily circumvented in many sub-Saharan countries where management capacity and governance structures are ineffective [8].

Why Blanket Bans Could Exacerbate Biodiversity Loss

One currently promoted solution to address such concerns is to ban trophy hunting altogether. However, a blanket ban on trophy hunting could lead to worse conservation outcomes for three main reasons. First, financial resources for conservation are limited, particularly in developing countries. Hence, both nonconsumptive and consumptive uses of wildlife are necessary to generate enough funding to support meaningful conservation success over large areas [9]. While ecotourism can help reduce poverty in communities coexisting with biodiversity [3], ecotourists generally prefer travelling to more accessible areas [10], greatly limiting the opportunities for conservation in more remote regions. Instead, sustainable hunting can create important incentives for biodiversity conservation in areas where ecotourism is not economically viable [11]. At a time when greater proportions of conservation budgets are being spent on enforcement, the revenue from trophy hunting can empower

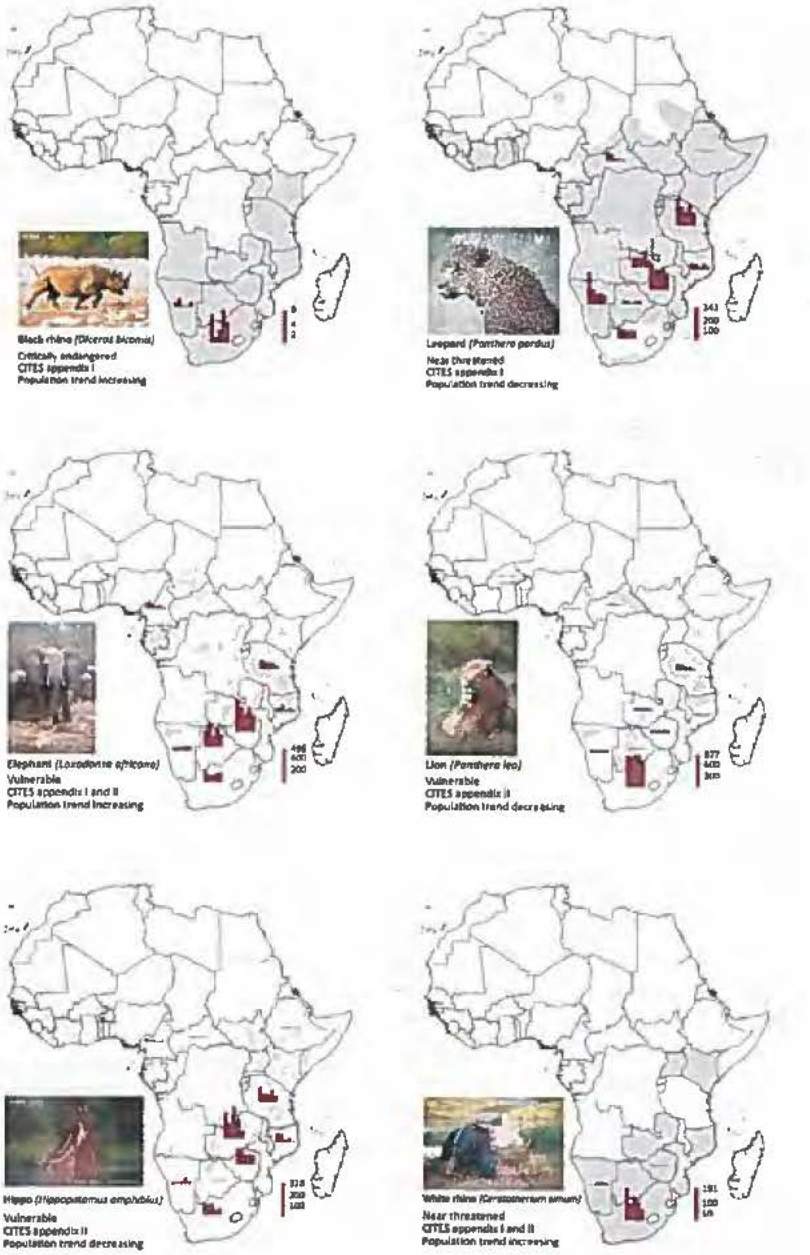


Figure 1. Number of Trophies Exported from 2009 to 2013 (Red Bars) for Six Charismatic African Species Subject to Trophy Hunting. Gray-shaded areas correspond to the range maps of species obtained from www.iucnredlist.org/technical-documents/spatial-data. Each species is listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Net export data for each species retrieved from the CITES Trade Database (http://trade.cites.org) by searching for 'trophies' under the 'trade terms' bar. Information about the conservation status, population trend, and CITES listing retrieved from www.iucnredlist.org and www.cites.org. Numbers next to the external bar in each panel indicate the scale to interpret bar charts of annual trophies taken per species and per country.

communities to protect their resources by the employment of more antipoaching rangers or the construction of disincentive infrastructure [12]. If revenue cannot be generated from trophy hunting, natural habitats will be transformed to other forms of land use that provide higher return on investments compared with conservation [3], but have negative impacts on biodiversity.

Second, trophy hunting can have a smaller footprint than ecotourism in terms of carbon emissions, infrastructure development, and personnel, and can generate more revenue from a lower volume of tourist hunters. An often-neglected relation exists between ecotourism and aviation with regard to energy use and greenhouse gas emissions. Compared with ecotourism, the trophy-hunting industry relies on fewer tourist hunters, because the income generated per hunter is higher [13]. Additionally, hunters are interested in maintaining good-quality habitat for the simple reason that the quality of the individuals harvested therein is also high [14]. Finally, hunters are prepared to hunt in areas lacking attractive scenery, and require less infrastructure, therefore minimizing habitat degradation.

Third, management for hunting places emphasis on maintaining large wildlife populations for offtake, as opposed to ecotourism, where the presence of only a few individual animals is sufficient to maximize profits [2]. Both the consumptive and nonconsumptive uses of biodiversity can generate important revenue, so allowing local stakeholders, such as private landowners and communities, to retain property rights over these species is a necessary precursor for them to justify offsetting the direct and opportunity costs of conservation. Thus, the economic models underlying ecotourism and trophy hunting may lead to diverging management strategies. Empirical evidence shows that the strategy of artificially managing small populations within electrified fences to maximize economic return from

Box 1. Prescriptions to Make Trophy Hunting More Effective for Conservation

1. Net Conservation Benefit
1.1 Mandatory levies imposed on safari operators by governments that are invested directly into trust funds for conservation and management.
1.2 Ecolabeling certification schemes adopted for trophies originating from areas that contribute to broader biodiversity conservation and respect animal welfare concerns.

2. Biological Sustainability
2.1 Mandatory population viability analyses to ensure that harvests cause no net population decline.
2.2 Ban posthunt sales of any portion of the quarry shot, to avoid illegal wildlife trade.

3. Socio-Economic-Cultural Benefit
3.1 Promote and fund trophy-hunting enterprises run (or leased) by local communities.
3.2 Create trusts to facilitate equitable benefit sharing within local communities and promote long-term economic sustainability.

4. Adaptive Management: Planning, Monitoring, and Reporting
4.1 Mandatory scientific sampling of hunted animals, including tissue for genetics, teeth for age analysis, stomach contents, full morphometrics, disease screening, and so on.
4.2 Mandatory 5-year reviews of all individuals hunted and detailed population management plans submitted to government legislators to extend permits.

5. Accountable and Effective Governance
5.1 Full disclosure to the public of all data collected (including levied amounts), although personal details of proponents held by government legislators only.
5.2 Independent government observers placed randomly and without forewarning on safari hunts as they happen.
5.3 Trophies are confiscated and permits are revoked when illegal practices are disclosed.

6. Animal welfare
6.1 Backup professional shooters and trackers present for all hunts to minimize welfare concerns

ecotourism and minimize management costs might be the most appropriate to enhance tourist experiences [2]. By contrast, wildlife populations potentially have higher hunting value when their sizes are larger (i.e., are more viable) and populations are better connected to enhance gene flow, because the latter can affect the fitness and quality of the individuals harvested.

Concluding Remarks

Inadequate political, legal, and governance structures are currently preventing trophy hunting from being an effective tool for creating conservation incentives in sub-Saharan Africa. At the same time, banning trophy hunting might not be the best solution because biodiversity loss could even be worse in its absence. Therefore, we propose a set of prescriptions that could enhance the contribution of trophy hunting to conservation and to the equitable sharing of the benefits with local people (Box 1). To make these prescriptions more relevant for decision-makers, we have summarized them according to the guiding principles on trophy hunting promoted by the International Union for the Conservation of Nature [15]. In particular, we make suggestions on how net biodiversity benefits and stakeholder returns can be achieved simultaneously, and highlight how the hunting industry and governance structures can be made more transparent to avoid unethical or illegal practices. Finally, we provide additional guidelines to account for animal welfare concerns. Promoting these and other prescriptions could enhance the role of trophy hunting in addressing the ongoing loss of species.

Acknowledgments

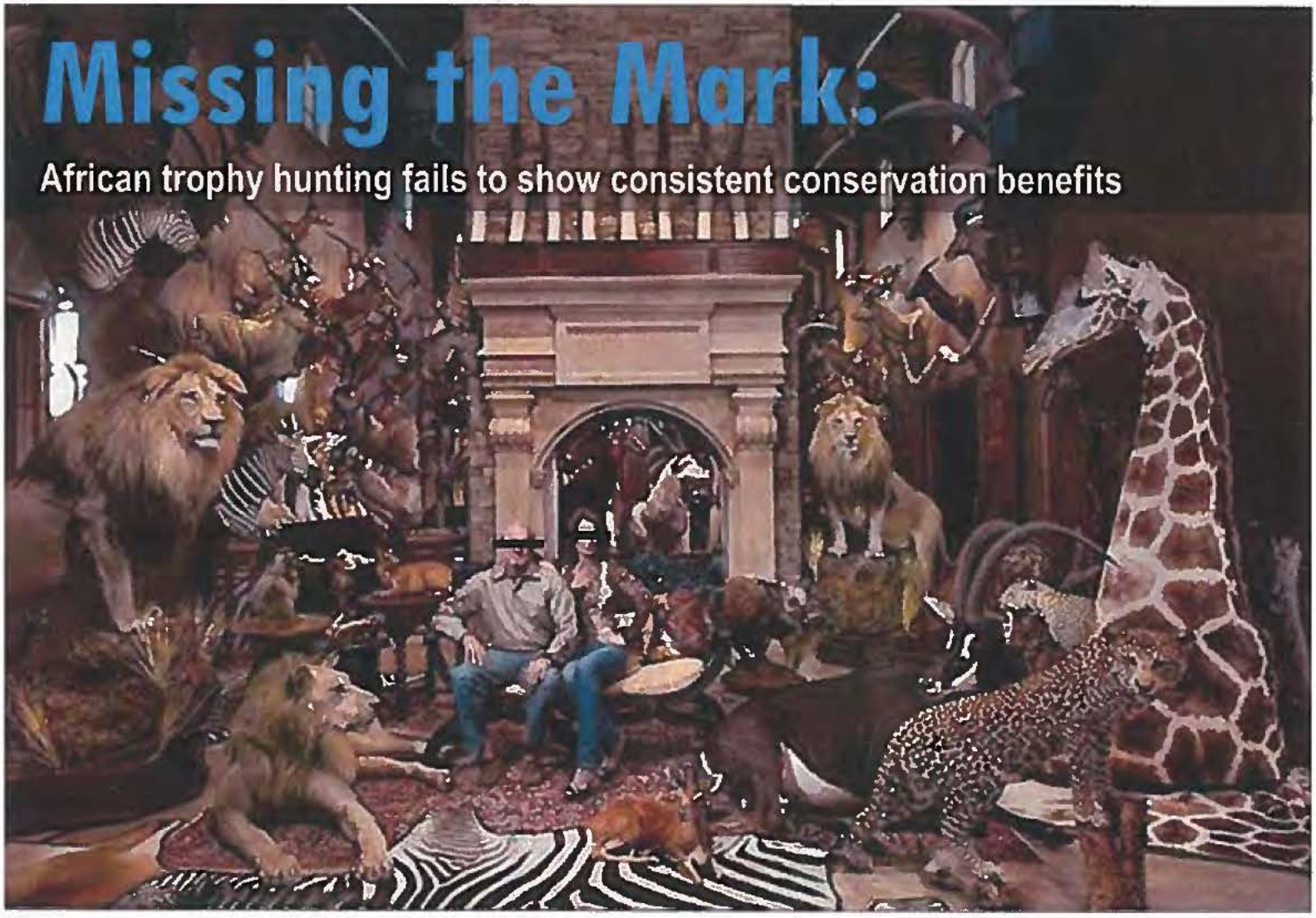
We thank M. Festa-Bianchet and an anonymous reviewer for comments that helped improve the manuscript. E.D.M. acknowledges ERC-StG Grant 260393 (GEDA) and the Academy of Finland Centre of Excellence Programme 2012–2017 (Grant 250444) for support. Unless specified otherwise, photographs in Figure 1 by E.D.M.

[1]Department of Biosciences, University of Helsinki, FI-00014, Helsinki, Finland
[2]School of Life Sciences, University of KwaZulu-Natal, Private Bag X 54001, Durban 4000, South Africa
[3]Department of Geography, University of Cambridge, Downing Place, Cambridge, CB2 3EN, UK
[4]The Environment Institute and School of Biological Sciences, The University of Adelaide, Adelaide, SA 5005, Australia
[5]Laboratoire Écologie, Systématique et Évolution – UMR CNRS 8079, Université Paris-Sud, Bat 362, F-91405, Orsay Cedex, France

*Correspondence: enrico.dimin@helsinki.fi (E. Di Minin).
http://dx.doi.org/10.1016/j.tree.2015.12.006

References
1. Cloete, P.C. *et al.* (2015) *Game Ranch Profitability in South Africa*, Caxton Printers
2. Di Minin, E. *et al.* (2013) Understanding heterogeneous preference of tourists for big game species: implications for conservation and management. *Anim. Conserv.* 16, 249–258
3. Di Minin, E. *et al.* (2013) Conservation businesses and conservation planning in a biological diversity hotspot. *Conserv. Biol.* 27, 808–820
4. Bradshaw, C.J.A. *et al.* (2006) Incorporating known sources of uncertainty to determine precautionary harvests of saltwater crocodiles. *Ecol. Appl.* 16, 1436–1448
5. Packer, C. *et al.* (2011) Effects of trophy hunting on lion and leopard populations in Tanzania. *Conserv. Biol.* 25, 142–153
6. Booth, V.R. (2010) *The Contribution of Hunting Tourism. How Significant is this to National Economies*, CIC Technical Series Publication, FAO
7. NACSO (2014) *The State of Community Conservation in Namibia – A Review Of Communal Conservancies, Community Forests and Other CBNRM Initiatives*, NACSO
8. Leader-Williams, N. *et al.* (2009) The influence of corruption on the conduct of recreational hunting. In *Recreational Hunting, Conservation and Rural Livelihoods: Science and Practice* (1) (Dickson, B. *et al.*, eds), In pp. 296–316, Blackwell Publishing
9. Naidoo, R. *et al.* (2015) Complementary benefits of tourism and hunting to communal conservancies in Namibia. *Conserv. Biol.* Published online October 13, 2015. http://dx.doi.org/10.1111/cobi.12643
10. Balmford, A. *et al.* (2015) Walk on the wild side: estimating the global magnitude of visits to protected areas. *PLOS Biol.* 13, e1002074
11. Lindsey, P.A. *et al.* (2006) Potential of trophy hunting to create incentives for wildlife conservation in Africa where alternative wildlife-based land uses may not be viable. *Anim. Conserv.* 9, 283–291
12. Di Minin, E. *et al.* (2015) Identification of policies for a sustainable legal trade in rhinoceros horn based on population projection and socioeconomic models. *Conserv. Biol.* 29, 545–555
13. Lindsey, P.A. *et al.* (2007) Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. *Biol. Conserv.* 134, 455–469
14. Ramanzin, M. and Sturaro, E. (2014) Habitat quality influences relative antler size and hunters' selectivity in roe deer. *Eur. J. Wildl. Res.* 60, 1–10
15. IUCN (2012) *Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives*, IUCN

NATURAL RESOURCES
COMMITTEE DEMOCRATS
RANKING MEMBER
RAÚL M. GRIJALVA



A report by the Democratic staff of the House Committee on Natural Resources

NOTE: This report has not been officially adopted by the Committee on Natural Resources and may not necessarily reflect the views of its members

Released: June 13, 2016

Executive Summary

Hunting of imperiled animals can save species from extinction. It is a claim that is counterintuitive to some and makes perfect sense to others. It is also the official position of the United States government, with the U.S. Fish and Wildlife Service claiming that "well-managed wildlife programs that include limited, sustainable sport hunting can and have provided significant long-term benefits to the populations of many species."[1] However, the debate has reached a fever pitch since the 2015 death of Zimbabwe's famed Cecil the Lion at the hands of American dentist and trophy hunting hobbyist, Water Palmer. This report evaluates that claim as it pertains to prized species in popular hunting locations, and examines the conditions under which trophy hunting may contribute to conservation.

Many governments and a number of private and non-profit groups, including conservation organizations, have long viewed well-regulated hunting as an important conservation tool. Indeed, much of the North American system of wildlife management is based on the principle that most hunters want healthy populations of game animals so that they will always have something to hunt. In places like the United States, where laws against wildlife poaching are generally well respected and enforced and transparent mechanisms funnel taxes and fees generated by hunters to effective conservation programs, hunting has helped restore populations of some prized game species when quotas are based on sound science. In places where hunting is poorly managed, as is the case in some parts of Africa, the claim that trophy hunting provides conservation benefits is much harder to prove, especially for species with populations that have already been depleted.

By definition, trophy hunters hunt to bring home a trophy for display consisting of all or part of their kill. In order to help ensure trophy hunting does not contribute to the extinction of a species, the Endangered Species Act (ESA) requires that hunting trophies of wildlife listed as endangered or threatened may only be brought into the United States if their importation – and by extension, the hunt – enhances the survival of the species. This high threshold is an important and appropriate safeguard against extinction.

An analysis of five major threatened or endangered game species (African elephant, African lion, black rhinoceros, southern white rhinoceros, and leopard) in four African countries (Namibia, South Africa, Tanzania, and Zimbabwe) found that trophy hunting is managed well in some areas and poorly in others. In many cases, the laws, institutions, and capacity necessary to make trophy hunting benefit conservation are lacking. The analysis also found that the U.S. Fish and Wildlife Service (FWS) – the agency responsible for allowing or prohibiting protected species imports – could make significant improvements to its permitting process that would help ensure that only trophies which truly do enhance species survival are allowed into the country. The report makes the following recommendations:

- Ensure that trophy hunts benefit conservation.
- Close regulatory loopholes that harm protected species.
- Tighten trophy import permitting requirements.
- Increase fees for trophy imports to fund science and conservation.
- Allow only imports taken using fair chase hunting methods.

[1] U.S. Fish and Wildlife Service. Questions and Answers (Black Rhino Permit). Last viewed May 17, 2016. Available online: https://www.fws.gov/international/permits/black-rhino-import-permit.html#13

Table of Contents

Chapter 1: Status of Wildlife Populations 4

African elephant 6

White and black rhinoceros 6

Leopard 7

African lion 8

Chapter 2: Is Trophy Hunting Helping or Hurting? 9

Necessary Safeguards 11

Potential Pitfalls 13

The Evidence, or Lack Thereof 15

Chapter 3: Findings and Recommendations 23

Ensure that trophy hunting enhances conservation. 23

Close regulatory loopholes that harm imperiled species. 23

Tighten trophy import permitting requirements 24

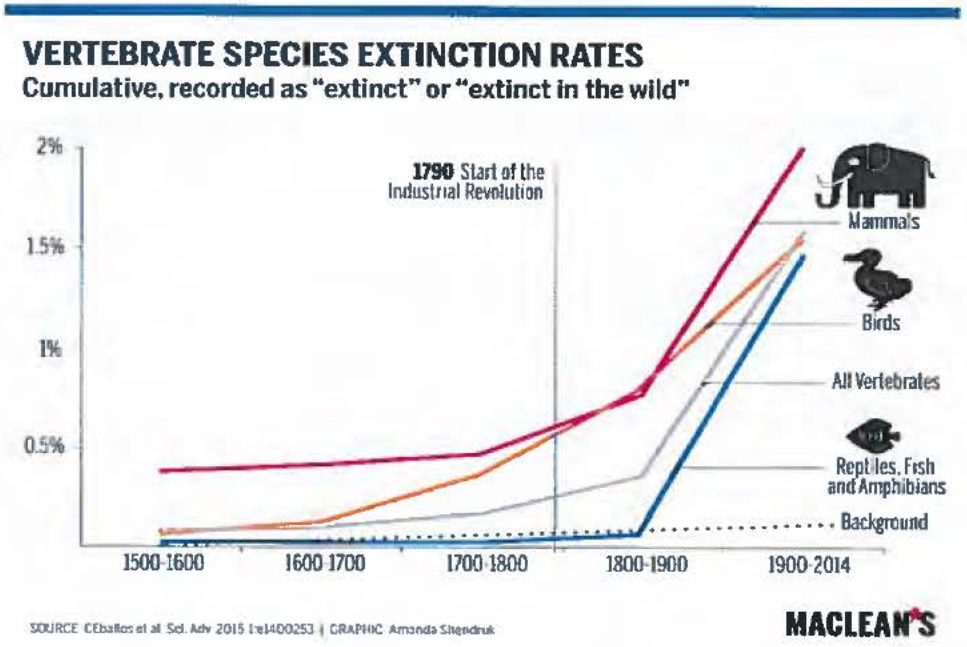
Increase fees for trophy imports to fund science and conservation. 24

Allow only imports taken using fair chase hunting methods. 25

CHAPTER 1: STATUS OF WILDLIFE POPULATIONS

Many scientists believe that Earth is now on the cusp of a sixth great extinction - the first one driven by humans. Particularly since the beginning of the industrial revolution, direct harvest, habitat loss through land conversion, and climate change driven by the burning of fossil fuels have put enormous pressure on species and have dramatically decreased biological diversity.[2]

Without question, loss and degradation of suitable habitat is the main driver of most species' decline. However, evidence shows that direct harvest of terrestrial species continues to pose a major threat, particularly in developing countries.[3] Poaching has skyrocketed in recent years, due mainly to the involvement of organized criminal syndicates that have taken advantage of the relatively large financial rewards and low penalties associated with wildlife trafficking.[4] Sub-Saharan Africa is the epicenter of the most recent wildlife poaching and trafficking crisis, with some populations of elephants, rhinoceros and other animals declining precipitously after showing signs of recovery in previous decades.



Available at: http://www.macleans.ca/society/science/infographic-charting-the-worlds-sixth-mass-extinction/

[2] Hunter, Philip. "The human impact on biological diversity. How species adapt to urban challenges sheds light on evolution and provides clues about conservation." *EMBO Reports* 8.4 (2007): 316-18. Web. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1852758/>.

[3] Lawson, Katherine, and Alex Vines. "Global Impacts of the Illegal Wildlife Trade: The Costs of Crime, Insecurity and Institutional Erosion." (2014). Web. 14 Feb. 2016. <https://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Africa/0214Wildlife.pdf>.

[4] "Annual Report 2014: Global Programme for Combating Wildlife and Forest Crime Annual Report 2014, version 1." *United Nations Office on Drugs and Crime*. United Nations Office on Drugs and Crime, n.d. Web. <https://www.unodc.org/documents/Wildlife/WLFC_Annual_Report_2014.pdf>.

Poaching for profit remains the biggest driver of these declines, but trophy hunting also removes a significant number of animals from these rapidly declining populations. One prominent researcher recently stated that in some countries "trophy hunting appears to be the primary driver of lion population declines outside protected areas."[5] While hunters claim that their presence deters poaching, illegal killing has soared to record levels despite the continued operation of trophy hunting lodges and outfitters. American trophy hunters import more trophies of protected species than do hunters from any other country,[6] and they may assume that hunting in other countries is regulated as closely as it is at home. This assumption could lead defenders of trophy hunting to dismiss suggestions that their activities may not be sustainable in certain places.

This report will focus on the four African countries from which the most hunting trophies are imported into the United States:

- Zimbabwe
- Tanzania
- South Africa
- Namibia



It will also focus primarily on five species that are prized by hunters and are listed as threatened or endangered under the ESA:


African elephant (*Loxodonta Africana)*


Black rhinoceros (*Diceros bicornis*) **and**
Southern white rhinoceros (*Ceratotherium simum simum*)


Leopard (*Panthera pardus*)


African lion (*Panthera leo*)

[5] Vidal, John. "Trophy hunting just part of the story behind declining lion numbers in Africa." *The Guardian* 29 July 2015. Web. <http://www.theguardian.com/environment/2015/jul/29/trophy-hunting-just-part-story-behind-declining-lion-numbers-africa>.

[6] *Convention on International Trade in Endangered Species of Wild Fauna and Flora*. Convention on International Trade in Endangered Species of Wild Fauna and Flora, n.d. Web. <http://trade.cites.org/>.

Species and populations of animals can often support some level of hunting if they do not face other threats that jeopardize their continued existence in the wild. The species discussed in this report, however, do face other threats, and have all been listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the ESA, or both for many years. This section describes the current population trends and drivers for the five wildlife species in question.



African elephant

Researchers have estimated that more than 20 million elephants roamed across Africa as recently as the early 1800s.[7] Since that time, though, overhunting, habitat loss, and poaching have reduced the overall population size to between 420,000 and 650,000 animals.[8]

Elephant population numbers in Tanzania (43,000[9]), Namibia (20,000[10]), South Africa (18,000[11]), and Zimbabwe (47,000[12]) are far below historical levels. In the cases of Tanzania and Zimbabwe, significant recent declines have been widely documented. The African elephant is currently listed as threatened under the ESA and has been subject to intense poaching pressure in recent years to fuel the black market ivory trade.



White and black rhinoceros

It is estimated that Africa was home to more than one million rhinos less than two centuries ago, but overhunting by European colonizers and more recent episodes of poaching have severely depleted their numbers.[13] Two subspecies of white rhinoceros are recognized. Northern white rhinos are critically endangered, as only three individuals remain in captivity. They are listed as endangered under the ESA. The southern white rhino is mainly found in southern Africa, Kenya and Uganda. It is listed as threatened under the ESA due to its similar appearance to several species of endangered rhinos.[14] The 2010 population estimate for white rhino – the most recent available – was around 20,000, 99% of which are in South Africa, Namibia, Zimbabwe and

---

[7] Smil, Vaclav. Harvesting the Biosphere: What We Have Taken from Nature. Massachusetts: MIT Press, 2013. Print.

[8] UNEP, CITES, IUCN, TRAFFIC. *Elephants in the Dust - The African Elephant Crisis: A Rapid Response Assessment*. United Nations Environment Programme, GRID-Arendal. 2013. Web.

[9] "Tanzania elephant population declined by 60% in five years, census revealed." The Guardian. June 2, 2015. Web. < http://www.theguardian.com/environment/2015/jun/02/tanzania-epicentre-of-elephant-poaching-census-reveals>.

[10] "Namibian government responds to elephant hunting debate." Africa Geographic. June, 3, 2014. Web, < http://africageographic.com/blog/namibian-government-responds-to-elephant-hunting-debate/>.

[11] "South Africa to Resume Elephant Kills." Los Angeles Times. February 28, 2008. Available online: http://articles.latimes.com/2008/feb/26/world/fg-elephants26

[12] Department of the Interior, Fish and Wildlife Service. *Enhancement finding for African elephants taken as sport-hunted trophies in Zimbabwe during 2014*. Fish and Wildlife Service. July 22, 2014. Web.

[13] "African Rhinos." *World Wildlife Fund*. World Wildlife Fund, n.d. Web. <http://wwf.panda.org/what_we_do/endangered_species/rhinoceros/african_rhinos/>.

[14] Emslie, R. "Ceratotherium simum." The IUCN Red List of Threatened Species. IUCN, n.d. Web. <http://www.iucnredlist.org/details/4185/0>.

Kenya.[15] The most recent southern white rhino estimates for Namibia (469), South Africa (18,796), Zimbabwe (290), and Tanzania (zero) reflect both the legacy of overexploitation and the recent poaching crisis perpetuated by illegal trade in rhino horn.[16]

Black rhinos were once the most common species of rhinoceros in Africa, but their numbers have dwindled to fewer than 5,000 in the wild.[17] The black rhino is listed as endangered under the ESA.[18] Ninety-six percent of the wild population resides in just four countries: South Africa, Namibia, Zimbabwe and Kenya. Population estimates for Namibia (1,750), South Africa (1,915), Tanzania (113) and Zimbabwe (431) show just how close this species is to extinction.[19] As with white rhinos, intense poaching over the past several years has reversed recent conservation gains. The West African black rhino, one of four black rhino subspecies, was declared extinct in 2011.[20]

Leopard

The leopard is a wide-ranging and adaptable species that faces many threats, including hunting and habitat loss. Leopards are listed as endangered under the ESA except for southern African populations, which are listed as threatened.[21] No historical population estimate exists, and current counts are very difficult to obtain. The often cited 1988 estimate of 700,000 in Africa is considered unreliable.[22] Leopards have been extirpated from more than one third of their historical range and the overall population of leopards in Africa is decreasing, according to the International Union for Conservation of Nature (IUCN).[23]

Among our focus countries, Namibia's estimated population of roughly 14,000 leopards makes it one of the healthiest in Africa.[24] Estimates for Zimbabwe and Tanzania are widely considered to be unreliable, and a decade-old estimate of 4,250 leopards for South Africa showed a decline from previous surveys.[25] More recently, South Africa has announced that its leopard hunting

---

[15] Emslie, R. "Ceratotherium simum." The IUCN Red List of Threatened Species. IUCN, n.d. Web. <http://www.iucnredlist.org/details/4185/0>.
[16] IUCN, Species Survival Commission, African and Asian Rhino Specialist Groups, and TRAFFIC. *African and Asian Rhinoceroses – Status, Conservation and Trade. Convention on International Trade in Endangered Species of Wild Fauna and Flora*. November 20, 2009. Web.
[17] IUCN, Species Survival Commission, African and Asian Rhino Specialist Groups, and TRAFFIC. African and Asian Rhinoceroses – Status, Conservation and Trade. December 2012. Web.
[18] Emslie, R. "Diceros bicornis." The IUCN Red List of Threatened Species. IUCN, n.d. Web. <http://www.iucnredlist.org/details/6557/0>.
[19] Emslie, R. "Diceros bicornis." The IUCN Red List of Threatened Species. IUCN, n.d. Web. <http://www.iucnredlist.org/details/6557/0>.
[20] "Black Rhino." World Wildlife Fund. World Wildlife Fund, n.d. Web. <http://wwf.panda.org/what_we_do/endangered_species/rhinoceros/african_rhinos/black_rhinoceros/>.
[21] Henschel, P. "Panthera pardus ." The IUCN Red List of Threatened Species. IUCN, 2008. Web. <http://www.iucnredlist.org/details/15954/0>.
[22] Henschel, P. "Panthera pardus ." The IUCN Red List of Threatened Species. IUCN, 2008. Web. <http://www.iucnredlist.org/details/15954/0>.
[23] IUCN Red List of Threatened Species. Available online: http://www.iucnredlist.org/details/15954/0
[24] Stein, Andrew, et al. *Namibian National Leopard Survey 2011 Final Report*. Ministry of Environment and Tourism, MET Game Products Trust Fund, and Safari Club International Foundation. 2011. Web.
[25] Conservation Breeding Specialist Group, and Endangered Wildlife Trust. *Leopard population and habitat viability assessment 2005*. 2005. Web.

quota for 2016 is zero because of inadequate management of hunting practices and unreliable monitoring of populations.[26]



African Lion

Although past numbers are unknown, the geographic range of African lions has shrunk by nearly 90% over the past century and numbers have declined precipitously over a relatively short period of time.[27] There are now fewer than 20,000 lions left in the wild.[28] The species was recently listed as threatened under the ESA for populations in southern and eastern Africa, and endangered for populations in northern and western Africa. Habitat loss and hunting (for pest control, poaching or bush meat) are the greatest threats to lion populations. Poorly managed trophy hunting has also been linked to population declines.[29,30]

Lion populations seem to have stabilized – at least temporarily – at low levels in Namibia, South Africa, and Zimbabwe.[31] However, most of South Africa's lions are captive-bred animals used for canned hunting – where trophy animals are bred in captivity and "hunted" in small enclosures – and Tanzania's lion population has dropped by 60% in just over a decade.[32]

Summary

It is clear that there is little margin for error in managing these species. Habitat loss, poaching, and a legacy of uncontrolled hunting have pushed all of them to the brink of extinction. While populations in some areas have shown signs of stabilization or even recovery, strict controls on additional mortality are necessary to prevent further decline. With respect to trophy hunting, it is critical to ensure that the CITES non-detriment standard and the ESA enhancement standard are met for all trophies, as the ESA requires.

---

[26] Pinnock, D. "South Africa bans leopard trophy hunting for 2016." Africa Geographic. Web. http://africageographic.com/blog/south-africa-bans-leopard-trophy-hunting-2016/

[27] Declining Lions. National Geographic. Available online: http://animals.nationalgeographic.com/animals/big-cats-initiative/lion-decline-map/

[28] "Panthera leo ." The IUCN Red List of Threatened Species. IUCN, 2015. Web. <http://www.iucnredlist.org/details/15951/0>

Packer, C., et al. "Effects of Trophy Hunting on Lion and Leopard Populations in Tanzania." Conservation Biology 25.1 (2011): 142-53. Web <http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2010.01576.x/abstract>

[30] Rosenblatt, Elias, et al. "Detecting declines of apex carnivores and evaluating their causes: An example with Zambian lions." Conservation Biology 180 (2014): 176-86. Web. <http://www.sciencedirect.com/science/article/pii/S0006320714003875>..

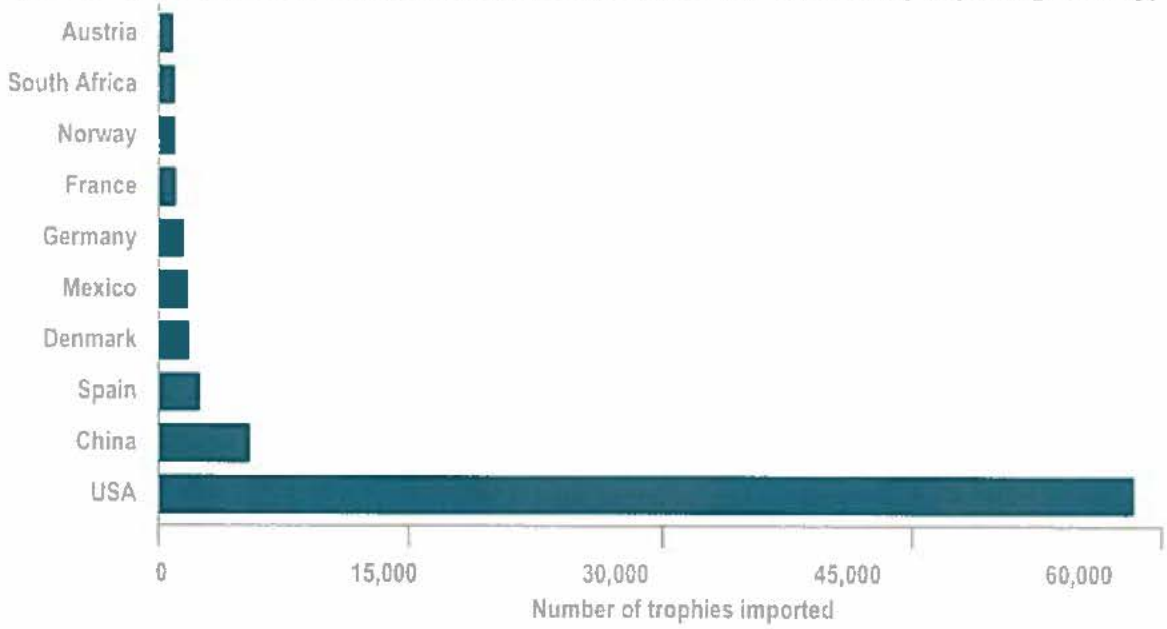
[31] IUCN Red List of Threatened Species. Available online: http://www.iucnredlist.org/details/15951/0

[32] The Hidden Consequences of Hunting Africa's Lions. Los Angeles Times. August 22, 2015. Available online: http://www.latimes.com/world/africa/la-fg-south-africa-lions-20150822-story.html

CHAPTER 2: IS TROPHY HUNTING HELPING OR HURTING?

Proponents of trophy hunting contend that it is a potential source of funding for wildlife conservation. Safari Club International (SCI), a non-profit group representing the interests of trophy hunters, believes that "lawful, ethical, vigilant hunters play an important role in public acceptance of sustainable hunting as a vital tool for modern wildlife conservation and management."[33] They further contend that trophy hunting can create incentives for conserving habitat and ecosystems where hunted animals roam.[34] Critics counter that trophy hunting can be mismanaged and potentially contribute to declines in the populations of species, and that the same land used for trophy hunting can support lucrative photographic tourism.[35] The United States is the largest importer of animal trophies, highlighting our responsibility to ensure that Americans are not contributing to the decline of already imperiled wildlife (see Table 1).

Table 1. Top 10 Importers of Mammal Trophies (2008-2013, as reported by importing country)



Source: CITES Trade Database at http://trade.cites.org/

[33] Can Lion Trophy Hunting Support Conservation? National Geographic. July 29 2015. Available online: http://news.nationalgeographic.com/2015/07/150729-lion-trophy-hunting-conservation-animals-cecil/

[34] Duan Briggs, "Trophy Hunting may be a Key to Saving Wildlife"," *ARC Centre of Excellence for Environmental Decisions*, March 25, 2015.
Biggs, Dr. Duan. "ARC Centre of Excellence for Environmental Decisions (CEED) Media Release." *ARC Centre of Excellence for Environmental Decisions* . N.p., 25 May 2015. Web. <http://ceed.edu.au/images/media_releases/CEED%20trophy%20hunting%2025March15.pdf>.

[35] Packer, C., et al. "Effects of Trophy Hunting on Lion and Leopard Populations in Tanzania." Conservation Biology 25.1 (2011): 142-53. Web. <http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2010.01576.x/abstract>.

The individuals applying for trophy import permits do not fit the profile of the average American hunter. These excursions require the purchase of round trip airfare to Africa, lodging, the services of guides and professional hunters, and other services. The individuals who applied most frequently for U.S. trophy import permits related to the species and countries in this report between 2009 and 2014 include an auto distributor worth $3.2 billion,[36] an oil and gas company CEO who reportedly made almost $10 million in 2014,[37] the wife of an owner of multiple companies and a trophy collector,[38] a winner of the Dallas Safari Club's Big Game Award in 2012 for successful hunts of an African elephant, buffalo, lion and leopard,[39] and the CEO of a food manufacturing company.[40]

The *New York Times* recently published estimates of the market values of selected animal trophies (see Table 2).[41]

Table 2. Estimated Market Value for "Big 5" trophies in 2015

	Trophy Value (in current US dollars)
Lion	$8,500 to $50,000
Elephant	$25,000 to $60,000
White Rhinoceros	$125,000 and up
Leopard	$15,000 to $35,000
Buffalo	$12,500 to $17,000

[36] "Forbes 400: #164 Dan Friedkin." *Forbes*. Forbes, n.d. Web. <http://time.com/3976344/cecil-lion-zimbabwe-walter-palmer/http://www.forbes.com/profile/dan-friedkin/>.
[37] http://www1.salary.com/Dan-O-Dinges-Salary-Bonus-Stock-Options-for-CABOT-OIL-GAS-CORP.html
[38] White, Tyler. "Texas oilman, hunter showcases extravagant trophy room of African animals in Nat Geo." *My San Antonio* 5 Aug. 2015. Web. <http://www.mysanantonio.com/news/local/article/Texas-oil-man-hunter-showcases-extravagant-6424004.php>.
[39] "Africa Big Game Award." *Dallas Safari Club*. Dallas Safari Club, n.d. Web. <https://www.biggame.org/awards/africa-big-game-award/>.
[40] http://www.johannafoods.com/news.htm
[41] "The Big Five: Africa's Most Sought-After Trophy Animals." *The New York Times* 10 Aug. 2015. Web. <http://www.nytimes.com/interactive/2015/08/10/world/africa/africa-big-game-hunting.html?_r=0>.

Fees for hunting animals for trophies vary considerably and are based on an animal's rarity, the effort required to hunt it, and its popularity for hunting (see Table 3). Walter Palmer reportedly paid more than $50,000 to his guides for his lion hunting trip. The recent auction of the right to hunt a black rhinoceros in Namibia cost $350,000.[42]

Table 3. Sample Trophy Fees for Select Animals from an Outfitter in Zimbabwe in 2016

	Trophy Value (in current US dollars)
Lion	$19,500
Lioness	$8,450
Elephant	$38,000
Leopard	$15,000
Buffalo	$13,250
Crocodile	$6,450
Hippopotamus	$7,950

Source: Africa Sky Hunting Outfitters at http://www.africanskyhunting.co.za/pricelist.html

It is clear that this is a lucrative industry and that those involved have the means to contribute significantly to the conservation of the species they hunt, as well as the wherewithal to ensure that they are acting responsibly and not promoting practices that that are detrimental to wildlife. However, as the tragic death of Cecil the Lion showed us, trophy hunters do not always play by the rules, and the trophy hunting industry needs to be regulated and held accountable for there to be any hope of a consistent conservation benefit.

Necessary Safeguards

In order for trophy hunting to fulfill its purported conservation potential, several conditions must exist. First, countries must establish strong conservation laws and enforce them rigorously and consistently. Second, management under these laws must be rooted in sound science and demonstrate that it is adequate to protect wildlife. Third, trophy hunting programs must operate transparently and demonstrate wildlife conservation benefits. Specifically with respect to species

[42] Merchant, Nomaan, and Michael Graczyk. "Http://www.dallasnews.com/news/metro/20140111-permit-to-hunt-black-rhino-auctioned-for-350000.ece." *The Dallas Morning News* 11 Jan. 2014. Web.

listed under the ESA, a trophy may only be imported into the United States if permitting that import would "enhance the propagation or survival of the affected species."[43]

The United States uses ESA to implement CITES. The four African countries profiled in this report are also CITES signatories and have enacted implementing legislation. CITES lists and categorizes wildlife and plant species based on the extent to which they might be threatened by trade, and regulates the international trade of wildlife and wildlife parts through a series of permits. It requires that exporting and importing countries make a finding that the trade in a listed species is not detrimental to that species' survival; this is a lower standard than the ESA requirement for an enhancement finding. A hunter attempting to import a trophy of an animal listed under Appendix I (the most protective category) of CITES into the United States is required to obtain an import permit from FWS and export permit from the range country for the wildlife or wildlife parts. Table 4 shows ESA and CITES requirements.

Table 4. Required Findings for Permitted Wildlife Imports and Exports

	Wildlife category	Permit requirements
Convention on International Trade in Endangered Species (CITES)	Appendix I	Import permit, export permit, and non-detriment finding
	Appendix II	Export permit and non-detriment finding
Endangered Species Act (ESA)	Endangered	Import permit and enhancement finding
	Threatened	Import permit and enhancement finding OR 4(d) rule

The ESA enhancement standard may be met in a number of ways, including evidence that the hunt promotes protection of wildlife habitat, funding for law enforcement or other conservation efforts, and development of science that feeds into these efforts. It cannot be met by showing the economic benefits hunting may provide to communities. If hunting is sustainable and contributes to conservation, those benefits will accrue and be greater over time, as enhancement of threatened and endangered populations is a necessary condition for ensuring sustainability. It is important to understand that while community based natural resource management (CBNRM) programs designed to support hunting and conservation can help make trophy hunting more sustainable, their mere existence does not guarantee that a trophy will meet the enhancement standard.[44]

In theory, trophy hunting supports conservation programs in Africa through several mechanisms. A portion of the fees taken for hunting animals can be used by governments to fund conservation activities that benefit species. Revenue generated from trophy hunting can also be used to maintain rangelands and local populations of hunted animals, both of which have conservation

[43] Endangered Species Act of 1973. §10(a)(1)(A). Available online: http://legcounsel.house.gov/Comps/Endangered%20Species%20Act%20Of%201973.pdf

[44] Leader-Williams, Nigel; and Hutton, Jon M.. Does extractive use provide opportunities to offset conflicts between people and wildlife?. Cambridge University Press, 2005. Cambridge Books Online. Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511614774.010

implications. Older research has described countries dependent on trophy hunting revenue to fund the operational costs of government wildlife management authorities, counter-poaching enforcement activities, and development assistance to local communities. In Zimbabwe, for example, CBNRM efforts through the Communal Areas Management Plan for Indigenous Resources (CAMPFIRE) program attempt to alter local people's perception of wildlife from a nuisance or threat to a viable source of economic profit. Translating theory to practice has proven challenging, however, and a number of factors can impact whether or not efforts to ensure trophy hunting enhance the conservation of ESA listed species.

Potential Pitfalls

Claiming that trophy hunting benefits imperiled species is significantly easier than finding evidence to substantiate it. If a country lacks the political will to strengthen and implement its conservation laws, or lacks the resources necessary to conduct populations surveys, prevent poaching, or protect and restore habitat, then killing additional animals through trophy hunting will only make the situation worse.

Significant discussion in the academic literature centers on the use of trophy hunting revenues as a means to finance conservation efforts. Several African countries have established programs that seek to link wildlife-related markets with conservation conditions. Although research indicates that the success of such efforts is often dependent on several factors, including wildlife management practices and access to benefits at the local level, researchers have also found that trophy hunting revenue has the potential to play an important role in financially supporting conservation programs.[45] However, trophy hunting accompanied by poor habitat management can be detrimental to conservation efforts.[46] Whilesome countries are undeniably able to generate revenue from trophy hunting, species conservation outcomes depend on the way trophy hunting and wildlife management are governed.[47] Some analysts note that corruption within governments or organizations can prevent trophy hunting revenues from funding conservation activities and can even lead to the mismanagement of hunted populations.[48]

"Some note that corruption within governments or organizations can prevent trophy hunting revenues from funding conservation activities and can lead to the mismanagement of hunted populations."

[45] Lindsey, P.A., et al. "Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa." Biological Conservation 134.4: 455-469. Web. <http://www.africanwildlifeconservationfund.org/wp-content/uploads/2011/09/Economic-and-conservation-significance.pdf>.

[46] Crosmary, W.G., S. D. Côté, and H. Fritz. "The assessment of the role of trophy hunting in wildlife conservation." Animal Conservation 18.2 (2015): 136-37. Web. <http://onlinelibrary.wiley.com/doi/10.1111/acv.12205/epdf>.

[47] Nelson, Fred, Peter Lindsey, and Guy Balme. "Trophy hunting and lion conservation: a question of governance?" Oryx 47.4: 501-09. Web. <http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9016211&fileId=S003060531200035X>.

[48] Endangered and Threatened Wildlife and Plants; Listing Two Lion Species, 80 Fed Reg. 246(December 23, 2015). *Federal Register*. Web.

Trophy hunting can also undermine wildlife conservation if it results in alterations to ecosystems, such as habitat fragmentation, the introduction of exotic species, or targeted reduction of predators of trophy animals.[49] Scientists report that trophy hunting can affect a specific, localized population of a given species in many ways: by reducing the number of animals in the population, by reducing the population's reproductive capacity, and by altering the ecosystem where the species resides.[50] If quota levels are not based on scientific information, or are fixed in a way that ignores changes in the population's size and behavior, trophy hunting could have negative consequences for the population's health.[51] High rates of trophy hunting could also combine with other factors, such as poaching, to cause wildlife population declines.

The degree to which the trophy hunting industry is well regulated and responsible also has important conservation implications. Tourist hunters require the services of experts who know the local terrain and local laws in order to conduct a legal hunt that maximizes the chances of success. Professional hunters are good at what they do; clients frequently have to do little more than pull the trigger. Taking home a trophy is almost guaranteed. Some companies will even refund a portion of an unsuccessful hunter's fees.[52] By contrast, the success rates for hunting whitetail deer in the United States – a species that has been restored to the point of near ubiquity in some places – is below 50%.[53] The expectation of coming home from Africa with a trophy has led to rash behavior, including the son of a former presidential candidate demanding to be given a trophy from a rhinoceros he failed to kill.[54] These expectations can put pressure on guides and professional hunters to take shortcuts. The use of tactics such as baiting and drugging target animals, hunting in small enclosures, and using vehicles and artificial lighting to aid in hunts has been widely reported.

If exporting countries adhere to science-based quotas, and importing countries – particularly the United States – are thorough in implementing CITES and evaluating permit applications to ensure that only legal, sustainable trophies are allowed, the trophy hunting industry will have to adhere to high conservation standards. However, if quotas are set arbitrarily and permitting is lax, then there will be no incentive to prove that trophy hunts make things better for imperiled species.

---

[49] Loveridge, Andrew J., Jonathan C. Reynolds and E.J. Milner-Gulland. "Does Sport Hunting Benefit Conservation?" Key Topics in Conservation Biology 1st Edition. Ed. David Macdonald and Katrina Service. Malden: Blackwell Publishing, 2007. 222-238. Print.

[50] Crosmary, W.G., S. D. Côté, and H. Fritz. "Does trophy hunting matter to long-term population trends in African herbivores of different dietary guilds?" Animal Conservation 18.2 (2015): 117-30. Web. <http://onlinelibrary.wiley.com/doi/10.1111/acv.12144/abstract>.

[51] Lindsey, P.A., et al. "Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa." Biological Conservation 134.4: 455-69. Web. <http://www.africanwildlifeconservationfund.org/wp-content/uploads/2011/09/Economic-and-conservation-significance.pdf>.

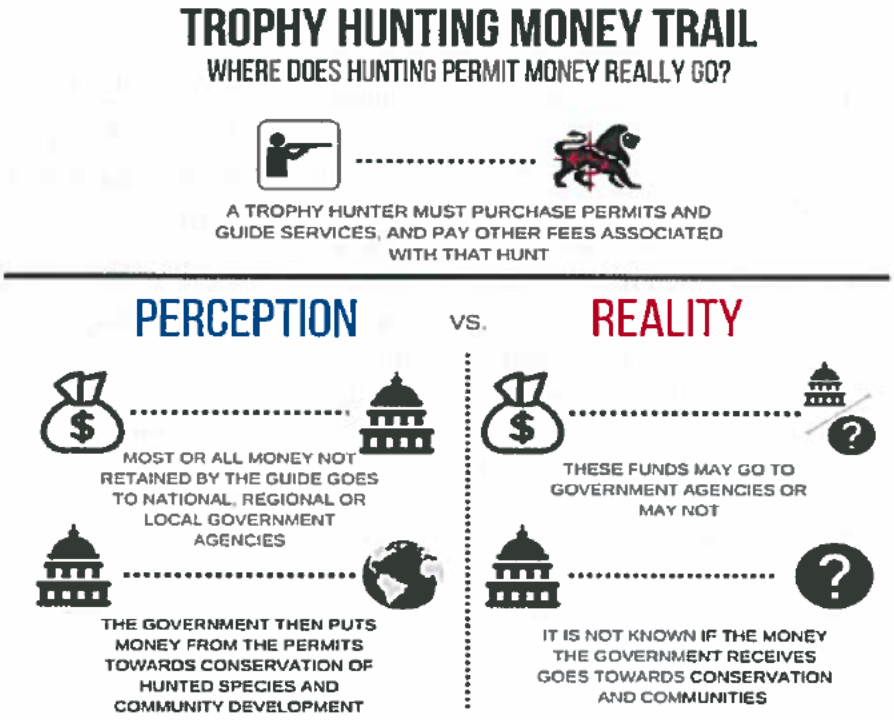
[52] "7 day Lion and Plains Game Hunting." *Africa Sky Hunting*. Africa Sky Hunting, n.d. Web. <http://www.africanskyhunting.co.za/packages/7daylionplainsgame.html>.

[53] Dougherty, Craig. "Deer Hunting: A Success Story." *Outdoor Life* 2 Oct. 2013. Web. <http://www.outdoorlife.com/blogs/big-buck-zone/2013/10/deer-hunting-success-story>.

[54] Berger, Sebastien. "Ross Perot's son in dispute over ownership of rhino's head." *The Telegraph* 7 Nov. 2009. Web. <http://www.telegraph.co.uk/news/worldnews/africaandindianocean/southafrica/6517637/Ross-Perots-son-in-dispute-over-ownership-of-rhinos-head.html>.

The Evidence, or Lack Thereof

To determine whether or not trophy hunting is living up to its billing as a conservation tool, we conducted comprehensive reviews of the academic literature, conservation programs in the four target countries, and the FWS import permitting program. In assessing the flow of trophy hunting revenue to conservation efforts, we found many troubling examples of funds either being diverted from their purpose or not being dedicated to conservation in the first place.



Several reports, including one from the U.S. Agency for International Development (USAID) in 2013, outline the failure of Tanzanian authorities to manage land and wildlife effectively, and show little evidence that trophy hunting is contributing positively to wildlife conservation.[55] In addition, the country has recently caved to pressure to allow non-sporting methods of hunting, including baiting lions and leopards.[56] As mentioned earlier, Zimbabwe has attempted to use trophy hunting as a conservation tool, but has had limited success. Despite significant support from international NGOs and foreign governments, including the United States, the CAMPFIRE program has been poorly administered and the government has been incapable of delivering the promised improvements in wildlife conservation or community development. [57]

Namibia seems to be the exception to the rule. Its communal conservancy model has worked to fund conservation efforts and increase some wildlife populations through selective trophy

[55] United States Agency for International Development. *Tanzania Wildlife Management Areas Evaluation – Final Evaluation Report*. USAID. July 15, 2013. Web. < http://pdf.usaid.gov/pdf_docs/pdacy083.pdf>.
[56] "Tanzanian Hunting Laws." *Tanzania Professional Hunters Association*. Tanzania Professional Hunters Association, n.d. Web. <http://tzpha.com/tzlaws.html>.
[57] Frost, Peter G.H., and Ivan Bond. "The CAMPFIRE programme in Zimbabwe: Payments for wildlife services." Ecological Economics 65.4 (2008): 776-87. Web. <http://archives.cerium.ca/IMG/pdf/CampfireArticle.pdf>.

hunting.[58] In addition to the revenue generated by conservancies, Namibia has auctioned off some permits for special hunts, including one for an aging endangered black rhinoceros in 2014. While controversial, this practice is based on sound science and generates significant funding for wildlife conservation and research.[59] The 2014 black rhino permit from Namibia was sold to an American hunter for $350,000; FWS issued an import permit for the trophy after finding that it would enhance survival of the species. The proceeds were deposited into Namibia's Game Products Trust Fund and will be used to help implement the country's successful Black Rhinoceros Conservation Strategy.

On the whole, though, the evidence shows that trophy hunting is having negative impacts across sub-Saharan Africa. According to scientists, unsustainably high rates of trophy hunting have caused population declines in African lions and possibly African leopards.[60] Many hunting areas are also fenced, which fragments the habitat into small blocks and alters species migrations.[61] Some scientists contend that an increase in tuskless elephants in parts of Africa is due to selective hunting and poaching of elephants with large tusks.[62] Hunting and poaching of wild elephants in general are currently outpacing the reproductive rate of the species, causing an unsustainable loss of elephants annually.[63] While poaching for ivory is certainly a bigger driver of decline, it would be exceedingly difficult to prove – as the ESA requires – that removing additional animals from a vulnerable and dwindling population would benefit the species.

"According to scientists, unsustainably high rates of trophy hunting have caused population declines in African lions and possibly African leopards."

Conservation programs' effectiveness depends on the ability of government institutions to implement and enforce them. Unfortunately, the best measures of governance and corruption show significant deficits for two of the four studied countries. Tanzania ranks in the bottom third of all countries with respect to government corruption, and reports have shown inconsistent and arbitrary application of wildlife laws.[64] Freedom House notes that "corruption remains a serious problem, and is pervasive in all aspects of political and commercial life, but especially in the

[58] The World Bank. *Implementation Completion and Results on a Grant in the Amount of US$ 7.1 Million to the Republic of Namibia for an Integrated Community-based Ecosystem Management Project.* Report No. ICR2045. November 29, 2011. Web.

[59] "Black Rhino Import Permit from Namibia." U.S. Fish & Wildlife Service International Affairs. U.S. Fish & Wildlife Service, n.d. Web. <http://www.fws.gov/international/permits/black-rhino-import-permit.html>.

[60] Packer, Craig, et al. "Sport Hunting, Predator Control and Conservation of Large Carnivores." PLoS ONE (2009). Web. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0005941>.

[61] Lindsey, Peter A., L. G. Frank, R. Alexander, A. Mathieson, and S. S. Romanach. "Trophy Hunting and Conservation in Africa: Problems and One Potential Solution." Conservation Biology 21.3 (2007): 880-83. Web. <http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2006.00594.x/abstract>.

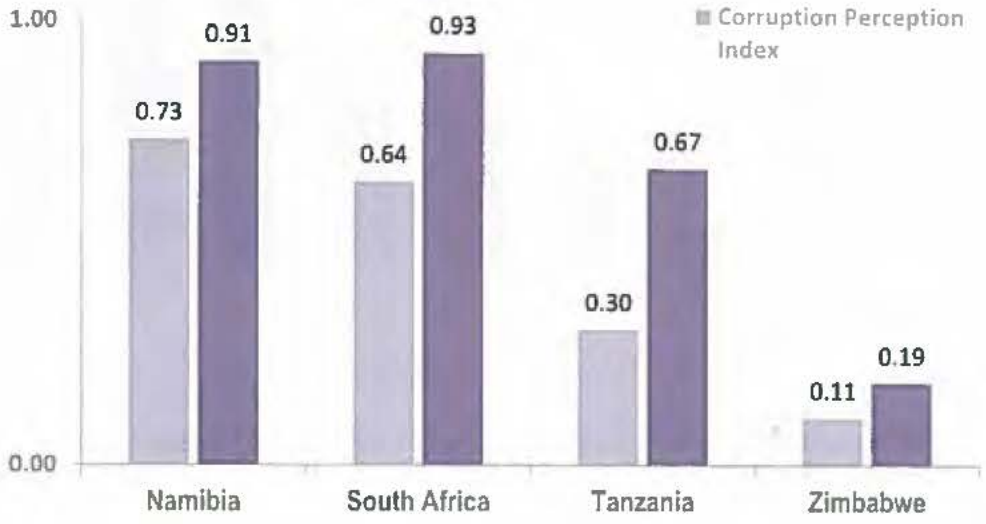
[62] Whitehouse, Anna M. "Tusklessness in the elephant population of the Addo Elephant National Park, South Africa." Journal of Zoology 257.2 (2002): 249-54. Web. <http://onlinelibrary.wiley.com/doi/10.1017/S0952836902000845/abstract>.

[63] "Elephant poaching rates virtually unchanged in 2014." Convention on International Trade in Endangered Species of Wild Fauna and Flora. Convention on International Trade in Endangered Species of Wild Fauna and Flora, 23 Mar. 2015. Web. <https://cites.org/eng/mike_figures2014>.

[64] Benjaminsen, Tor A., et all. "Wildlife Management in Tanzania: State Control, Rent Seeking and Community Resistance."*Development and Change* 44.5 (2013): 1087-109. Web. <http://onlinelibrary.wiley.com/doi/10.1111/dech.12055/pdf>.

energy and natural resources sectors."[65,66] Zimbabwe consistently ranks as one of the most corrupt countries in the world according to Transparency International, and the Ibrahim Index of African Governance ranks the country 44th out of 54 countries.[67,68] This is largely a result of the disastrous policies of Zimbabwean dictator Robert Mugabe. To cite just one impact on environmental quality, Mugabe's sweeping and sudden land use "reforms" in 2000 devastated the country's economy and led to an explosion of wildlife poaching.[69]

Table 5. Corruption and Governance Indicators for Study Countries
(1.00 = Least corrupt/Best governed)



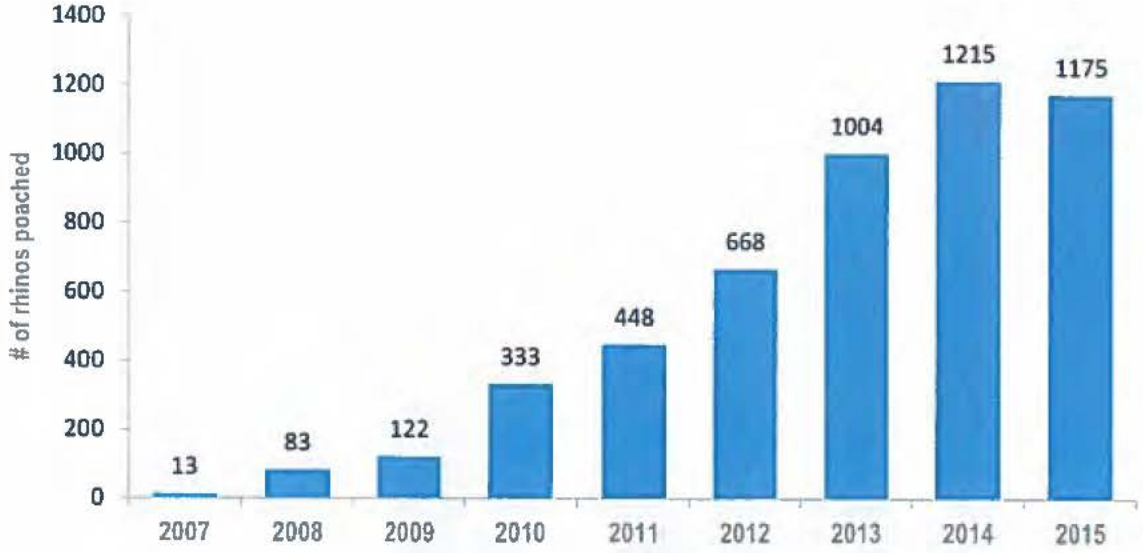
Source: Mo Ibrahim Foundation Index of African Governance 2015: http://mo.ibrahim.foundation/iiag/data-portal/
Transparency International Corruption Perceptions Index 2015:http://www.transparency.org/cpi2015#map-container

Even in countries where corruption is relatively less prevalent, though, serious concerns linger about the ability of government officials to manage wildlife populations sustainably. Wildlife management in South Africa is generally better funded than in many other places on the continent, but the country's wildlife population has been hit hard by poaching in recent years, particularly with respect to its white rhino population.[70] While trophy hunting industry proponents assert that the presence of hunting operations deters poaching, there is no evidence of

[65] "Table of Results: Corruption Perceptions Index 2015." Transparency International. Transparency International, n.d. Web. <https://www.transparency.org/cpi2015#results-table>.
[66] "Tanzania - Freedom in the World." *Freedom House*. Freedom House, n.d. Web. <https://freedomhouse.org/report/freedom-world/2015/tanzania>.
[67] "Table of Results: Corruption Perceptions Index 2015." Transparency International. Transparency International, n.d. Web. <https://www.transparency.org/cpi2015#results-table>.
[68] "Overall Governance: Africa." Ibrahim Index of African Governance. Mo Ibrahim Foundation, n.d. Web. <http://www.moibrahimfoundation.org/iiag/data-portal/>.
[69] Jenkins, Nash. "Who's Really Responsible for the Killing of Zimbabwe's Lions and Other Wildlife?" *Time* 29 July 2015. Web. <http://time.com/3976344/cecil-lion-zimbabwe-walter-palmer/>.
[70] McKenzie, David, and Brent Swails. "Rhino wars: Inside South Africa's losing battle to end poaching." *CNN* 22 Feb. 2015. Web. <http://www.cnn.com/2015/09/22/africa/south-africa-rhino-poaching/>.

such an effect. Rhino poaching has soared during the last decade even as the South African government has encouraged trophy hunting (see Figure 5).

Table 6. Number of Rhinos Poached in South Africa, by year



Source: https://www.savetherhino.org/rhino_info/poaching_statistics

South Africa has recently come under increasing fire for allowing the practice of canned hunting, described earlier in this report. South Africa has also fallen victim in recent years to a phenomenon known as "pseudo-hunting," whereby individuals associated with wildlife trafficking rings participate in legally permitted hunts for white rhino with the intention of selling the trophy for profit.[71]

While it does not have authority to manage wildlife populations in other countries directly, FWS does have the ability – and the responsibility – under the ESA to ensure that trade by U.S. citizens in threatened and endangered species enhances the survival of those species. FWS made headlines in 2014 when it made negative enhancement findings for African elephant trophies from Zimbabwe and Tanzania, basing its decision on questionable management practices, uncontrolled poaching, and evidence of population decline.[72] While these particular bans remain in effect, our review found that FWS has been reluctant to use its ESA authority with respect to trophy imports in other cases where the enhancement standard is clearly not being met.

The ESA gives FWS the authority to require an import permit for any species listed as threatened or endangered under the Act, including those species treated as threatened or endangered due to being similar in appearance to a listed species. Import permits are rarely issued for endangered species, but are frequently issued for threatened species. In addition, FWS has employed special

[71] IUCN Species Survival Commission, African and Asian Rhino Specialist Groups, and TRAFFIC. African and Asian Rhinoceroses – Status, Conservation and Trade. IUCN. January 2007. Web.
[72] Service Suspends Import of Elephant Trophies from Tanzania and Zimbabwe. U.S. Fish and Wildlife Service. April 4, 2014. Available online: http://www.fws.gov/news/ShowNews.cfm?ID=2E6FF2A2-E10F-82BC-DAE08807810E3C6B

rules authorized under section 4(d) of the ESA to exempt many imports of ESA listed trophies from these permitting requirements. Table 4 shows that for the species and countries covered in this report, FWS required only one ESA import permit from 2010-2014, even though more than 2,700 permit-eligible trophies were imported during that time. We know these trophies are being imported only because they must be declared to Customs officials. By not requiring a permit, FWS does not collect data that could be useful in determining whether the trophy imports should have been allowed under the ESA, such as information on the permit applicant, the hunting guides and outfitters, and the hunt itself.

Table 7. Trophy imports into the United States from four African countries (2010-2014)

	Number of trophies for which FWS *could have* required ESA import permit	Number of trophies for which FWS *actually* required ESA import permit
Black Rhinoceros	1	1
Leopard	1,469	0
Elephant (Tanzania)	106	0
Elephant (Namibia, South Africa, Zimbabwe)	922	0
Southern White Rhinoceros*	N/A	N/A
Lion**	N/A	N/A
Total	2498	1

Source: U.S. Fish and Wildlife Service
* Southern White Rhinoceros listed as threatened due to similarity of appearance in July, 2014
**Lion listed as threatened in December, 2015.

Even when it does require an ESA import permit, FWS does not collect all of the relevant information it could collect to make enhancement findings. In most cases no data is collected about the guides or professional hunters, amounts paid for services, permits, and fees, or the method used to kill the animal. Yet some guides and professional hunters are known to repeatedly violate wildlife protection laws—sometimes being arrested or even convicted multiple times for wildlife-related crimes over several years.[73,74,75,76,77] FWS trophy permit applications

[73] "The Madness of Modern-Day Poaching." Outside Online. March, 2014. Web. <http://www.outsideonline.com/1922121/madness-modern-day-poaching>
[74] "Criminal Nature: The Global Security Implications of the Illegal Wildlife Trade." International Fund for Animal Welfare. June, 2013. Web. <http://www.ifaw.org/sites/default/files/ifaw-criminal-nature-2013-low-res_0.pdf>

do state clearly that violations of the Lacey Act, the Migratory Bird Treaty Act, or the Bald and Golden Eagle Protection Act preclude anyone from getting a permit. In December of 2015, FWS announced it would enforce to the limit of its authority prohibitions on previous offenders at the federal and state level, which is an important step.[78] While existing regulations – even as interpreted in the December 2015 Director's Order – state that FWS must consider violations of laws other than those listed above, such violations do not preclude issuance of an import permit. Nothing prohibits such an individual from importing an ESA listed trophy for which FWS does not require a permit.

Determinations by FWS that the importation of an endangered or threatened species will enhance the survival of the species typically rely on the assumption that the funds generated by the trophy hunt will be used effectively for conservation efforts. Unfortunately, among the countries that were the focus of this investigation, only one of the positive enhancement findings relied on information about whether population increases did or did not occur or population decreases did not occur as a direct result of the additional funds (the black rhino in Namibia). In that case, the funding from the hunt directly enhanced the survival of the species and because the rhino was past its reproductive age, its absence gave younger males a chance to mate with the females.[79]

Enhancement findings and non-detriment findings are not required to be updated on a regular basis. Typically, FWS decides when an update will happen. The result is inconsistent assessments and a shortage of current data to aid in evaluating trophy import permit applications. In some cases it is possible, if not likely, that permits are issued even when conditions on the ground are drastically different than those described in the most recent enhancement or non-detriment findings. For example:

- The non-detriment finding covering leopards in South Africa, Tanzania, and Zimbabwe is less than one page long and was issued in 1982. The average lifespan of a leopard in the wild is 12-15 years, yet FWS has not reassessed the value of trophy hunting to leopard species conservation in more than three decades.[80] Earlier this year South Africa banned the export of leopard trophies after the country made a negative non-detriment finding under CITES, saying that poor management and a lack of monitoring make the export of hunting trophies a threat to the survival of the species.[81]

---

[75] African Arguments, October 29, 2012, Rhino Poaching - Organised Crime and Economic Opportunity Driving Trade [analysis], BYLINE: Keith Somerville.

[76] "Mules Hunting Rhinos?" Sinister Scam Unfolds in South Africa. Planetsave. June 22, 2011. Web. < http://planetsave.com/2011/06/22/mules-hunting-rhinos-sinister-scam-unfolds-in-south-africa/>

[77] "South African Hunter Fined for Over Illegally Killing Rhino for Vietnamese Client." Saving rhinos. Jan, 20, 2011. Web. <http://www.savingrhinos.org/2011/01/20/south-african-hunter-fined-over-illegally-killing-rhino-for-vietnamese-client>

[78] Director's Order No. 212. U.S. Fish and Wildlife Service. December 9, 2015. Web. <http://www.fws.gov/policy/do212.html>

[79] Memorandum from "Chief, Branch of Permits, Division of Management Authority. Subject: Enhancement from the Import of Black Rhino Trophy from Namibia (PRT-229051). To: File. Earliest possible date is after September 2012.

[80] "Mammals: Leopard." *San Diego Zoo Animals*. San Diego Zoo, n.d. Web. <http://animals.sandiegozoo.org/animals/leopard>.

[81] Pinnock, Don. "Leopard trophy hunting 'banned' for 2016." *Conservation Action Trust*. N.p., 26 Jan. 2016. Web. <http://conservationaction.co.za/media-articles/leopard-trophy-hunting-banned-for-2016/>.

- The southern white rhinoceros is treated as a threatened species under the ESA due to its similarity of appearance with other listed rhinoceros species. The similarity of appearance listing is designed to help reduce illegal poaching and trafficking of rhino horn and allows FWS to make an enhancement finding and require permits for trophy imports. However, FWS has not taken these steps and does not currently have plans to evaluate the species for ESA listing, even though poaching is having a severe impact on the species. The southern white rhinoceros is also listed under CITES Appendix I outside of South Africa, which means a non-detriment finding is required for trophy importation. The most recent finding for Namibia (the only other country from which FWS has recently permitted southern white rhino imports) was made in 2002.

The sporadic preparation of enhancement findings and liberal employment of exemptions from ESA permitting requirements significantly reduce the amount of information FWS has to make informed decisions. Continuing to allow trophy imports for species which have not been recently assessed and which are known to be subject to intense poaching pressure could exacerbate an already dire situation. Many scientific studies on the topic contain disclaimers that point out the inadequacy of the available data.[82] As a result, it is difficult to confidently conclude that any particular trophy import would enhance the survival of a species.

In addition to the fact that enhancement findings are updated infrequently and often based upon limited information, the information that does exist is in some cases provided by parties with potential conflicts of interest. Groups that are not affiliated with FWS, the host country government or academia – including Safari Club International, the largest advocacy organization representing big game trophy hunters – frequently generate data used by FWS in its enhancement decisions.[83] It is often the case that no other entities are generating that data and FWS does not have the resources to generate it themselves or ground-truth it. Some of these NGOs spend hundreds of thousands of dollars to generate data about the impact of trophy hunting on a species.[84,85] At the same time, they may be spending significant resources to influence legislation and legislators[86,87] while contributing to the campaigns of members of Congress directly.[88,89] FWS determinations do not disclose the sources of the data aside from identifying the authors without naming their affiliation(s). The determinations do not disclose whether the data has been

[82] Crosmary, W.G., S. D. Côté, and H. Fritz. "The assessment of the role of trophy hunting in wildlife conservation." Animal Conservation 18.2 (2015): 136-37. Web. <http://onlinelibrary.wiley.com/doi/10.1111/acv.12205/epdf>.
[83] U.S. Fish & Wildlife Service. Personal Interview, 11, Dec. 2015
[84] Jackson, John J. "The Role of Conservation Force in African Lion Conservation: Challenges and Solutions for the Conservation of Lions and Other Large Carnivores in Sub-Saharan Africa." *Conservation Force*. Conservation Force, n.d. Web.
[85] United States. Cong. House. Committee on Science, Space and Technology, Subcommittee on Investigations and Oversight. *Hearing on The Science of How Hunting Assists Species Conservation and Management*. June 19, 2012. 1st sess. Washington (statement of Dr. Al Maki, Vice-President, Safari Club International).
[86] "Safari Club International - Profile for 2014 Election Cycle." *OpenSecrets.org*. Center for Responsive Politics, n.d. Web. <https://www.opensecrets.org/orgs/summary.php?id=D000000757&cycle=2014>.
[87] "Safari Club International - Lobbying Totals, 1998-2014." *OpenSecrets.org*. Center for Responsive Politics, n.d. Web. <https://www.opensecrets.org/orgs/lobby.php?id=D000000757>.
[88] "Safari Club International - Profile for 2014 Election Cycle." *OpenSecrets.org*. Center for Responsive Politics, n.d. Web. <https://www.opensecrets.org/orgs/summary.php?id=D000000757&cycle=2014>.
[89] "Safari Club International - SPENDING BY CYCLE - Party Split by Cycle." *OpenSecrets.org*. Center for Responsive Politics, n.d. Web.

peer reviewed. Indeed, a recent assessment of lion population status across Africa found no scientific merit in any of the SCI-funded "surveys" that had been conducted in various range states.[90,91] A determination that a hunting trophy import will enhance the survival of the species would be more credible if it disclosed the data sources and whether it has been peer reviewed.

Summary

On paper, all four countries examined in this report have equally strong frameworks for ensuring that trophy hunts benefit species conservation. Unfortunately, the implementation of these frameworks has in many cases been marred by corruption and has not produced the advertised and desired results. Even in countries with better execution of wildlife conservation plans, significant questions remain about whether or not trophy hunting is sustainable. The only way to answer these questions is to produce and analyze more and better data, and the U.S. government has an important role to play in that endeavor. The recent decision by FWS to ban imports of African elephant trophies from Tanzania and Zimbabwe is a promising development. However, the agency is not making full use of its significant authority to ensure that American trophy hunters are not making a bad situation worse for African wildlife.

[90] "Panthera leo ." The IUCN Red List of Threatened Species. IUCN, 2015. Web. http://www.iucnredlist.org/details/15951/0

[91] Bauer, H., K. Nowell, P. Henschel, P. Funston, G. Chapron, L. Hunter, D.W. Macdonald & C. Packer. 2015. Lion (Panthera leo) populations are declining rapidly across Africa, except in intensively managed areas. PNAS. www.pnas.org/cgi/doi/10.1073/pnas.1500664112

CHAPTER 3: FINDINGS AND RECOMMENDATIONS

Our analysis shows that trophy hunting cannot be assumed to have a conservation benefit on the strength of a guarantee that hunters' fees will flow to communities or wildlife agencies. Additional oversight is necessary to ensure that importing trophies of ESA listed species is in fact helping those species survive in the wild. The following recommendations would provide the necessary accountability and certainty that the ESA requires.

Ensure that trophy hunting enhances conservation.

The ESA generally prohibits the importation of listed species or their parts into the United States. The only exceptions allowed are for scientific purposes or to enhance the propagation or survival of the affected species. While the recent negative enhancement findings for African elephants from Zimbabwe and Tanzania are encouraging, it is clear that in the case of many trophies hunted in Tanzania, Zimbabwe, South Africa and Namibia, FWS has allowed imports without verifying that those imports do in fact enhance species conservation. Given FWS' limited resources, as well as the incomplete information available to hunters about the biological implications of their particular hunt, the responsibility for supplying this information should fall on the countries that promote trophy hunting to American tourists.

FWS should require any country that wishes to make trophies eligible for U.S. import to submit annual reports on any threatened or endangered species under consideration. These reports should include up-to-date population surveys, an analysis of threats to the species, documentation of dedicated revenue streams from hunting to conservation work, and evidence that trophy hunting is part of a science-based and effective conservation strategy. FWS should assess the validity of the information submitted, request supplemental information as necessary, and either make, renew, or update enhancement findings for each species, as appropriate.

FWS should also make a more direct evidentiary connection between the trophy import and the enhancement finding, and assess potential impacts at the appropriate level of detail given what is known about the ecology of the species and differences among populations in different regions of the country. Enhancement and non-detriment findings should clearly cite the sources of information used to produce the finding and require disclosure of study methodologies and funding sources. FWS should penalize countries or outside groups that knowingly submit false information.

Close regulatory loopholes that harm imperiled species.

Implementation of the ESA species enhancement requirement is arbitrary, confusing, and not based on sound science. FWS should rescind regulations that allow trophy imports to meet lesser conservation standards and require enhancement findings and import permits for all trophies of listed species, including those treated as threatened or endangered due to similarity of appearance. FWS' recent African lion listing shows that the agency can require import permits for species listed in CITES Appendix II and as threatened under the ESA, rather than restricting permits to species listed under Appendix I or as endangered under the ESA. FWS should apply that standard consistently. Given the astronomically high rates of southern white rhino poaching in South Africa, FWS should immediately commence a status review for that species to

determine if it warrants a stand-alone ESA listing. FWS should use its existing authority under Section 4(b)(7) of the ESA to issue, for any species proposed to be listed, an emergency rule prohibiting the importation of trophies until a final listing decision is made and a 4(d) rule with more rigorous enhancement finding criteria can be developed.

Tighten trophy import permitting requirements.

Trophy import permit applications are an excellent opportunity to gather relevant information about the structure and practices of the hunting industry in host countries. That data is not currently collected or compiled. FWS should require that ESA trophy import permit applications filed by hunters include documentation regarding the details of the hunt, including hunting method(s), information on the payee and the amounts paid for guide services, permits, and fees, and whether the guide is licensed by the host country. In its enhancement findings, FWS should consider the percentage of guides that are licensed and the terms of the licensure, including any best practices and sanctions for failing to follow them.

FWS should expand upon its recent commitment to deny trophy import permits to people who have been convicted of wildlife violations by revising its regulations to specify that the threshold to forbid an import permit is any violation of state, federal, or international wildlife law or regulation. The agency should require permit applicants to provide that information under penalty of law. The agency should issue clear guidance indicating the type of violations that merit disqualification for receiving an import permit.

Increase fees for trophy imports to fund science and conservation.

Many permitting program challenges directly result from insufficient resources. FWS currently charges $100 for a permit to import a trophy of an ESA listed animal. The fees raise approximately $400,000 per year for FWS, a fraction of the $5 million it costs to run the permitting program.[92] While trophy import permits do not comprise the entire cost of the program, they are a significant proportion. Taxpayers are covering 92% of all permit fees, which means they are subsidizing the hobby of people wealthy enough to afford the other trophy hunting-related expenses outlined in this report.

Even with higher standards in place, ensuring compliance with conservation requirements for trophy hunts and imports will be difficult without some system of accountability. FWS has already signaled that it will increase trophy import permit fees to cover the cost of the permitting program. Fees should be increased significantly to also cover the cost of more frequent enhancement findings and the cost of conservation officers within countries exporting trophies to the United States. These officers could be based in U.S. embassies and act as observers of randomly selected trophy hunts. They could also conduct compliance checks and double as general wildlife conservation attachés to offer assistance with poaching and trafficking countermeasures.

[92] U.S. Fish & Wildlife Service. Personal Interview, 11, Dec. 2015

Allow only imports taken using fair chase hunting methods.

"Fair chase" hunting is generally defined as the ethical, sportsmanlike, and lawful pursuit of free-ranging wild game in a manner that does not give the hunter an improper advantage.[93] Most hunters and hunting organizations in North America support fair chase hunting as part of a general code of conduct. Unfortunately, many of the practices commonplace on African trophy hunts do not qualify as fair chase. Baiting, drugging, and fencing of target animals, or hunting from vehicles or in or around protected areas, each occur (either legally or illegally) in some or all of the countries profiled in this report. Such tactics do not benefit species conservation, and they contribute to the poor reputation and negative media attention trophy hunters have acquired.

As a first step, FWS should develop a fair chase standard and require trophy import permit applicants to certify that the hunt was conducted using fair chase methods. FWS should also seek adoption of a resolution at this year's CITES Conference of the Parties laying out best management practices and standards for fair chase hunting that must be met in order for countries to receive quotas for CITES listed species. FWS should consider, in its enhancement and non-detriment findings, whether host country laws or guide licensure organizations set their own fair chase standards.

Conclusion

The United States has proven that well-regulated hunting can help conserve wildlife, even for threatened or endangered populations. However, our past has shown that poorly regulated hunting can decimate wildlife populations and lead to the collapse of ecosystems and the disappearance of hunting opportunities. We have a responsibility to set an example for the rest of the world and make absolutely certain that Americans are not contributing to the decline of species already facing extinction or severe population loss. Hunting is a valuable part of American culture, but as the outrage over the death of Cecil the Lion shows, it will only remain so if hunters verifiably contribute to conservation.

[93] "Rules of Fair Chase." Pope and Young Club. Last visited March 28, 2016. Web. < https://pope-young.org/fairchase/>.

IUCN SSC Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives

Ver. 1.0 (09 August 2012)

Citation: IUCN SSC (2012). IUCN SSC Guiding principles on trophy hunting as a tool for creating conservation incentives. Ver. 1.0. IUCN, Gland.

Section I. Introduction

IUCN has long recognized that the wise and sustainable use of wildlife can be consistent with and contribute to conservation, because the social and economic benefits derived from use of species can provide incentives for people to conserve them and their habitats. This document builds on existing IUCN policies by setting forth SSC guiding principles on the use of "trophy hunting", as defined in Section II, as a tool for creating incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources.

Trophy hunting is often a contentious activity, with people supporting or opposing it on a variety of biological, economic, ideological or cultural bases. This document is focused solely on the relevance of trophy hunting for conservation and associated local livelihoods. Nothing in this document is intended to support or condone trophy hunting activities that are unsustainable; adversely affect habitats; increase extinction risks; undermine the rights of local communities to manage, steward, and benefit from their wildlife resources; or foster corruption or poor governance.

Section II. Scope of this guidance

The term "trophy hunting" is here used to refer to hunting that is:

- Managed as part of a programme administered by a government, community-based organization, NGO, or other legitimate body;
- Characterized by hunters paying a high fee to hunt an animal with specific "trophy" characteristics (recognizing that hunters each have individual motivations);
- Characterized by low off-take volume;
- Usually (but not necessarily) undertaken by hunters from outside the local area (often from countries other than where the hunt occurs).

These elements differentiate the hunting at issue here from a broad array of other hunting activities, although it is recognized that what is here defined as trophy hunting may be given a different name in some countries. Thus these guiding principles are not intended to apply to subsistence hunting, to legal hunting of relatively common species, or to management activities undertaken by wildlife management agencies, although some elements of them may be relevant to these activities. Such hunting activities may also generate incentives for conservation, but are beyond the scope of this guidance.

These guiding principles apply specifically to trophy hunting programmes oriented to terrestrial wild animals in their native geographic ranges. Existing IUCN policy does not support moving species outside their native ranges for the primary purpose of trophy hunting[1]. In keeping with existing IUCN policy (IUCN Recommendation 3.093, adopted by the IUCN Congress at its 3rd Session in Bangkok, Thailand, 17-25 November 2004, which condemned "the killing of animals in enclosures or where they do not exist as free-ranging"), the IUCN SSC does not support trophy hunting of animals in enclosures where they cannot be considered "free-ranging" and cannot use their natural abilities to escape.

Section III: The policy context

IUCN's formal recognition that the ethical and sustainable use of wildlife can form an integral

[1] See: IUCN Position Statement on Translocation of Living Organisms (http://www.iucnsscrsg.org/download/IUCNPositionStatement.pdf) and IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species (http://intranet.iucn.org/webfiles/doc/SSC/SSCwebsite/Policy_statements/IUCN_Guidelines_for_the_Prevention_of_Biodiversity_Loss_caused_by_Alien_Invasive_Species.pdf)

and legitimate component of conservation programs dates back to the World Conservation Strategy in 1980, and was affirmed in Recommendation 18.24 at the 1990 IUCN General Assembly in Perth. IUCN's "Policy Statement on Sustainable Use of Wild Living Resources", adopted as Resolution 2.29 at the IUCN World Conservation Congress in Amman in October 2000, affirms that use of wildlife, if sustainable, can be consistent with and contribute to biodiversity conservation. IUCN recognizes that where an economic value can be attached to a wild living resource, perverse incentives removed, and costs and benefits internalized, favourable conditions can be created for investment in the conservation and the sustainable use of the resource, thus reducing the risk of resource degradation, depletion, and habitat conversion. In managing such use to enhance sustainability, the Policy Statement draws attention to the following key considerations:

- the need for adaptive management, incorporating monitoring and the ability to modify management to take account of risk and uncertainty;
- the supply of biological products and ecological services available for use is limited by intrinsic biological characteristics of both species and ecosystems, including productivity, resilience, and stability, which themselves are subject to extrinsic environmental change;
- institutional structures of management and control require both positive incentives and negative sanctions, good governance, and implementation at an appropriate scale. Such structures should include participation of relevant stake-holders and take account of land tenure, access rights, regulatory systems, traditional knowledge, and customary law.

More specifically, and with particular reference to southern Africa, IUCN has recognized that recreational hunting can contribute to biodiversity conservation. The IUCN at the 2004 WCC adopted Recommendation 3.093 stating that it "Supports the philosophy and practice that on state, communal and privately-owned land in southern Africa the sustainable and well-managed consumptive use of wildlife makes a contribution to biodiversity conservation" and further, that it "accepts that well-managed recreational hunting has a role in the managed sustainable consumptive use of wildlife populations".

Further, the IUCN SSC Caprinae Specialist Group adopted a formal position statement in December, 2000, recognizing that hunting, and in particular trophy hunting, can form a major component in conservation programmes for wild sheep and goats. This statement noted that "Trophy hunting usually generates substantial funds that could be used for conservation activities such as habitat protection, population monitoring, law enforcement, research, or management programs. Equally importantly, the revenues from trophy hunting can provide a strong incentive for conservation or habitat protection…"

The Convention on Biological Diversity has developed several statements of principles relevant for the management of trophy hunting. Most importantly, the 7th Conference of Parties to the CBD (Kuala Lumpur, February 2004) adopted the Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity (AAPG), and IUCN members party to the CBD were urged to honour these commitments by Resolution 3.074 of the 3rd IUCN World Conservation Congress (Bangkok, October 2004). The AAPG are based on the assumption that it is possible to use biodiversity in a manner in which ecological processes, species, and genetic variability remain above the thresholds needed for long term viability, and that all resource managers and users have the responsibility to ensure that such use does not exceed these. Some key relevant principles from the Addis Ababa Principles and Guidance include:

- Recognizing the need for a governing framework consistent with international/national laws, local users of biodiversity components should be sufficiently empowered and supported by rights to be responsible and accountable for use of the resources concerned (Principle 2);
- Adaptive management should be practiced, based on:

    - Science and traditional and local knowledge;
    - Iterative, timely and transparent feedback derived from monitoring the use, environmental and socio-economic impacts, and the status of the resource being used; and
    - Adjusting management based on timely feedback from the monitoring procedures (Principle 4)
- Sustainable use management goals and practices should avoid or minimize adverse impacts on ecosystem services, structure, and functions as well as other components of ecosystems (Principle 5);
- An interdisciplinary, participatory approach should be applied at the appropriate levels of management and governance related to the use (Principle 9);
- Users of biodiversity should seek to minimize waste and adverse environmental impact, and optimize benefits from uses (Principle 11);
  The costs of management and conservation of biological diversity should be internalized within the area of management and reflected in the distribution of the benefits from the use (Principle 13).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) provides for the authorization of trade of trophies in certain specimens of Appendix I-listed taxa for personal use (Res. Conf. 2.11 (rev. CoP 9). CITES has adopted a series of Resolutions for certain Appendix I-listed species subject to trophy hunting (Res. Conf 10.14 (rev. CoP 14) on Leopard *Panthera pardus*; Res. Conf 10.15 (rev. CoP 14) on Markhor *Capra falconeri;* and Res. Conf 13.5 (rev. CoP 14) on Black Rhinoceros *Diceros bicornis*), which set out quotas and conditions for such trade.

The European Charter on Hunting and Biodiversity (ECHB), adopted under the European Bern Convention, provides specific guidance on hunting and conservation. In Resolution 4.026, adopted at the 4th World Conservation Congress Barcelona, October 2008), IUCN requested that its members promote the ECHB in the implementation of IUCN's policies and Programme for 2009-2012. While the ECHB explicitly addresses sustainable hunting in Europe, its principles and guidelines are relevant and pertinent in a wider geographic context. Key principles of the ECHB include:

- ensuring that harvest is ecologically sustainable (Principle 3);
- maintaining wild populations of indigenous species with adaptive gene pools (Principle 4);
- maintaining environments that support healthy and robust populations of harvestable species (Principle 5);
- encouraging use to provide economic incentives for conservation (Principle 6); and
- empowering local stakeholders and holding them accountable (Principle 9).

Section IV. Trophy hunting and conservation

Trophy hunting is a form of wildlife use that, when well managed, may assist in furthering conservation objectives by creating the revenue and economic incentives for the management and conservation of the target species and its habitat, as well as supporting local livelihoods. However, if poorly managed, it can fail to deliver these benefits. Although a wide variety of species (many of which are both common and secure) are hunted for trophies, some species that are rare or threatened may be included in trophy hunting as part of site-specific conservation strategies. Examples include Cheetah *Acinonyx jubatus* and Black Rhinoceros in southern Africa, and Straight-Horned Markhor *Capra falconeri megaceros* in the Torghar Valley of Pakistan, all of which are species listed on Appendix I of CITES.

Trophy hunting takes place in both North America and Europe, and in developing countries where wildlife management infrastructure is often less fully developed. These hunts are usually conducted by persons willing and able to pay substantial amounts of money for the opportunity. They typically involve taking small numbers of individual animals and require limited development infrastructure. They are thus high in value but low in impact. In some cases, trophy hunting forms an important component of Community-Based Conservation/Community-Based Natural Resource Management, which aim to devolve responsibility for the sustainable use and management of wildlife resources from distant bureaucracies to more local levels.

Understanding the context within which trophy hunting occurs is critical to understanding its potential to benefit conservation. In many parts of the world, much wildlife exists outside of protected areas. Wildlife shares landscapes with people, and typically competes for space and environmental resources with other forms of economically productive land uses, such as agriculture and pastoralism, upon which the livelihoods of local people depend. Wildlife can impose serious costs on local people, including physical harm, damaging crops, and competing with livestock for forage. Where wildlife provides few benefits to local people and/or imposes substantial costs, it is often killed (legally or illegally) for food, various commercially valuable wildlife products, or as problem animals, and its habitats are degraded or lost to other forms of land use. In some circumstances trophy hunting can address this problem by effectively making wildlife more valuable than, and/or complementary to, other forms of land use. It can return benefits to local people (preferably through effective co-management), encouraging their support for wildlife, and motivating investment at community, private, and government levels for research, monitoring, habitat protection, and enforcement against illegal use (see Annex 1 for examples). Trophy hunting, if well managed, is often a higher value, lower impact land use than alternatives such as agriculture or tourism.

However, where poorly managed, trophy hunting can have negative ecological impacts including altered age/sex structures, social disruption, deleterious genetic effects, and in extreme cases, population declines. It can also be difficult to ensure that benefits from hunting accrue to those in the best position to help conservation.

Section V: The Guiding Principles

The IUCN SSC considers that trophy hunting, as described in Section II above, is likely to contribute to conservation and to the equitable sharing of the benefits of use of natural resources when programmes incorporate the following five components: Biological Sustainability; Net Conservation Benefit; Socio-Economic-Cultural Benefit; Adaptive Management: Planning, Monitoring, and Reporting; and Accountable and Effective Governance

Biological Sustainability

Trophy hunting as described in Section II, can serve as a conservation tool when it:

1. Does not contribute to long-term population declines of the hunted species or of other species sharing its habitat, noting that a sustainably harvested population may be smaller than an unharvested one;
2. Does not substantially alter processes of natural selection and ecosystem function; that is, it maintains “wild populations of indigenous species with adaptive gene pools.[2]” This generally requires that hunting offtake produces only minor alterations to naturally occurring demographic structure. It also requires avoidance of breeding or culling to deliberately enhance population-genetic characteristics of species subject to hunting that are inconsistent with natural selection;
3. Does not inadvertently facilitate poaching or illegal trade of wildlife;

[2] Direct quote from Principle 4 of the European Charter on Hunting and Biodiversity.

4. Does not artificially and/or substantially manipulate ecosystems or their component elements in ways that are incompatible with the objective of supporting the full range of native biodiversity.

Net Conservation Benefit

Trophy hunting can serve as a conservation tool when it:

1. Is linked to identifiable and specific parcels of land where habitat for wildlife is a priority (albeit not necessarily the sole priority or only legitimate use); and on which the "costs of management and conservation of biological diversity [are] internalized within the area of management and reflected in the distribution of the benefits from the use[3]";
2. Produces income, employment, and/or other benefits that generate incentives for reduction in pressures on populations of target species, and/or help justify retention, enhancement, or rehabilitation of habitats in which native biodiversity is prioritized. Benefits may create incentives for local residents to co-exist with such problematic species as large carnivores, herbivores competing for grazing, or animals considered to be dangerous or a threat to the welfare of humans and their personal property;
3. Is part of a legally recognized governance system that supports conservation adequately and of a system of implementation and enforcement capable of achieving these governance objectives.

Socio-Economic-Cultural Benefit

Trophy hunting can serve as a conservation tool when it:

1. Respects local cultural values and practices (where "local" is defined as sharing living space with the focal wildlife species), and is accepted by (and preferably, co-managed and actively supported by) most members of the local community on whose land it occurs;
2. Involves and benefits local residents in an equitable manner, and in ways that meet their priorities;
3. Adopts business practices that promote long-term economic sustainability.

Adaptive Management: Planning, Monitoring, and Reporting

Trophy hunting can serve as a conservation tool when it:

1. Is premised on appropriate resource assessments and/or monitoring of hunting indices, upon which specific quotas and hunting plans can be established through a collaborative process. Optimally, such a process should (where relevant) include local communities and draw on local/indigenous knowledge. Such resource assessments (examples might include counts or indices of population performance such as sighting frequencies, spoor counts) or hunting indices (examples might include trophy size, animal age, hunting success rates and catch per hunting effort) are objective, well documented, and use the best science and technology feasible and appropriate given the circumstances and available resources;
2. Involves adaptive management of hunting quotas and plans in line with results of resource assessments and/or monitoring of indices, ensuring quotas are adjusted in line with changes in the resource base (caused by ecological changes, weather patterns, or anthropogenic impacts, including hunting offtake);
3. Is based on laws, regulations, and quotas (preferably established with local input) that are transparent and clear, and are periodically reviewed and updated;
4. Monitors hunting activities to verify that quotas and sex/age restrictions of harvested animals are being met;

[3] Direct quote from Practical Principle 13 of the Addis Ababa Principles and Guidelines on Sustainable Use of Biodiversity.

5. Produces reliable and periodic documentation of its biological sustainability and conservation benefits (if this is not already produced by existing reporting mechanisms).

Accountable and Effective Governance

A trophy hunting programme can serve as a conservation tool when it:

1. Is subject to a governance structure that clearly allocates management responsibilities;
2. Accounts for revenues in a transparent manner and distributes net revenues to conservation and community beneficiaries according to properly agreed decisions;
3. Takes all necessary steps to eliminate corruption; and
4. Ensures compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.

Section VI: Appropriate use of these guiding principles

SSC's intention is that these guiding principles may serve to assist authorities responsible for national and subnational policy, law and planning; managers responsible at the site level; and local communities in designing and implementing trophy hunting programs where biodiversity conservation and equitable sharing of natural resources are objectives.

These guiding principles should not be interpreted as in any way dismissing the values – whether they are biological, social, cultural or economic – of hunting programs that may be truly sustainable, but that do not produce incentives for conservation and associated conservation benefits.

Although IUCN and SSC are not currently engaged in endorsing or certifying trophy hunting programmes, they consider that for any such endorsement or certification to be credible, it should be conducted by a recognized independent body. Nothing in this document is intended to be interpreted in any way as a specific endorsement or criticism of a particular trophy hunting programme.

Annex 1. Examples of trophy hunting as part of a conservation strategy

Note: *Due to the varied potential conservation impacts of trophy hunting it is useful to provide a small set of illustrative case studies highlighting both positive and negative conservation impacts. We have here included two illustrations of generally positive conservation impacts. We would welcome suggestions for further examples, both positive and negative, noting that in the case of negative examples we are sensitive to not casting blame or criticizing member groups and member states.*

Case study 1: Trophy hunting in Namibian communal Conservancies

Namibia's communal Conservancy programme is widely viewed as a conservation and rural development success story, and trophy hunting plays a central role in this success. Innovative legislative reforms in the mid-1990s devolved conditional rights to use and manage wildlife on communal lands to communities, if they organized to form a Conservancy. The intent of this approach was to devolve rights and benefits from wildlife to communities – people often viewed by colonial conservationists as "poachers" - to create incentives for communities to live with, value, and benefit from wildlife. Forming a Conservancy requires that the community defines its membership, borders, and management committee; develops a Constitution; agrees a method for equitable distribution of benefits; and develops a sustainable game management and utilization plan. Conservancies can use wildlife consumptively in various ways, including trophy hunting, own-use hunting game cropping, and live sales; and organize nonconsumptive use through tourism. Conservancies retain all the revenue gained from utilization and management.

The spread of the conservancy movement has been rapid, and conservation impacts extensive and widespread. Today there are 71 registered communal Conservancies covering 14.98 million ha (with another 20 conservancies under development) and include around 240 000 members. Current communal Conservancies alone mean that 18.2% of Namibia's land surface is under conservation management. This is a contrast from the previous status of these areas as subject to long-term human-wildlife conflict, uncontrolled poaching, and low levels of wildlife.

Sustainable use of wildlife has been a strong catalyst to the recovery of wildlife in communal areas. Prior to the introduction of conservancies, wildlife in Namibia's communal areas had been decimated and was at historic lows in many instances. Wildlife was perceived by communities mainly as a threat to livelihoods, with its best use being illegal poaching for meat for the pot. The advent of Conservancies drastically altered this attitude. Wildlife is now increasingly seen as a valued asset, with growing wildlife populations meaning more income for conservancies, more jobs for conservancy members, more game meat at the household level, and more funds to support rural development. As a result, poaching has become socially unacceptable and game numbers have staged remarkable recoveries in most areas where Conservancies have operated for a period of time. For instance, on communal lands in northeast Namibia, from 1994 to 2011, elephant have increased from 12,908 to an estimated 16,993; sable from 724 to an estimated 1,474; and common impala from 439 to 9,374. In northwest Namibia[4], from the early 1980s to today, desert elephants have increased from approx. 150 to approx. 750; Hartmann's Mountain Zebra from est. <1,000 to > 27,000; and black rhino have more than tripled, making it the biggest free-roaming population of rhino in the world. From 1995, the population of lion in this area has increased from an est. 20 to an est. 130, with exponential range expansion. Game populations have been re-established in Conservancies that have low densities of specific species or species that have gone locally extinct. This support has allowed for the re-establishment of a large number of species, including giraffe, red hartebeest, black faced impala and black rhino. Further, Conservancies, a large proportion of which are located adjacent or

[4] Game guard programs, precursors of the current model, were introduced in this area in the early 1980s.

close to protected areas, strengthen Namibia's protected area system by ensuring wildlife friendly environments adjacent to protected areas and through the creation of movement corridors between them.

Trophy hunting has been a central driver of this transformation. It is by far the largest generator of benefits from sustainable consumptive wildlife use, with 41 Conservancies hosting 40 trophy hunting concessions during 2011. Since registration of the first four communal conservancies in 1998, a total of 97 948 km^2 have been opened to trophy hunting concessions under community management. Benefits from consumptive use of wildlife (cash, employment, and in-kind [largely meat]) received by Conservancies and their members from 1998-2009 amounted to N$76.5 million (US$10.17 million) (NACSO Database, 2011). As the benefits from consumptive use have driven recovery of wildlife populations through reduction of poaching, these recoveries have in turn paved the way for non-consumptive tourism, more than doubling the returns from wildlife to communities. In 2011 more than 30 joint venture tourism lodges and 24 community campsites were functioning in communal Conservancies, generating Conservancy benefits (including cash, employment and in-kind benefits) of N$102.8 million (US$13.64 million) from 1998-2009. Tourism enterprises have proven to be strong, complementary additions to consumptive use options, with consumptive use (primarily trophy hunting) generating the majority of cash income to Conservancies (which can be put toward wildlife management activities and community development purposes), and tourism operations providing the greater individual employment benefits to Conservancy members. Benefits from consumptive use are critical because these can start to flow when wildlife populations are initially too low to support tourism, stimulating recoveries of wildlife to levels at which photographic tourism can become viable.

Community development activities paid for by benefit streams from sustainable use, among others, include improvements to schools or school facilities and equipment; improvements to rural health clinics; support to pensioners; scholarship funds; transport for the sick or injured; mitigation of human / wildlife conflict; and sponsoring of community sports teams. Finally, the hunting operations provide meat to community members (many very marginalized): meat provided from trophy hunting and own-use harvesting was valued at N$17,413,120 (US$2.29 million) between 1998 and 2009[5] (NACSO, 2010).

A number of cutting edge tools and practices have been developed by the Namibia CBNRM Programme to ensure sustainable hunting is playing a key conservation role, including:

- annual quota setting procedures for sustainable harvest offtake rates: jointly carried out by the MET, NGOs, and the Conservancies, and based upon annual game counts, hunting operator reports, and local knowledge of conservancy/MET/NGO staff;
- trophy hunting tender procedures for Conservancy hunting concessions: these aim to attain market values for game in a transparent manner, and strengthen relationships between the Conservancy committee and the hunting operator;
- trophy hunting contracts: through the Conservancy movement communities have been empowered to become meaningful partners in the development and support of hunting activities, although many remain on a steep learning curve; and
- Conservancy management plans and practices: **f**unds generated from wildlife use are used by conservancies to employ community game guards and implement game management and monitoring systems, allowing communities to proactively counter poaching threats and mitigate increasing incidents of human/wildlife conflict.

Sources:

[5] The value of distributed meat is calculated by using market values and average meat yields of game animals from which the meat was distributed, as recorded by conservancies in the Event Book.

NACSO. 2010. Namibia's communal conservancies: a review of progress 2009. NACSO, Windhoek, Namibia

Naidoo, R., Weaver, L. C., Stuart-Hill, G. & Tagg, J. (2011). Effect of biodiversity on economic benefits from communal lands in Namibia. *Journal of Applied Ecology* 48: 310-316.

Weaver, C., Hamunyela, E., Diggle, R., Matongo, G. & Pietersen T. (2011). The catalytic role and contributions of sustainable wildlife use to the Namibia CBNRM programme. In: Abensperg-Traun, M., Roe, D. & O'Criodain, C. eds. (2011). *CITES and CBNRM*.
Proceedings of an international symposium on "The relevance of CBNRM to the conservation and sustainable use of CITES-listed species in exporting countries", Vienna, Austria, 18-20 May 2011. IUCN and London, Gland, Switzerland & IIED, UK. Pp. 59-70

Case study 2: Conservation and trophy hunting in the Torghar Valley, Pakistan

Torghar (black mountains/hills in Pushtoo) is in the province of Balochistan in Pakistan. In the early 1980s, wild Straight-horned Markhor *Capra falconeri megaceros* and Afghan Urial *Ovis orientalis* were close to being extirpated from this region due to uncontrolled hunting and competition for grazing with domestic herds. Enforcement efforts against hunting were poor due to weak institutional capacity and lack of political will. In the mid-1980s, a tribal decree banning hunting was issued by a local leader, but could not be enforced. Local Jazalai (a Pathan tribe) leaders, with support from the United States Fish and Wildlife Service (USFWS), launched a community-based conservation programme in 1986, the Torghar Conservation Project (later managed by STEP, the Society for Torghar Environmental Protection). This project used limited and monitored trophy hunting, initially of Urial only and later also of Markhor, to provide revenue to fund the employment of local people as game guards and to provide community benefits. The hypothesis was that development of local livelihoods based on trophy hunting would change the attitude of local people toward wildlife, demonstrating that conservation could be an economically viable land use, and providing incentives for enforcement. In line with its commitment to conservation, the trophy hunting has been conservative, with 1-2 Markhor and 1-4 Urial taken per year.

After careful consideration, tribesmen accepted a ban on their traditional hunting in return for the economic benefits of the conservation programme. Illegal hunting virtually ceased. While exact population numbers cannot be ascertained in the difficult terrain, use of repeated standardized survey protocols have found that the Torghar populations of Markhor and Urial have steadily increased since the project started. Surveys at Torghar by USFWS-sponsored biologists found the estimated population of Markhor grew from less than 100 in 1990 to 2,541 in 2005, with estimated Urial populations increasing from 1173 in 1994 to 3,146 in 2005.

Over this period, the programme has continually faced a lack of regulatory support, including government reluctance to recognize local involvement in conservation, bans on hunting imposed by the national Conservation Council, and the listing of Markhor on Appendix I of CITES, making export of trophies to major market countries such as the United States problematic. Despite these obstacles the programme has grown, attracting further support from the United Nations Development Programme, WWF-Pakistan, the Global Environment Facility and others. While other means of raising revenue such as ecotourism based on photography have been considered, the region is remote and attracts few visitors.

TCP/STEP has also generated considerable benefits for the approx. 400 families of the local area. Revenues raised by trophy hunting and donor grants pay salaries for ca. 82 game guards, and have been used for community needs such as construction of water tanks, dams and irrigation channels (to provide water during droughts), supply of young fruit trees, a medical camp and emergency drought relief.

Sources:

Frisina, M. & Tareen, S.N. (2009). Exploitation prevents extinction: Case study of endangered Himalayan sheep and goats. In: Recreational Hunting, Conservation and Rural Livelihoods: Science and Practice (eds. B. Dickson, J. Hutton & W.M. Adams). 1st edition, Wiley-Blackwell, Oxford, UK. pp. 141-156.

Rosser, A.M., Tareen, N & Leader-Williams, N. (2005) Trophy hunting and the precautionary principle: a case study of the Torghar Hills population of straight-horned markhor. In: Biodiversity and the Precautionary Principle: risk and uncertainty in conservation and sustainable use (eds. R Cooney and B Dickson). Earthscan, London. pp. 55-72.

Valdez, R. 2008. Capra falconeri. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 27 March 2012.

Woodford M.H., Frisina M.R. & Awan G.A. (2004) The Torghar Conservation Project: Management of the Livestock, Suleiman Markhor (*Capra falconeri*) and Afghan Urial (*Ovis orientalis*) in the Torghar Hills, Pakistan. *Game and Wildlife Science* 21: 177-187.

BRIEFING PAPER
April 2016

Informing decisions on trophy hunting

A Briefing Paper for European Union Decision-makers regarding potential plans for restriction of imports of hunting trophies

For more information, please contact:

Dan Challender
IUCN Species Programme
dan.challender@iucn.org

Rosie Cooney
IUCN CEESP/SSC Sustainable Use and Livelihoods Specialist Group
rosie.cooney@iucn.org



SUMMARY

Trophy hunting is currently the subject of intense debate, with moves at various levels to end or restrict it, including through bans on carriage or import of trophies. In the European Parliament, a group of Members have called for signing of a Written Declaration calling: "to examine the possibility of restricting all import of trophies into the EU, to ensure proper implementation of the rules by Member States, and to persuade countries that are issuing permits to trophy hunters without due consideration for the impacts of trophy hunting on conservation and animal welfare to discontinue this practice".

This paper seeks to inform discussions on this Declaration and other relevant discussions in the European Union on restriction of imports of hunting trophies.

Trophy hunting is hunting of animals with specific desired characteristics (such as large antlers), and overlaps with widely practiced hunting for meat. It is clear that there have been, and continue to be, cases of poorly conducted and poorly regulated hunting both beyond and within the European Union. While "Cecil the Lion" is perhaps the most highly publicised controversial case, there are examples of weak governance, corruption, lack of transparency, excessive quotas, illegal hunting, poor monitoring and other problems in a number of countries. This poor practice requires urgent action and reform.

However, legal, well regulated trophy hunting programmes can – and do – play an important role in delivering benefits for both wildlife conservation and for the livelihoods and wellbeing of indigenous and local communities living with wildlife.

RECOMMENDATIONS

To avoid significant negative impacts on species populations, habitat conservation, poaching levels, and the rights and livelihoods of indigenous and local communities, IUCN calls on the European Parliament, Council and Commission to ensure that any decisions that could restrict or end trophy hunting programmes:

i. are based on careful and sound analysis and understanding of the particular role that trophy hunting programmes are playing in relation to conservation efforts at all levels in source countries, including their contribution to livelihoods in specific affected communities;

ii. are based on meaningful and equitable consultation with affected range state governments and indigenous peoples and local communities and do not undermine local approaches to conservation;

iii. are taken only after exploration of other options to engage with relevant countries to change poor practice and promote improved standards of governance and management of hunting;

iv. are taken only after identification and implementation of feasible, fully funded and sustainable alternatives to hunting that respect indigenous and local community rights and livelihoods and deliver equal or greater incentives for conservation over the long term.

SUMMARY *continued*

Habitat loss and degradation is the primary driver of declines in populations of terrestrial species. Demographic change and corresponding demands for land for development are increasing in biodiversity-rich parts of the globe, exacerbating this pressure on wildlife and making the need for viable conservation incentives more urgent.

Well managed trophy hunting, which takes place in many parts of the world, can and does generate critically needed incentives and revenue for government, private and community landowners to maintain and restore wildlife as a land use and to carry out conservation actions (including anti-poaching interventions). It can return much needed income, jobs, and other important economic and social benefits to indigenous and local communities in places where these benefits are often scarce. In many parts of the world indigenous and local communities have chosen to use trophy hunting as a strategy for conservation of their wildlife and to improve sustainable livelihoods.

In many parts of the world indigenous and local communities have chosen to use trophy hunting as a strategy for conservation of their wildlife and to improve sustainable livelihoods

Time-limited, targeted conditional moratoria – particularly if accompanied by support for on-the ground management reform – may be useful tools in driving improvements in hunting practice. Such moratoria could focus on particular countries or species. But blanket bans or restrictions affect both good and bad hunting practices. They are a blunt instrument that risks undermining important benefits for both conservation and local livelihoods, thus exacerbating rather than addressing the prevailing major threats of habitat loss and poaching.

Rather than bans on trophy hunting, poor practices (within the EU or in other countries) could be improved by sustained engagement with and support for responsible national agencies to improve governance frameworks and on-the-ground management.

Or, if decisions to ban or restrict trophy hunting are taken, there is a need to identify and implement in advance viable alternative long-term sources of livelihood support and conservation incentives.

While tourism can be a one viable alternative in a limited number of cases, it requires access, infrastructure, guaranteed wildlife viewing opportunities and political stability – all conditions that are missing in many of the places where trophy hunting is working. But tourism and hunting can be complementary land uses in many areas, with both activities – when regulated by effective protocols – contributing to making wildlife a viable land use.

IUCN stands ready to assist European decision-makers in better understanding the role of trophy hunting in conservation and livelihoods and is actively pursuing a major research exercise to enable this.

BACKGROUND

What is at stake?

Trophy hunting is currently the subject of intense debate and polarised positions, with controversy and deep concern over the practice of trophy hunting, its ethical basis, and its impacts. It is clear that there have been, and continue to be, cases of poorly conducted and poorly regulated hunting, with Cecil the Lion perhaps the most highly publicised example of this.

Intense scrutiny of hunting due to these bad examples has been associated with many confusions (and sometimes misinformation) about the nature of hunting, including:

- trophy hunting is the same as “canned” hunting;
- trophy hunting is illegal;
- trophy hunting is driving declines of iconic species, particularly large African mammals like elephant, rhino and lion;
- trophy hunting could readily be replaced by photographic tourism.

None of these statements is correct.

Concerns over hunting, sometimes driven by these confusions, have sparked calls at various levels directed at ending or limiting trophy hunting, typically by restricting the national level licensing of hunting or the transport or import of hunting trophies.

In the European Union (EU), a group of Members of the European Parliament (MEPs) have called for the signing of a Declaration to ban import of trophies into the EU (European Parliament 2016). This paper seeks to inform discussions on this Declaration.

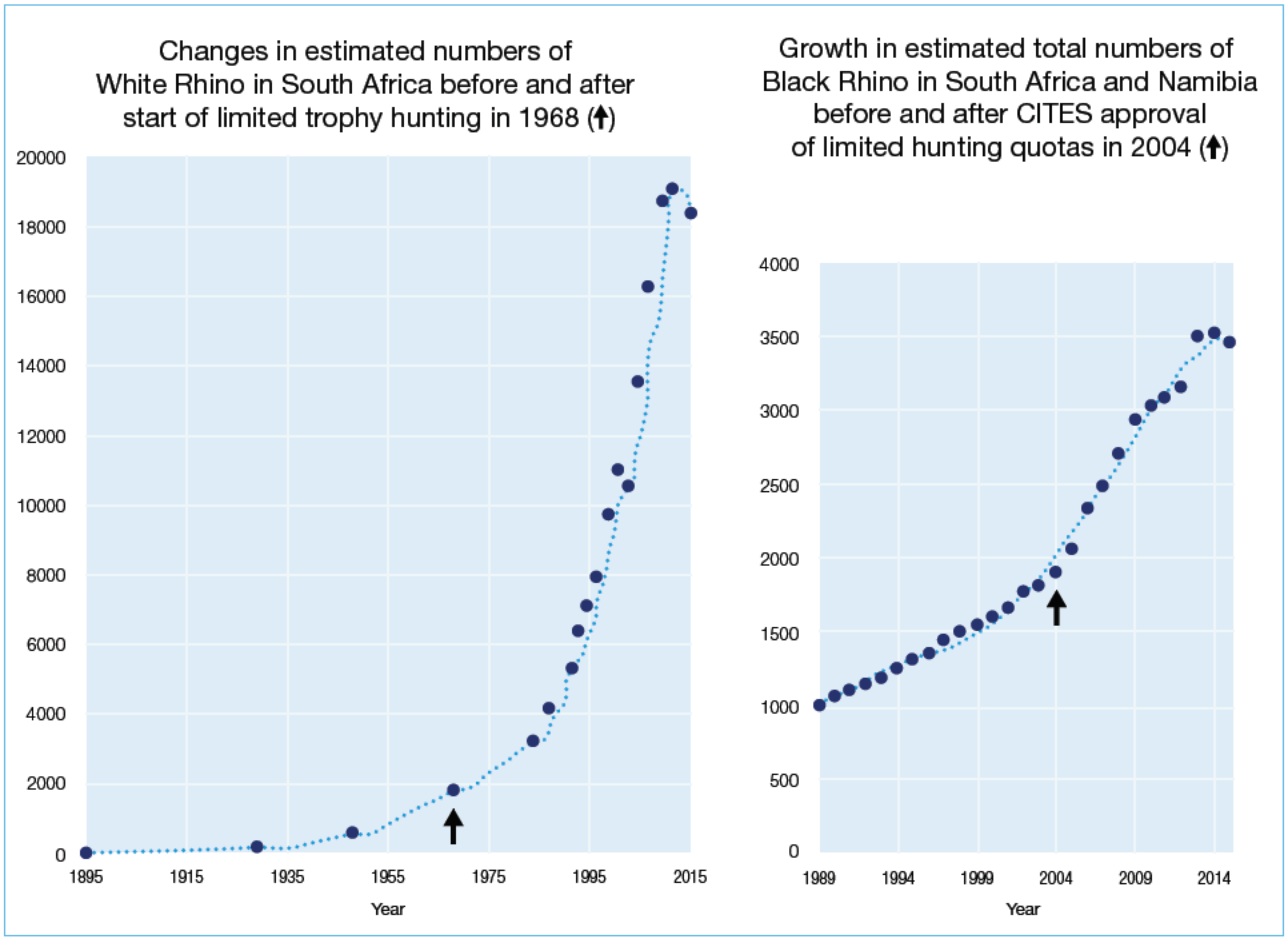


Figure 1 Trophy hunting programmes have contributed to the recovery of African White and Black Rhinos (see Annex 1: Case Study 1).

What is trophy hunting?

Trophy hunting generally involves the payment of a fee by a foreign or local hunter for a hunting experience, usually guided, for one or more individuals of a particular species with specific desired characteristics (such as large size or antlers). The trophy is usually retained by the hunter and taken home. Meat of hunted animals is usually used for food by local communities or the hunter. It may be a distinct activity or overlap with recreational or meat hunting. Many deer hunters, for example, may desire a trophy but also hunt for food or for the experience.

It takes place in most countries of Europe, the USA, Canada, Mexico, several countries in East, Central and South Asia, around half of the 54 countries in Africa (Booth and Chardonnet, 2015), several countries in Central and South America, and in Australia and New Zealand.

A wide variety of species are hunted, from abundant to threatened. Most are native, some are introduced. Hunting of introduced species is not further discussed here, as it constitutes a small proportion of hunting and raises quite different conservation issues.

Is trophy hunting "canned hunting"?

There is a tendency for the media and decision-makers to conflate canned hunting (hunting of animals in confined enclosures where they are unable to escape) with trophy hunting. Canned hunting represents a very small proportion of hunting, raises very different issues from trophy hunting of free-ranging animals, and is condemned by existing IUCN policy (IUCN Recommendation 3.093, "Application of the IUCN Sustainable Use Policy to sustainable consumptive use of wildlife and recreational hunting in southern Africa", 2004). It is not discussed further in this document.

Is it legal? And who decides?

Trophy hunting is often incorrectly conflated with the poaching for the organised international illegal wildlife trade (IWT) that is currently devastating many species including African elephant and African rhinos.

However, trophy hunting typically takes place as a legal, regulated activity under programmes implemented by government wildlife agencies, protected area managers, indigenous and local community bodies, private landowners, or conservation/development organisations. In a number of cases revenues from hunting are in fact funding law enforcement or providing community benefits that counter incentives to engage in IWT (see Case Studies 1,4,8,9; Figure 2).

In some contexts, all decisions on hunting quotas, species, and areas are made by government wildlife agencies. However, under many trophy hunting governance systems local landowners or community organizations participate alongside governments in deciding these questions and sometimes are the key decisionmakers (see Case Studies 2,4-7,10; Figure 2).

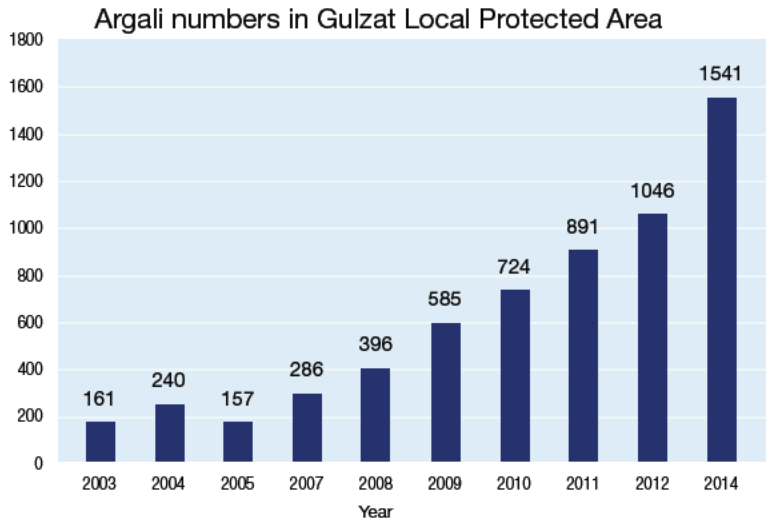


Figure 2 Local communities have developed a conservation approach for Argali in Mongolia using legal, regulated trophy hunting to pay guards and incentivise protection from poaching. Graph shows growth in population of Argali in Gulzat Local Protected Area. Trophy hunting was introduced in 2010 (see Annex 1; Case Study 2). Source: WWF Mongolia, unpublished data.

This is not to say that there is not a level of illegal practice taking place (both within and beyond the EU), as in most industries. There are regulatory weaknesses and illegal activities taking place in some countries, sometimes very serious. These include hunting in excess of quotas, in the wrong areas, taking of non-permitted species, and for African rhinos, problems with "pseudohunting" and sale of hunting trophies into black markets in consumer states.

Where does the money go?

Prices paid for hunts vary enormously, from hundreds to hundreds of thousands of (US) dollars, and globally involve a substantial revenue flow from developed to developing countries.

In developing countries, landowners/managers will often negotiate with "hunting operators" to decide who will get the hunting right or "concession" on their land, and on what terms. The operator, in turn, secures contracts with clients overseas and runs the hunting trips. The price paid by the hunter will generally include three things:

- the operator's costs (where applicable);
- payment to the local entity (community, private or state land owner/manager) with which the operator has the contract; and
- "official" government payments of various types which typically help finance wildlife management and conservation activities.

In developing countries generally 50-90% of the net revenues (excluding operator costs) are allocated to the local entity, with the remainder to the government authority. The local community benefit can be as high as 100% (Case Study 5). Meat from the hunts is also often contributed or sold to local community members and can be highly locally valued (Naidoo et al., 2016). In most of Europe and North America, a share of hunters' fees usually goes to governmental wildlife authorities to finance wildlife management and conservation activities.

How can trophy hunting be good for conservation?

Trophy hunting takes place in a great variety of governance, management, and ecological contexts, so its impacts on conservation vary enormously, from negative to neutral to positive. In many contexts good evidence is lacking or scanty, so it is currently impossible to evaluate precisely how widespread each outcome is.

Negative conservation impacts of poorly managed hunting can include overharvesting, artificial selection for rare or exaggerated features, genetic or phenotypic impacts due to hunting (such as reduced horn size), introduction of species or subspecies beyond their natural range (including into other countries), and predator removal.

With effective governance and management trophy hunting can and does have positive impacts

However, it is clear that with effective governance and management trophy hunting can and does have positive impacts (see Annex 1 for examples). Habitat loss and degradation, driven primarily by expansion of human economic activities, is the most important threat to terrestrial wildlife populations (Mace et al., 2005), along with other threats such as poaching for bushmeat and illegal wildlife trade and competition with livestock. Demographic change (population expansion) and demands for food, income and land for development are increasing in many biodiversity-rich parts of the globe, exacerbating these pressures on wildlife and making the need for viable conservation incentives more urgent.

In contrast, hunting can be a positive driver for conservation because it increases the value of wildlife and the habitats it depends on, providing critical benefit flows that can motivate and enable sustainable management approaches. Trophy hunting programmes can:

1. **generate incentives for landowners (government, private individuals or communities) to conserve or restore wildlife** on their land. Benefits to landowners from hunting can make wildlife an attractive land use option, encouraging them to maintain or restore wildlife habitat and populations, remove livestock, invest in monitoring and management, and carry out anti-poaching activities (see Case Studies 1,3-7 for examples). For example, policies enabling landowners to benefit from sustainable use of wildlife have led to the total or partial conversion of large areas of land from livestock and cropping *back* to wildlife in South Africa, Zimbabwe, Namibia, Pakistan, the United States and Mexico (see Case Studies 1, 3-6). Without such benefits, the future of these lands and the wildlife that inhabit them is highly uncertain.
2. **generate revenue for wildlife management and conservation, including anti-poaching activities**, for government, private and communal landholders (see Case Studies 1-7, 9 for examples). Government agencies in most regions depend at least in part on revenues from hunting to manage wildlife and protected areas. For example, state wildlife agencies in the USA are funded primarily by hunters (both trophy and broader recreational hunting) through various direct and indirect mechanisms including the sale/auction of trophy hunt permits (Heffelfinger, Geist and Wishart, 2013; Mahoney, 2013). The extent of the world's gazetted protected areas, many of which fall in IUCN categories IV and VI and include hunting areas, could significantly decline as these areas become inoperable. Private land-owners in South Africa and Zimbabwe and communal landowners in Namibia also use trophy-hunting revenues to pay guards and rangers, buy equipment, and otherwise manage and protect wildlife (Case Studies 1,4,5). Revenues from trophy hunting operations in Mongolia, Tajikistan and Pakistan are used to pay local guards to stop poaching and to improve habitat for game animals (Case Studies 2,6,7). Trophy hunting operators and the patrols they directly organize, finance and deploy can reduce poaching (Case Studies 4,6,9; Lindsey et al., 2007).
3. **increase tolerance for living with wildlife, reducing the effects of human-wildlife conflicts and reducing illegal killing**. Where wildlife imposes serious costs on local people, such as loss of crops and livestock or human injury and death, and there are no legal means for people to benefit from it, retaliatory killing and local poaching are common. This is particularly important in Africa where elephants and other species destroy crops and large cats kill humans and livestock (see Case Studies 4,5).

Is trophy hunting driving declines of large African mammals?

Concern is frequently expressed that trophy hunting is driving declines of iconic African large mammals such as elephants, rhinos and lions. While there is evidence for a small number of populations that unsustainable trophy hunting has contributed to local declines (e.g. Loveridge et al., 2007, Packer et al., 2009, 2011), it is not a significant threat to any of these species and is typically a negligible or minor threat to African wildlife populations (Lindsey, 2015).

The primary causes of population declines of the large mammals subject to trophy hunting, such as the African Elephant, African Buffalo, White Rhino, Black Rhino, African Wild Dog and Hartmann's Mountain Zebra are habitat loss and degradation, competition with livestock, illegal or uncontrolled poaching for meat and trade in animal products (ivory, horn, etc.), and retribution killing for human-wildlife conflict (Schipper et al., 2008). For Lions specifically, the most important causes of population declines are indiscriminate killing in defense of human life and livestock, habitat loss, and prey base depletion (usually from poaching) (Bauer et al., 2015).

For all of these species, as the case studies note, well-managed trophy hunting can indeed promote population recovery, protection, and maintenance of habitat (see Figure 3).

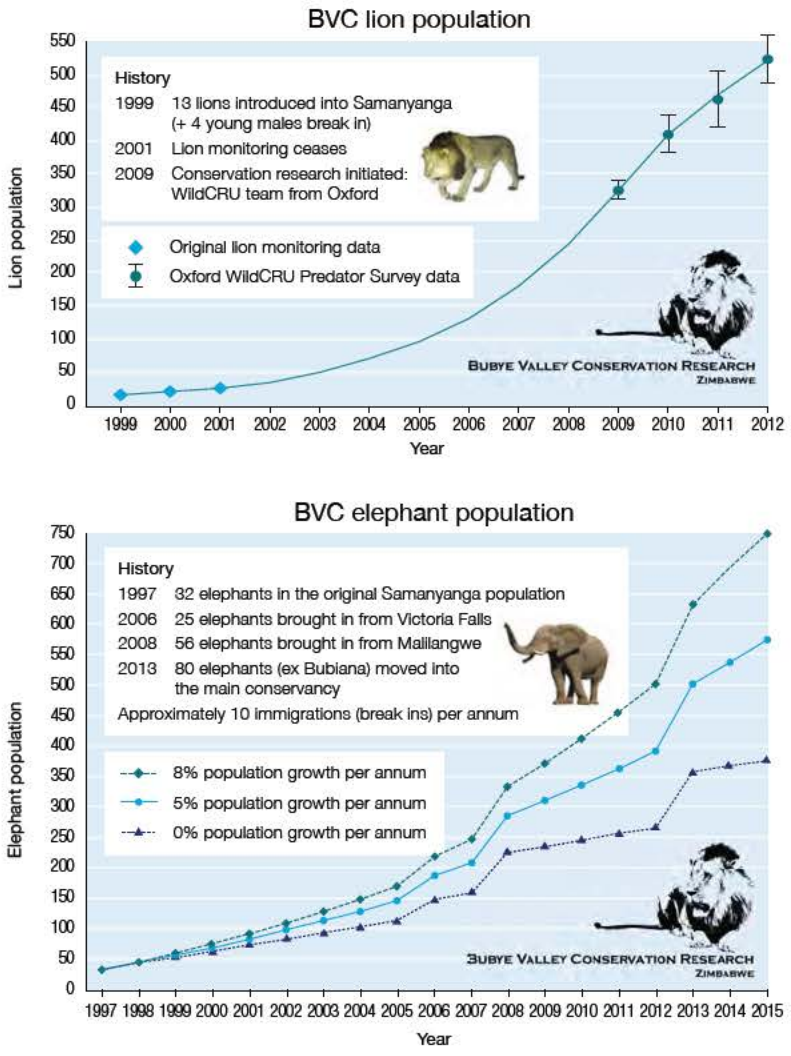


Figure 3 Bubye Valley Conservancy, a private conservancy in Zimbabwe on land previously used for farming, is dependent on limited trophy hunting to fund wildlife protection and conservation (see Annex 1; Case Study 4). Lion and African Elephant populations have grown steadily.

How does trophy hunting affect indigenous and local community rights and livelihoods?

This varies enormously across different contexts and different regions, and there are cases in which trophy hunting takes place without meaningful community participation in decision-making around wildlife management, without adequate respect for community rights and consent, and with insufficient or poorly functioning benefit-sharing mechanisms.

However, it is likewise clear that there are a significant number of trophy hunting programmes where indigenous or local communities have freely chosen to use trophy hunting as a tool to provide the incentives and revenue to help them conserve and manage their wildlife and/or improve their livelihoods (Case Studies 2,3,5–7,10). In many further cases communities have less decisionmaking power over trophy hunting, but nonetheless gain a share of hunting revenue (see Lindsey et al., 2013). Communities benefit from trophy hunting through hunting concession payments or other hunter investments, which typically support improved community services like water infrastructure, schools and health clinics; gaining jobs as guides, game guards, wildlife managers and other hunting-related employment; and gaining access to meat. These are typically poor rural communities with very few alternative sources of income and sometimes no other legal source of meat.

How would broad import restrictions, such as those raised by the Written Declaration on Trophy Hunting, affect conservation and livelihoods?

Trophy import restrictions by key importing entities such as the EU can make trophy hunting programmes economically unviable at local level, particularly where the restrictions affect "high value" iconic species (Case Study 5; Figure 4). Removing the incentives and revenue provided by hunting would be likely to cause serious declines of populations of a number of threatened or iconic species. For example, the recovery of some populations of African Elephant, Black Rhino, White Rhino, Hartmann's Mountain Zebra, Cheetah and Lion in Africa, of Markhor, Argali and Urial in Asia, and of Bighorn Sheep in North America could be stopped and reversed (Case Studies 1-8). Importantly, populations of threatened species that are not hunted could also be negatively impacted, including e.g. Snow Leopard and African Wild Dog (Case Study 8).

To avoid serious conservation impacts, any restrictions which would have this effect should be preceded by establishment of fully funded, feasible, long-term alternatives that generate conservation incentives and finance conservation actions.

Making the option of trophy hunting unviable through import restrictions would lead to some indigenous and local communities losing cash income from hunting concessions on their land, reduced access to meat, and loss of employment. For example, the indigenous Khwe San and the Mbukushu (around 5000 people) in Bwatwata National Park are some of Namibia's poorest people, but have earned around N$2.4 million (ca US$155,000) per year in hunting payments in recent years (R. Diggle, In litt.). Stopping trophy hunting would be an enormous setback, in terms not only of income but also meat – living in a National Park they cannot graze livestock or grow commercial crops. Likewise, if trophy hunting became unviable the thousands of rural Zimbabwean households that directly benefit from CAMPFIRE would lose approx. US$1.7 per annum (already reduced from US$2.2 million by US elephant trophy import bans) (C. Jonga (CAMPFIRE Association), In litt.). These are very substantial amounts in countries where the average income for rural residents is a few dollars a day or less.

Even more fundamentally, perhaps, unilateral trophy restrictions by importing states in these cases will take decision-making power away from already-marginalized rural communities as to how they can manage their land and wildlife in ways that respect their right to self-determination and that best meet their livelihood aspirations.

If and where import restrictions are pursued and where such owner/user rights and benefits exist, respect for equity, community rights and sustainable livelihoods require that they are based on consultation with such communities and establishment of feasible, sustainable, freely chosen alternative livelihood opportunities.

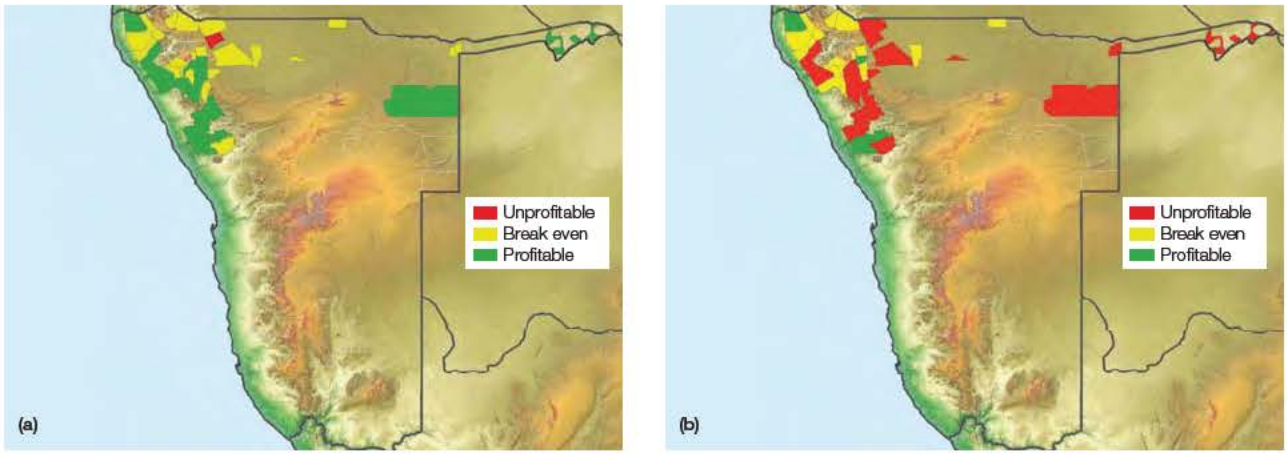


Figure 4 Trophy hunting provides critical revenue underpinning the success of the Namibian communal conservancy programme. Maps illustrate the economic viability of community conservancies in Namibia under (a) the status quo; and (b) a simulated trophy hunting ban (from Naidoo et al., 2016); see Annex 1; Case Study 5.





Images courtesy of Wildscreen Exchange, www.wildscreenexchange.org

Can't trophy hunting be replaced by photographic tourism?

Trophy hunting is not the only means to make wildlife valuable to people and to return local benefits. Photographic tourism can be a very valuable option in many places and has generated enormous benefits for conservation. However, it is viable over only a very limited percentage of the wildlife area currently managed for trophy hunting: it requires political stability, proximity to good transport links, minimal disease risks, high density wildlife populations to guarantee viewing, scenic landscapes, high capital investment, infrastructure (hotels, food and water supply, waste management), and local skills and capacity. Tourism and hunting are frequently highly complementary land uses when separated by time or space. Where tourism is feasible in areas currently used for hunting, it is typically already being employed alongside hunting (Case Studies 1,4,5). Like trophy hunting, if not carefully implemented it can have serious environmental impacts and can return a very low level of benefit to local communities, with most value captured offshore or by in-country elites (Sandbrook and Adams, 2012).

Are there other alternatives?

Effective alternative approaches to trophy hunting need to provide tangible and effective conservation incentives: they need to make wildlife valuable to people over the long term and should preferably empower local communities to exercise rights and responsibilities over wildlife conservation and management. For example, various forms of Payment for Ecological Services (PES schemes) offer considerable potential where they can effectively mobilise investments or voluntary contributions from governments, philanthropists and the private sector, and effectively motivate species and habitat conservation. The land leasing scheme carried out by Cottar's Safari Service with Maasai communities in Olderkesi, Kenya offers an example (IUCN SULi et al., 2015, p15), albeit limited by the difficulty of mobilising stable funding. The REDD+ approach (a form of PES scheme established through an intergovernmental process) can provide incentives and revenue flows to local communities in some areas, although with many caveats. All these options are challenging, with a critical challenge ensuring that revenue flows will be sustainable over the long term and not contingent on highly changeable donor priorities.

How could trophy hunting practices be improved?

Broad-scale restrictions and bans are not the only solution for addressing poor trophy hunting practice, outside or within the EU. Import restrictions are often attractive interventions as they are easy to implement and can be carried out at low cost to decision-making bodies. However, conservation success is rarely achieved by single decisions in distant capitals, but typically requires long term, sustained multi-stakeholder engagement in-country and on the ground. Trophy hunting is no exception.

As an alternative to blanket bans or other broad unilateral restrictions that would curtail trophy hunting programmes, EU decisionmakers may want to give more consideration to whether specific trophy hunting programmes both within the EU and beyond are meeting requirements for best practice, as elaborated in the IUCN SSC *Guiding Principles for Trophy Hunting as a Tool for Conservation Incentives* (IUCN SSC, 2012) and other publications including the *European Charter on Hunting and Biodiversity* adopted under the Bern Convention on the Conservation of European Wildlife and Natural Habitats (Brainerd, 2007). Where there are problems in governance and management of trophy hunting, as there are in many places, it will be most effective to actively engage with relevant countries to improve quality of governance and management, including increasing transparency in funding flows, community benefits, allocation of concessions and quota setting; strengthening of rights and responsibilities of indigenous peoples and local communities; and improving monitoring of populations and of hunts. There are important roles for many hunting stakeholders in improving standards, including importing countries, donors, national regulators and managers, community organisations, researchers, conservation organisations, and the hunting industry and hunter associations in reaching these standards.

Are there cases where trophy import bans might provide benefits?

Conditional, time-limited, targeted import moratoria aimed at addressing identified problems could help improve trophy hunting practice in certain instances. However, bans are unlikely to improve conservation outcomes unless there is a clear expectation that improved standards will lead to the ban being lifted, and the country has the capacity as well as the political will to address the problem. It is therefore critical to the impact of targeted moratoria that – at least in developing countries – they are accompanied by funding and technical support for on-the-ground management improvements, and the status of the initial problem is reviewed after a specified period.



Simon Stuart PhD
Chair
IUCN Species Survival Commission



Luc Bas
Director
IUCN European Regional Office

Annex

Case studies of trophy hunting having positive conservation and livelihood benefits

Case Study 1

Rhinos in South Africa and Namibia

Since trophy hunting programmes were introduced for these species, White Rhino increased in South Africa from 1,800 (in 1968) to around 18,400; and Black Rhino increased in South Africa and Namibia from around 2,520 (in 2004) to around 3,500 (see Figure 1). By end 2015, these two countries conserved 90% of Africa's rhinos, yet only 0.34% and 0.05% of their white and black rhino populations were hunted. Not only has rhino hunting clearly been sustainable, it has played an integral part in the recovery of these species through providing incentives for private and communal landholders to maintain the species on their land, generat ing income for conservation and protection, and/or helping manage populations to increase population recovery.

Limited sport hunting of rhinos along with live sales and tourism has provided the economic incentives to encourage over 300 South African private land owners to collectively build their herd to ~6140 white rhinos and 630 black rhinos on 49 private/communal land holdings – very important populations of these iconic species. This has added over 2,000 km^2 of conservation land – equivalent of another Kruger National Park! However, increasing security costs and risks due to escalating poaching and declining economic incentives have resulted in a worrying trend of private rhino owners and managers divesting their rhino, threatening future expansion of range and numbers. Import restrictions that threaten the viability of hunting would likely further reduce incentives and exacerbate this trend.

Many private reserves rely heavily on trophy hunting and that of white rhinos to cover operational expenses. For example, a South African reserve, known to the IUCN African Rhino Specialist Group, with identity concealed here for rhino security reasons, manages an increasing population of 195 white rhinos and many other species. Their conservation efforts are self-funded. Analysis of eight years' data revealed that only ~18% of the total reserve's operational expenditure was generated from tourism, while trophy hunting generated the bulk of income needed to fund operational expenditure (63%). Over the last eight years, only seven (or <1% of the population annually) white rhino have been hunted on the reserve, generating (inflation adjusted) US$617,000; with live sales of another 47 white rhino over the period bringing in an additional US$973,000. The reserve allocates all of the proceeds from rhino hunting towards rhino protection and conservation management costs. Average white rhino hunting revenue in the reserve over the last eight years translated to US$400 for each living white rhino in the reserve today/year; equivalent to 29%–33% of estimated current rhino protection and law enforcement costs/rhino/year in Kruger National Park and on Private Land of US$1,210–US$1,360/rhino/year, respectively. The Reserve Manager indicates that "the income from hunting in general and from the live sales of rhino, has sustained the management of the Reserve for decades" noting the recent ban on the import of lion trophies into the US has already had a negative impact on income to fund conservation with the cancellation of some hunts.

Rhino hunting has not been without its problems, with some 'pseudo-hunters' using the legal sport hunting route to access rhino horn for illegal sale in South East Asia. Increased regulation has seen the record high 231 rhino hunting applications in South Africa in 2011 plummet to normal levels of 62 white rhino and one black rhino hunted in 2015. In Namibia a further 3 white rhino and 1 black rhino were hunted in 2015. These numbers represent only 0.35% of the white and black rhinos conserved by these two countries, respectively, yet will have generated turnover close to US$4 million.

Case Study 2

Argali in Mongolia

As part of a plan to create community-based wildlife hunting management based on Altai Argali in the Gulzat Local Protected Area of northwest Mongolia, the Uvs Aimag Citizen's Meeting imposed a 4-year ban on Argali hunting to enable restoration of the population. Largely unmanaged, open-access hunting and increased competition for forage from goats were likely chief causes of the population decline.

With local herders now protecting the population, it grew from roughly 200 in the years immediately preceding the ban to an estimated 724 in 2010. After the ban was lifted in 2010, 12 Argali were harvested over the next 4 years generating around $123,000 at the local level. Meanwhile, the Argali population doubled again to more than 1,500 (WWF Mongolia, unpublished data) (Figure 2).

Case Study 3

Bighorn Sheep in North America

EuroAmerican settlement with the corresponding surge in livestock numbers and uncontrolled hunting led to a rapid decline in Bighorn Sheep in North America, from roughly 1 million in 1800 to fewer than 25,000 by 1950. Since then, based primarily on more than US$100 million contributed by trophy hunting groups through fees and donations, hundreds of thousands of hectares have been set aside for Bighorn Sheep and other wildlife and the bighorn population has more than tripled from its historic low to roughly 80,000 today (Damm and Franco, 2014; Hurley et al., 2015).

Restoration in Canada and the U.S. was largely based on hunters working with state/provincial wildlife agencies to support research, habitat acquisition and management. For example, in the state of Wyoming, auctions of Bighorn Sheep hunting tags yield approximately $350,000 annually, of which 70% goes to conserving Bighorn Sheep and 10% to other wildlife. These revenues and funds from Bighorn Sheep organizations were used to cover approximately one-third of the total cost of more than US$2 million paid to domestic sheep producers to voluntarily remove their sheep from 187,590 ha of public grazing lands. Other hunting, fishing, and wildlife groups covered the other two-thirds of the total cost because removing domestic sheep grazing from these areas benefitted a diversity of wildlife (K. Hurley (Wild Sheep Foundation), pers. comm.).

Indigenous-managed trophy hunting has driven recoveries in Mexico. In 1975, 20 Bighorn Sheep were reintroduced to Tiburon Island in the Sea of Cortez, an island owned and managed by Seri Indians. The original cause of the species' extinction on the island is unknown. The bighorn population quickly grew to around 500, probably the carrying capacity for the island. In 1995, a coalition of institutions initiated a programme to fund Bighorn Sheep research and conservation while providing needed income for the Seri through international auctioning of exclusive hunting permits on the island. Initially, permits often garnered 6-figure (US dollars) auction bids. From 1998 – 2007, the Seri Indians earned US$3.2 million from Bighorn Sheep hunting permits and sale of young for translocation, funds that were reinvested in Seri community projects, management of the Bighorn Sheep population, and maintenance of the island in an undisturbed state. Funding from trophy hunting for the island's conservation continues, with the Seri selling recent permits for US$80,000-90,000 each. The island has also been an important source population for reestablishing other Bighorn Sheep populations in the Sonoran Desert and elsewhere on the mainland. Because of the substantial revenues from trophy hunting of Bighorn Sheep and Mule Deer, many ranchers in the Sonoran Desert have greatly reduced or eliminated livestock to focus on wildlife (Valdez et al., 2006; Lee, 2008; Wilder et al., 2014; Hurley et al. 2015).

Case Study 4

Private wildlife lands in Zimbabwe

In Zimbabwe, the devolution of wildlife use rights to landholders in 1975 resulted in a transition from game ranching being a hobby practiced by a few dozen ranchers to some 1,000 landowners and 27,000 km^2 conserving wildlife by 2,000, with trophy hunting a primary driver of this change (Child, 2009; Lindsey et al., 2009). Although these numbers have declined significantly under the land reform programme, and despite the current challenging economic conditions in the country, some private conservancies continue to play a crucial role in conservation. The following all rely on trophy hunting as the primary source of revenue and they would all be unviable without it; photographic tourism has been tried and has not been a viable alternative.

The Savé Valley Conservancy (SVC), covering 344,000 ha, was created in the 1990s by livestock ranchers who agreed that wildlife management could be a better use of the land than livestock. Cattle ranching operations had eliminated all elephants, rhinos, buffalo and lions, among other species, in the area. Today, SVC has around 1,500 African Elephants, 117 Black Rhinos and 43 White Rhinos, 280 Lions and several packs of the Endangered African Wild Dog. Hunting on the Sango Ranch, SVC's largest property, yields around US$600,000 annually and employs 120 permanent workers who represent more than 1,000 family members (Lindsey et al., 2008; W. Pabst and D. Goosen, pers. comm.; SVC, n.d.; Sango Wildlife; n.d.).

The 323,000-ha Bubye Valley Conservancy (BVC) was converted from a cattle ranch 20 years ago and now has roughly 500 Lions, 700 African Elephants, 5,000 African Buffalo, 79 White Rhinos and, at 202, the third largest Black Rhino population in Africa (see Figure 3). Trophy fees in 2015 generated US$1,380,605. BVC employs approximately 400 people and invests US$200,000 annually in community development projects (BVC, n.d.; B. Leathem, pers. comm.).

The Cawston Game Ranch in Zimbabwe, at 12,600 ha, is much smaller than SVC and Bubye, and thus is more limited in terms of game species it can harbor. When the ranch was purchased a few native game species existed but Common Wildebeest, Plains Zebra, Giraffe, Tsessebe, Common Impala, Bushbuck, Red Hartebeest, Gemsbuck and Waterbuck had to be reintroduced. Approximately 4,500 game animals now inhabit the ranch. Large predators are limited to Leopards, Brown Hyaenas and an occasional Cheetah. Hunting contributes 68% of gross revenues, derived almost wholly from plains game, particularly Sable and Tsessebe. The ranch employs 41 people and its value to local communities is estimated at US$60,000/yr (V. Booth, unpublished data).



Image courtesy of Wildscreen Exchange, www.wildscreenexchange.org

Case Study 5

Communal conservancies in Namibia

In the early 1990s, many residents of Namibian communal lands viewed wildlife as a detriment to their livelihoods because animals destroyed crops and water installations and killed or injured livestock and people. Today, 82 communal conservancies covering 162,033 sq km and home to more than 184,000 people are engaged in community-based conservation, including indigenous and tribal communities.

Trophy hunting has underpinned Namibia's successes in community-based natural resource management. Recent analysis indicates that if revenues from trophy hunting were lost, **most** conservancies would be unable to cover their operating costs – they would become unviable, and both wildlife populations and local benefits would decline dramatically (Naidoo et al., 2016; see Figure 4). Overall, conservancies generate around half their benefits (including cash income to individuals or the community, meat, and social benefits like schools and health clinics) from photographic tourism and half from hunting. Note much of this is reinvested into managing and protecting wildlife. Around half the conservancies gain their benefits **solely** from hunting, with most of the rest deriving part of their income from hunting alongside tourism. Only 12% specialise in tourism (Naidoo et al., 2016). Revenues from trophy hunting of 29 wildlife species on conservancies totaled US$1,671,379 in 2013. Five CITES-listed species—Elephant, Common Hippopotamus, Hartmann's Mountain Zebra, Lion and Leopard—accounted for 63% of this total. For example, every time an elephant is harvested a community directly receives approximately US$20,000 in payment, plus approximately 3,000 kg of meat.

Wildlife populations have shown dramatic increases since the beginning of the communal conservancy programme in Namibia. On communal lands in northeast Namibia, from 1994-2011, the Sable population increased from 724 to 1,474 and the common impala from 439 to 9,374. In the conservancy region of northwest Namibia, from the early 1980s to 2011, the threatened Hartmann's Mountain Zebra population increased from less than 1,000 to an estimated 27,000, and the number of Black Rhino more than tripled, making it the largest free-roaming population in Africa (conservancies are unfenced). The growth of communal conservancies and protection offered by national parks has enabled elephants to increase their population from around 7,500 in 1995 to more than 20,000 today. The Kunene Conservancy's Lion population grew from roughly 25 lions in 1995 to 150 today, and Namibia now has a large free-roaming Lion population outside of national parks (NACSO, 2015; C. Weaver (WWF Namibia), pers. comm.).





Images courtesy of Wildscreen Exchange, www.wildscreenexchange.org

Case Study 6

Markhor and Urial in Pakistan

The Torghar Conservation Project in Pakistan was initiated by local Pathan tribal leaders in the mid-1980s concerned that uncontrolled illegal hunting for food had greatly reduced populations of both the Suleiman (straight-horned) Markhor (< 100 animals) and the Afghan Urial (around 200). After unsuccessfully petitioning the government to protect the populations, the local leaders developed the Torghar Conservation Project based on a simple concept: local Pathan tribesmen would give up hunting in exchange for being hired as game guards to prevent poaching, and the project would be financed by revenues derived from a limited trophy hunt of Markhor and Urial by foreign hunters. The area covers about 1,000 sq km inhabited by about 4,000 tribal people. Between 1986 and 2012, hunting of these two species generated US$486,400 for the provincial government and US$2,712,800 for the local community, the latter covering salaries of more than 80 game guards, funding various community projects including schools and healthcare facilities, and supporting actions to reduce grazing competition with livestock. Illegal hunting declined dramatically: as of 2012 the Markhor population had grown to an estimated 3,500, while a 2005 survey of Urial estimated 2,541 (Johnson, 1997; Woodford et al., 2004; Frisina and Tareen, 2009; Mallon, 2013).

Similar examples exist elsewhere in Pakistan. Community-based conservancies using trophy hunting in the regions Khyber-Pakhtunkhwa and Gilgit-Baltistan have led to the recovery and substantial increase of Markhor populations. These developments have contributed to the recent improvement of the conservation status of Markhor in the IUCN Red List, and it is no longer listed as threatened. Stable and increasing populations are limited to areas with sustainable hunting and protected areas (Michel and Rosen Michel, 2015).

Case Study 7

Markhor in Tajikistan

In the mid-90s fewer than 350 Tajik Markhor inhabited southern Tajikistan. Around 2004, several traditional local hunters, concerned that the Markhor population would go extinct due to widespread poaching, established small enterprises dedicated to Markhor conservation and future sustainable use. Trophy hunts yield ca. US$100,000 per Markhor. Today, based on revenues from trophy hunting, four community-based conservancies (run by three family enterprises and one community-based NGO) successfully lead the recovery of the Markhor, with local people employed as guards and various community development projects funded. A range-wide survey conducted in 2014 recorded 1,300 Markhor (Alidodov et al., 2014). This success is spawning the creation of more conservancies based on trophy hunting in the region (Michel and Rosen, in press; S. Michel, pers. comm.).

Case Study 8

Benefits to non-target threatened species

Revenues from trophy hunting are also important for conserving threatened species that are not hunted. Populations of Black Rhino and White Rhino and of the African Wild Dog on the Savé and Bubye Conservancies in Zimbabwe are not hunted, but proceeds from trophy hunting support their conservation. In the Pamirs in Tajikistan, trophy hunting concessions for Argali and ibex are showing higher densities of the threatened Snow Leopard than nearby areas without trophy hunting, likely due to higher prey densities and reduced poaching (Kachel, 2014). Likewise, high densities of Snow Leopard have been recorded in one Markhor conservancy (Rosen 2014). The threatened Grizzly Bear population of the Yellowstone National Park region in the United States has benefitted from the retirement of areas of land from livestock grazing—and thus reduced bear-livestock conflicts—partially paid for by Bighorn Sheep hunting revenues (K. Hurley (Wild Sheep Foundation), pers. comm.).

Case Study 9

Revenues for government wildlife agencies, including for anti-poaching

Even where there are clear and serious failures in hunting management, hunting may generate an important actual or potential revenue stream for conservation in the face of increasing threats of poaching and habitat loss. In Tanzania, for example, many commentators have highlighted serious weaknesses in hunting governance requiring deep reforms, including corruption in the distribution of revenues and other practices, unsustainable quotas, and poor law enforcementenforcement (Nelson, Lindsey and Balme, 2013). While this is not a "good practice" example, it clearly illustrates some of the complexity of the conservation costs and benefits of hunting in specific circumstances.

Financial Year (July/June)	Tourist Hunting	Photographic Tourism
2009/2010*	18,444,881.00	2,706,603.00
2010/2011*	23,536,347.00	2,863,287.24
2011/2012*	15,062,217.75	2,080,978.00
2012/2013*	15,917,430.93	3,904,808.35
2013/2014**	16,723,425.00	5,016,703.03
2014/2015**	16,277,373.00	4,736,187.00
2015/2016 (until January 2016)**	11,215,723.47	3,041,225.00

Table 1 Revenue from trophy hunting and photographic tourism accrued to the Wildlife Division in Tanzania from lands under its jurisdiction (in US$).
Source: *MNRT 2013; **figures provided by Tanzania Wildlife Division.

Tanzania has approximately 305,000 km^2 set aside as wildlife land managed as hunting blocks (including Game Reserves, Wildlife Management Areas, and other reserve types). Due to the fact that some hunting blocks are vacant, the area currently leased for hunting is estimated at 210,000 km^2 (V. Booth and M. Pani, *In litt*., based on analysis of official records provided by Tanzania Wildlife Division).

Hunting generates the bulk of the income raised in direct revenues by Tanzania's Wildlife Division from these lands, via a variety of fees (set out in the *Wildlife Conservation (Tourist Hunting) Regulations 2015)* (see Table 1). Revenue from hunting constituted approximately 16,277,373.00 USD in 2014/2015 (US$80/km^2 in the leased area). While most of these revenues are returned to central Treasury, 25% is directed into the Tanzania Wildlife Protection Fund (TWPF, 2016), established by statute to carry out wildlife protection and conservation activities including anti-poaching. According to the official TWPF website, these hunting revenues generate around three-quarters of its funding for these activities (TWPF, 2016).

If these revenues were not replaced by alternative means, expenditures on anti-poaching and other critical management activities would presumably sharply decrease.

Selous Game Reserve illustrates a special case. It has, over the last decade, suffered devastating levels of organised commercial elephant poaching for the illegal ivory trade, associated with serious allegations of official corruption and complicity and suggestions from some quarters of involvement of elements of the hunting industry. However, the Selous retention scheme (recently re-established) provides for the re-investment of 50% of revenues raised from hunting in the Reserve into conservation and anti-poaching activities to protect the Reserve's wildlife. Benson Kibonde, chief warden in Tanzania's Selous Game Reserve during 1994-2008 and 2012–2015, and responsible for leading two major anti-poaching initiatives, recently expressed serious concerns about the impacts of import bans on hunted ivory trophies on field level anti-poaching activities. He saw these as problematic not only because of heavy practical involvement of hunting companies in anti-poaching activities, but because "85% of the Selous retention scheme funds come from hunting. If any amount of the hunting revenue is compromised, the registered success in anti-poaching efforts could be seriously jeopardized" (Kibonde, 2015; p. 45).

Note that the revenues raised for conservation from hunting can be likewise important in developed countries (see Case Study 3). For instance, they form the bulk of wildlife management agencies' budgets in the USA and Canada (Heffelfinger et al., 2013; Mahoney, 2013).

Case Study 10

Polar Bears in Canada

Several hundred Polar Bears are harvested annually in northern Canada, the large majority for subsistence and the remainder for trophy hunts (with meat used for subsistence). The largest harvest of Polar Bears occurs in the territory of Nunavut, which harbors 50–60% of the world's population. At least nine Nunavut indigenous communities offer Polar Bear trophy hunts. Inuit have constitutionally protected rights under land claim agreements to co-manage wildlife. Most communities number a few hundred inhabitants. Income levels are generally low and unemployment rates very high. The Polar Bear harvest is based on quotas that are updated annually through a co-management system that integrates the best available scientific and traditional ecological knowledge. Community members decide how to allocate the quota between subsistence hunts and trophy hunts, with all meat from either used locally (Freeman and Wenzel, 2006; Shadbolt et al., 2012).

Communities work with hunting outfitters to attract hunters, usually from Canada or the United States. All trophy hunters are accompanied at all times by Inuit guides, with all transport and hunting conducted in the traditional method with a dogsled. Depending on the length of the hunt and other factors, hunting clients pay around US$20,000 – $50,000 to the outfitters, of which roughly half, US$10,000–$25,000, enters the northern communities. Almost all of the fees paid by the trophy hunter go to the Inuit outfitter, guide and assistants for their services and to maintain equipment used for both trophy and subsistence hunting. In accordance with the clan-sharing culture of Inuit society, community members recognize that these same people are the best providers of fresh food. In the community of Clyde River on Baffin Island, for example, each trophy-hunting guide harvested an average of ten times more food that was shared with community members than was harvested by hunters who were not guides (Foote and Wenzel, 2009; Shadbolt et al., 2012).

Inuit communities in Nunavut are already feeling the livelihood impacts of import bans, which nonetheless have had no effect on harvest levels. Approximately 400–500 Polar Bears were harvested annually in Nunavut during 2000–2012. In 2008, the United States listed the Polar Bear as endangered and banned the import of Polar Bear trophies. Before 2008, the U.S. accounted for the large majority of trophy hunters; after 2008 they accounted for none to a few annually. The U.S. ban had no obvious effect on the total harvested, but the proportion of the total taken by trophy hunters dropped from an average of 91 from 2003/4–2007/8 to 35 from 2008/9–2010/11, and the subsistence harvest increased accordingly (Shadbolt et al., 2012; Weber et al., 2015). Using a conservative value of $15,000 per trophy-hunted bear, this represents a reduction of at least $840,000 annually from trophy hunting for these Nunavut communities (excluding gratuities).



Image courtesy of Wildscreen Exchange, www.wildscreenexchange.org

References

Alidodov, M., Amirov, Z., Oshurmamadov, N., Saidov, K., Bahriev, J. and Kholmatov, I. 2014. Survey of markhor at the Hazratishoh and Darvaz Ranges, Tajikistan. State Forestry Agency under the Government of the Republic of Tajikistan, Dushanbe.

Bauer, H., Packer, C., Funston, P.F., Henschel, P. & Nowell, K. 2015. Panthera leo. The IUCN Red List of Threatened Species 2015: e.T15951A79929984.http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T15951A79929984.en. Downloaded on 25 March 2016.

Booth, V.R. and Chardonnet, P. (Editors) 2015. *Guidelines for improving the administration of sustainable hunting in sub-Saharan Africa*. FAO sub-Regional Office for Southern Africa, Harare, Zimbabwe.

Brainerd, S. 2007. *European Charter on Hunting and Biodiversity*. Adopted by the Standing Committee of the Bern Convention at its 27th meeting in Strasbourg, 26-29 November 2007. http://fp7hunt.net/Portals/HUNT/Hunting_Charter.pdf

BVC. n.d. *Bubye Valley Conservancy*. Bubye Valley Conservancy, Zimbabwe. http://bubyevalleyconservancy.com)

Child, B. 2009. Game ranching in Zimbabwe. In H. Suich, B. Child and A. Spenceley (eds.), *Evolution and Innovation in Wildlife Conservation*. Earthscan, London; pp 127-145.

Damm, G.R., and Franco, N.. 2014. *The CIC Caprinae Atlas of the World*. CIC International Council for Game and Wildlife Conservation, Budakeszi, Hungary with Rowland Ward Publications RSA Ltd., Johannesburg, South Africa.

European Parliament. 2016. Written Declaration, submitted under Rule 136 of the Rules of Procedure, on trophy hunting. DC\1083081EN.doc. http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-%2F%2FEP%2F%2FNONSGML%2BWDECL%2BP8-DCL-2016-0003%2B0%2BDOC%2BPDF%2BV0%2F%2FEN

Foote, L, and Wenzel, G.W. 2009. Polar Bear conservation hunting in Canada: economics, culture and unintended consequences. In M.M.R. Freeman and L. Foote (eds.), *Inuit, Polar Bears, and Sustainable Use: Local, National and International Perspectives.* CCI Press; pp 13-24.

Freeman, M.M.R., and Wenzel, G.W. 2006. The nature and significance of Polar Bear conservation hunting in the Canadian Arctic. *Arctic* **59**:21-30.

Frisina, M.R. and Tareen, N. 2009. Exploitation prevents extinction: case study of endangered Himalayan sheep and goats. In B. Dickson, J. Hutton and W.M. Adams (eds), *Recreational Hunting, Conservation, and Rural Livelihoods: Science and Practice*. Blackwell Publishing, UK; pp 141-154.

Heffelfinger, J.R., Geist, V., and Wishart, W., 2013, The role of hunting in North American wildlife conservation. *International Journal of Environmental Studies*, **70**, 399-413.

Hurley, K., Brewer, C. and Thornton, G.N. 2015. The role of hunters in conservation, restoration, and management of North American wild sheep. *International Journal of Environmental Studies* **72**:784-796.

IUCN SSC. 2012. *Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives* v1.0 (09 August 2012). IUCN, Gland. https://cmsdata.iucn.org/downloads/iucn_ssc_guiding_principles_on_trophy_hunting_ver1_09aug2012.pdf.

IUCN SULi, IIED, CEED, Austrian Ministry of Environment and TRAFFIC. 2015. Symposium Report, 'Beyond enforcement: communities, governance, incentives and sustainable use in combating wildlife crime', 26-28 February 2015, Glenburn Lodge, Muldersdrift, South Africa. http://pubs.iied.org/G03903.html.

Johnson, K.A. 1997. Trophy hunting as a conservation tool for Caprinae in Pakistan. In C.F. Freese (ed.), *Harvesting Wild Species: Implications for Biodiversity Conservation*. The Johns Hopkins University Press, Baltimore; pp 393-423.

Kachel, S.M. 2014. *Evaluating the Efficacy of Wild Ungulate Trophy Hunting as a Tool for Snow Leopard Conservation in the Pamir Mountains of Tajikistan*. A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Science in Wildlife Ecology; 87 pp.

Kibonde, B. 2015. Selous Game Reserve: Is there any hope for the future? *Hunter's Path* **4**, April 2015, pp. 42-45.

Lee, R. 2008. Hunting as a tool for wildlife conservation—the case of sheep hunting in Mexico. In R.D. Baldus, G.R. Damm and K. Wollscheid (eds), *Best Practices in Sustainable Hunting—A Guide to Best Practices from Around the World*. International Council for Game and Wildlife Conservation, Budapest, Hungary; pp 53-58.

Lindsey, P.A., Roulet, P.A, and Romañach, S.S. 2007 Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. *Biological Conservation* **134**: 455-469.

Lindsey, P.A., et. al. 2008. Savé Valley Conservancy: a large scale African experiment in cooperative wildlife management. Pages 163-184 in B. Child, H. Suich and A. Spencely (eds.), *Evolution and Innovation in Wildlife Conservation in Southern Africa*, Earthscan, London, UK.

Lindsey, P.A., Romañach, S. and Davies-Mostert, H. 2009. The importance of conservancies for enhancing the conservation value of game ranch land in Southern African. *Journal of Zoology* **277**: 99–105.

Lindsey, P.A., Balme, G.A., Funston, P., Henschel, P., Hunter, L., Madzikanda, H., Midlane, N., Nyirenda, V. 2013. The Trophy Hunting of African Lions: Scale, Current Management Practices and Factors Undermining Sustainability. *PLoS ONE* **8**(9): e73808. doi:10.1371/journal.pone.0073808

Lindsey, P.A. 2015. Bushmeat, wildlife-based economies, food security and conservation: Insights into the ecological and social impacts of the bushmeat trade in African savannahs. FAO/Panthera/ Zoological Society of London/IUCN SULi Report, FAO, Harare.

Loveridge, A.J., Searle, A.W., Murindagomo, F. and Macdonald, D.W. 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. *Biological Conservation* **134**: 548-558.

Mace, G., Masundire, H., Baillie, J., et al. (2005) Biodiversity. In Hassan R., Scholes R., Ash N., (eds). *Ecosystems and Human Well-being: Current State and Trends: Findings of the Condition and Trends Working Group*. Washington (D. C.): Island Press; pp 77–122.

Mahoney, S.P. 2013 Monograph: Conservation and Hunting in North America. *International Journal of Environmental Studies* **70**(3): 347-460.

Mallon, D. 2013. *Trophy Hunting of CITES-listed Species in Central Asia*. TRAFFIC report for the CITES Secretariat.

Michel, S., and Rosen, T. In press. Chapter 16.3 Hunting of Prey Species: A Review of Lessons, Successes, and Pitfalls – Experiences from Kyrgyzstan and Tajikistan. In P. Nyhus, T. McCarthy and D. Mallon (eds.), *Snow Leopards*. Elsevier.

Michel, S. & Rosen Michel, T. 2015. *Capra falconeri*. The IUCN Red List of Threatened Species 2015: e.T3787A82028427. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T3787A82028427.en.

MNRT. 2013. *The Wildlife Sub-sector Statistical Bulletin.* Wildlife Division, Dar Es Salaam, Tanzania.

NACSO. 2015. *The State of Community Conservation in Namibia – a Review of Communal Conservancies, Community Forests and other CBNRM Initiatives (2014/15 Annual Report)*. National Association of CBNRM Support Organisations, Windhoek.

Naidoo, R., Weaver, L.C., Diggle, R.W., Matongo, G., Stuart-Hill, G., and Thouless, C. 2016. Complementary benefits of tourism and hunting to communal conservancies in Namibia. *Conservation Biology* DOI: 10.1111/cobi.12643

Nelson, F., Lindsey, P. and Balme, G. 2013. Trophy hunting and lion conservation: A question ofgovernance? *Oryx* **47**(4): 501-509 doi:10.1017/S003060531200035X

Packer, C., Kosmala, M., Cooley, H.S., Brink, H., Pintea, L., Garshelis, D., & Nowel, K. 2009. Sport hunting, predator control and conservation of large carnivores. *PLoS ONE* **4**(6): e5941. doi:10.1371/ journal.pone.0005941

Packer, C., Brink, C., Kissui, B.M., Maliti H, Kushnir, H., Caro, T., 2011. Effects of trophy hunting on lion and leopard populations in Tanzania. *Conservation Biology* **25**:142–153.

Rosen, T. 2014. Tajikistan Brings Endangered Wild Goat From the Edge of Extinction to the Peak of Hope. *National Geographic Voices*: Cat Watch June 11, 2014. http://voices.nationalgeographic.com/2014/06/11/tajikistan-brings-endangered-wild-goat-from-the-edge-of-extinction-to-the-peak-of-hope/

Rosen Michel, T. and S. Michel. n.d. The return of the Markhor: Why CITES matters. Unpublished manuscript.

Sandbrook, C. and Adams, W.M., 2012. Accessing the Impenetrable: The Nature and Distribution of Tourism Benefits at a Ugandan National Park. *Society and Natural Resources*, **25**, 915-932. doi:10.1080/08941920.2011.644394

Sango Wildlife n.d. *Research*. Sango, Savé Valley Conservancy, Zimbabwe. http://www.sango-wildlife.com

Schipper, J., Chanson J. S., Chiozza, F. et al. 2008. Status of the World's Land and Marine Mammals: Diversity, Threat, and Knowledge. *Science* **322**: 225-230. doi: 10.1126/science.1165115

Shadbolt, T., York, G. and Cooper, E.W.T. 2012. Icon on Ice: *International Trade and Management of Polar Bears*. TRAFFIC North America and WWF-Canada. Vancouver, B.C.

SVC. n.d. *Savé Valley Conservancy*. Savé Valley Conservancy, Zimbabwe. http://savevalleyconservancy.org.

TWPF. 2016. *About Tanzania Wildlife Protection Fund (TWPF).* Tanzania Wildlife Protection Fund, Dar Es Salaam, Tanzania. http://www.twpf.go.tz/about/category/overview

Valdez, R., Guzman-Aranda, J.C., Abarca, F. J., Tarango-Aràmbula, L.A., and Clemente Sanchez, F. 2006. Wildlife conservation and management in Mexico. *Wildlife Society Bulletin* **34**(2): 270–282.

Weber, D.S., Mandler, T., Markus, D., Van Coeverden De Groot, P. J., Lee, D.S., Clark, D.A. 2015. Unexpected and undesired conservation outcomes of wild trade bans—an emerging problem for stakeholders? *Global Ecology and Conservation* **3**:389-400.

Wilder, B.T., et al. 2014. Local extinction and unintentional rewilding of Bighorn Sheep (*Ovis canadensis*) on a desert island. PLoS ONE **9**(3): e91358. doi:10.1371/journal.pone.0091358

Woodford, M.H., Frisina, M.R. and Awun, G.A. 2004. The Torghar conservation project: management of the livestock, Sulieman Markhor (Capra falconeri) and Afghan Urial (Ovis orientalis) in the Torghar Hills, Pakistan. *Game and Wildlife Science* **21**: 177-187.

THE IMPACT OF WILDLIFE MANAGEMENT POLICIES ON COMMUNITIES AND CONSERVATION IN GAME MANAGEMENT AREAS IN ZAMBIA





MESSAGE TO POLICY MAKERS

Natural Resources Consultative Forum

Together sustainably managing Zambia's natural resources

BY PHYLLIS SIMASIKU, HOPESON I. SIMWANZA, GELSON TEMBO, SUSHENJIT BANDYOPADHYAY AND JEAN-MICHEL PAVY

JUNE 2008

789

MESSAGE TO POLICY MAKERS

This report shows that Zambia's Game Management Areas (GMAs) are in a spiral of degradation economically, sociologically and ecologically – in spite of the unquestionable commitment and efforts of the Zambian Government, the Zambia Wildlife Authority (ZAWA), the communities and their partners.

10 years ago the government implemented the 1998 Zambia Wildlife Act as it realized that without viable natural resources, future generations would face increased risks of hunger and poverty, which would compel them to further exploit their diminishing natural resources. The enacted Policy for National Parks and Wildlife in Zambia instituted the concept of Community-Based Natural Resources Management.

Today, it appears that GMA governance through community institutions such as Community Resources Boards and Village Action Groups is failing to achieve the purpose for which GMAs were established; namely to act as buffer zones to National Parks in order to protect wild animals and their habitats to support a viable wildlife-based tourism industry, which contributes significantly to the national economy and to the improvement of welfare in GMAs.

Lessons from Zambia and other countries in the region demonstrate that blame must be placed, not with the unequivocal commitment and capacity of the Zambian Government and its partners, but rather with the wildlife management policy itself. This report encourages the Zambian Government to launch a national review of the management of GMAs with the view to design and adopt a new policy framework for wildlife management in the broader context of protected area and natural resources management. This report advises the government to ensure that this policy is drafted prior to modifying the Zambia Wildlife Act so it can influence its content.

FOREWORD

Both the Zambia Wildlife Act No. 12 and the Policy for National Parks and Wildlife in Zambia of 1998 recognize local communities as partners in wildlife conservation. Furthermore, these legislative policy instruments recognize the socio-economic and ecological importance of wildlife resources to the people of Zambia. However, one may ask: What is the impact of wildlife management policies on communities and conservation? The Zambian government has and continues to make efforts to enhance socio-economic and ecological benefits.

However, the economic, sociological and ecological performance of GMAs – as demonstrated in this document – indicates that not much has been achieved. Therefore, government is called upon to review the management of GMAs including designing a more effective and dynamic wildlife management policy framework and legislation. Furthermore, government is called upon to address the factors affecting the performance of GMAs and to adopt adaptive management approaches in order to learn from the community-based natural resources management programs within the Southern African region.

I sincerely hope that the government will act on the policy recommendations presented in this document. The Natural Resources Consultative Forum (NRCF), being a non-partisan grouping of stakeholders endorsed by the Ministry of Tourism, Environment & Natural Resources offers it services to facilitate this process and, if requested, to spearhead the required technical work and consultations.

Dr. Henry Mwima
Chairman
Natural Resources Consultative Forum

TABLE OF CONTENTS

EXECUTIVE SUMMARY vi

1. GAME MANAGEMENT AREAS: BACKGROUND 1
- A. THE RATIONALE BEHIND GMAs 1
- B. WILDLIFE UTILIZATION IN GMAs 1
- C. THE EVOLUTION OF COMMUNITY INVOLVEMENT IN GMAs 1
- D. GMA MANAGEMENT UNDER THE 1998 WILDLIFE ACT 2
- E. OTHER NATURAL RESOURCES IN GMAs 3
- F. NEW APPROACHES 3

2. ECONOMIC PERFORMANCE OF GMAs 5
- A. CONSUMPTIVE WILDLIFE USE 5
- B. NON-CONSUMPTIVE WILDLIFE USE 10

3. ECOLOGICAL PERFORMANCE OF GMAs 11
- A. WILDLIFE RESOURCES IN GMAs 11
- B. PAST TRENDS IN WILDLIFE POPULATIONS (BEFORE 2002) 11
- C. CURRENT TRENDS IN WILDLIFE POPULATIONS (AFTER 2002) 11
- D. CATEGORIZATION OF GMAs 12
- E. HABITAT TRANSFORMATION IN GMAs 13
- F. SETTLEMENT PATTERNS IN GMAs 14

4. SOCIOLOGICAL PERFORMANCE OF GMAs 17
- A. SOCIO-ECONOMIC CHARACTERISTICS OF GMAs 17
- B. THE NATIONAL GMA HOUSEHOLD SURVEY 17

5. FACTORS AFFECTING THE PERFORMANCE OF GMAs 21
- A. IDENTIFICATION OF THREATS 21
- B. UNSUSTAINABLE LIVELIHOOD ACTIVITIES 21
- C. LOW MANAGEMENT PERFORMANCE 22
- D. UNCOORDINATED GOVERNANCE 22

6. COMPARATIVE ANALYSIS OF CBNRM PROGRAMS 23
- A. ZIMBABWE: CAMPFIRE 23
- B. BOTSWANA: TRUSTS 23
- C. NAMIBIA: CONSERVANCIES 24
- D. LESSONS FROM NEIGBORING COUNTRIES 25
- E. LESSONS FROM ZAMBIA 25

7. A WAY FORWARD 26
- A. CONCLUSIONS 26
- B. POLICY RECOMMENDATIONS 27

ANNEX 1. GAME AND PROTECTED ANIMALS 29

ANNEX 2. ZAMBIA ECOSYSTEMS WITH ASSOCIATED NPs AND GMAs 30

ANNEX 3. 2007 HUNTING CONCESSIONS IN ZAWA'S HUNTING BLOCKS 31

ANNEX 4. PARTNERSHIPS WITH NON-GOVERNMENTAL ORGANIZATIONS 32

ANNEX 5. CURRENT STATE OF WILDLIFE IN ZAMBIA'S 36 GMAs 33

ANNEX 6. DATA SUMMARY OF GMA HOUSEHOLD SURVEY 35

REFERENCES 36

LIST OF FIGURES

FIGURE 1.1: National Parks and Game Management Areas of Zambia 4
FIGURE 2.1: Total safari quota allocation and utilization between 1995 and 2006 7
FIGURE 2.2: Quota utilization trends for key species (1995-2005) 7
FIGURE 2.3: Trends in trophy quality (2003-2005) 8
FIGURE 2.4: Trends in number of quality trophies harvested (1983-2006) 8
FIGURE 2.5: Comparative Income from Safari Hunting in Southern Africa 9
FIGURE 2.6: Bed capacities in GMAs (2006) 10
FIGURE 3.1: Population trends large ungulates in South Luangwa NP and Lupande GMA (1993-2002) 12
FIGURE 3.2: Evolution of classification of GMAs 1997 and today 13
FIGURE 3.3: Settlements and distributed farmland in Bilili Springs GMA 15
FIGURE 3.4: Settlements in Kaputa GMA 16
FIGURE 4.1: Comparison of welfare of households around national parks with national rural average 18
FIGURE 4.2: Differences in welfare between households participating or not in VAGs/CRBs 18
FIGURE 4.3: Comparison of welfare between VAG/CRB participating and non-participating households ... 19
FIGURE 4.4: Welfare of the same households whether they participate or not in VAGs/CRBs 19
FIGURE 5.1: Assessment of threats and pressures in GMAs 21
FIGURE 5.2: Expenditure components for ZAWA (2006) 22
FIGURE 6.1: Main sources of benefits in Namibian conservancies in 2005 24

LIST OF TABLES

TABLE 2.1: Mandatory allocation of hunting Revenues 5
TABLE 2.2: Disbursed revenues under LIRDP in Lupande GMA (1992-1999) 5
TABLE 2.3: Community hunting revenue disbursements 2002-2006 (rounded to nearest ZMK) 6
TABLE 2.4: Top quality trophies harvested between 2000 and 2006 9
TABLE 2.5: Income from GMA hunting sector in Zambia and Zimbabwe 9
TABLE 3.1: Abundance status of species in areas of the Western Region 2001 11
TABLE 3.2: Percentage of settled and cultivated land for selected GMAs 14

LIST OF BOXES

BOX 3.1: The special case of the Lechwe 16
BOX 4.1: Female-headed households in GMAs 20

ACRONYMS & ABBREVIATIONS

ADMADE	Administrative Management Design (for Game Management Areas)
AIDS	Acquired Immunodeficiency Syndrome
AMUs	Area Management Units
CAMPFIRE	Communal Areas Management Program for Indigenous Resources
CAs	Controlled Areas
CBNRM	Community-Based Natural Resources Management
CHAs	Controlled Hunting Areas
COMACO	Community Markets for Conservation
CRBs	Community Resources Boards
DANIDA	Danish International Development Assistance
DSI	Development Services & Initiatives
FNDP	Fifth National Development Plan
FZS	Frankfurt Zoological Society
GMAs	Game Management Areas
HCAs	Hunting Concession Agreements
HIV	Human Immune Virus
LIRDP	Luangwa Integrated Resource Development Project
METTPAZ	Management Effectiveness Tracking Tool for Protected Areas managed by ZAWA
NACSO	Namibia Association of CBNRM Support Organizations
NGOs	Non-Governmental Organizations
NORAD	Norwegian Agency for Development
NPs	National Parks
NPWS	National Parks & Wildlife Service
PCEXP	Per Capita Consumption Expenditure
PH	Professional Hunter
RDCs	Rural District Councils
REMNPAS	Reclassification and Effective Management of the National protected Areas Systems Project
SLAMU	South Luangwa Area Management Unit
USA	United States of America
USAID	United States Agency for International Development
VAGs	Village Action Groups
WTO	World Tourism Organization
WWF	Worldwide Fund for Nature
ZAWA	Zambia Wildlife Authority
ZMK	Zambian Kwacha

EXECUTIVE SUMMARY

BACKGROUND

Game Management Areas (GMAs) are wildlife estates in communally owned lands in which some wild animals are protected and used primarily for regulated hunting (consumptive tourism) and photographic safaris (non-consumptive tourism). The 36 GMAs in Zambia cover 22% of the country's territory equivalent to 170,000 km^2.

GMAs act as buffer zones for national parks. In the early 1980s, as heavy poaching decimated wildlife populations, new models of conservation with integrated community development emerged. The Zambia Wildlife Act number 12 of 1998 was enacted to enhance the concept of community participation in GMAs.

This document examines, as objectively as available data permit, the impact of the current wildlife management policy on the triple bottom line of economy, ecology and community welfare.

COMMERCIAL PERFORMANCE OF GMAs

Only about 10 of 36 GMAs have photographic tourism developments, and Chiawa and Bangweulu Community Resources Boards (CRBs) are the only recipients of revenue from lodges. Formal employment in the non-consumptive tourism sector remains extremely low. In the Mfuwe area, which is the most active tourist hub in any GMA in Zambia, there were only 700 permanent and temporary staff in 2005.

Analysis of utilization of key species (lion, leopard, sable, roan and buffalo) in the hunting packages show declining trends together with the trophy quality for major species. Compared to its neighbors, Zambia has underperformed on generating revenue from hunting. The main reason is the decreasing availability of trophy animals.

Consequently, the hunting revenues disbursed by Zambia Wildlife Authority (ZAWA) to CRBs have declined since 2004. Incomes fell by about K170 million in 2005 and K50 million in 2006.

ECOLOGICAL PERFORMANCE OF GMAs

Quantitative evidence suggests that in more than half of Zambia's GMAs animal populations have declined, mainly due to poaching, and in some GMAs the animal status is unknown. Many hunting blocks are affected. Kasonso Busanga, Nkala, Mulobezi and West Petauke appear to have degenerated from prime to secondary status, and twelve other GMAs are in a critical state of depletion.

A snap survey furthermore shows that the natural habitats available to support wildlife in GMAs is shrinking throughout the country due to increased settlements, cultivation, traditional land claims and uncoordinated planning by government departments. Bilili GMA is the worst affected with almost no land left for wildlife.

SOCIOLOGICAL PERFORMANCE OF GMAs

GMA communities are characterized by high poverty levels. Monthly per capita expenditure is estimated at ZMK 71,005 compared to ZMK 111,747 for rural areas generally and ZMK 244,352 for urban areas (LCMS, 2006). When compared to other rural communities, the welfare of communities in GMAs is 30% lower than national rural average.

A 2006 poverty impact study of nature-based tourism in GMAs found that, on average, households in GMAs gain from living in GMAs, but benefits are captured by the elite and relatively non-poor stratum of the community. The elite capture is supported by audit reports of CRBs in the Kafue National Park system, which pointed to large proportions of funds being spent on travel allowances, accommodation and meeting costs.

FACTORS AFFECTING THE PERFORMANCE OF GMAs

The most serious problems across all GMAs are poaching, human encroachment, fire, deforestation, subsistence agriculture and illegal fishing. Food insecurity is high. Very little funding goes to resource protection and only three GMAs (Lupande, Chiawa and Sandwe), meet the minimum requirements for management effectiveness. Some politicians apparently tolerate unlicensed use of resources by local people and discourage wildlife managers from implementing technically correct decisions.

COMPARATIVE ANALYSIS OF CBNRM PROGRAMS

Experiences from several Southern African countries show that community-based natural resources management can help reduce poverty if the policy framework is stimulating and if community institutions are effectively organized to participate in natural resources development. Namibian conservancies offer a model of joint ventures between communities and the private sector that may be beneficial in Zambia's GMAs.

CONCLUSION

This report paints an alarming picture of Zambia's GMAs in terms of economical, sociological and ecological benefits. Chapter 2 reveals that the commercial flow to and from GMAs probably is decreasing. Chapter 3 illustrates that natural habitats and wildlife are decreasing at an alarming rate in most GMAs. Chapter 4 shows that GMA communities are 30% poorer than the average Zambian rural communities. Chapter 5 demonstrates that 31 out of 36 GMAs fail to meet the requirements for satisfactory management effectiveness.

This report concludes that GMAs have failed to fulfill their purpose; namely to act as buffer zones to National Parks in order to protect wild animals and their habitats to support a viable wildlife-based tourism industry, which contributes significantly to the national economy and to the improvement of welfare in GMAs.

The key message to the Zambian Government and other policy makers is that current wildlife management policies are inadequate whether evaluated from an ecological, economic or sociological perspective. This report therefore urges them to launch, as rapidly as possible, a review of the governance of GMAs with the view to adopt a new policy for wildlife management prior to the revision of the wildlife legislation.

1. GAME MANAGEMENT AREAS: BACKGROUND

Game Management Areas (GMAs) are wildlife estates in communally owned lands (i.e. customary or traditional lands) in which some wildlife is protected (see Annex 1) and used primarily for regulated hunting (consumptive tourism) and/or photographic safaris (non-consumptive tourism) for the benefit of the nation, local communities and the wildlife resource. Human habitation is permitted, along with economic activities that are compatible with in-situ wildlife management such as agriculture, forestry and mining.

The current 36 GMAs (see Annex 2) cover about 170,000 km^2 or 22% of the country's territory.

A. THE RATIONALE BEHIND GMAs

The concept of GMAs goes back to the mid-1940s, when a few areas were declared as Controlled Areas (CAs) to permit a strictly controlled number of non-residents to hunt. In 1954, CAs were reclassified as Controlled Hunting Areas (CHAs) to allow for controlled hunting in general, formally initiated in 1956 when the Fauna Conservation Ordinance, Chapter 106, was put in force. CHAs were to serve as buffer zones between the country's 19 National Parks and farming areas to: (1) provide alternatives to commercial agriculture in areas of low agricultural potential, and (2) to enclose the mammalian hosts of the tsetse fly to prevent the spread of the domestic livestock disease Trypanosomiasis.

In 1962, the Fauna Conservation Ordinance, Chapter 106, was replaced with the Fauna Conservation Ordinance, Chapter 241, to be repealed and replaced, in 1971, with the National Parks and Wildlife Act, Chapter 316. Under the National Parks and Wildlife Act all CHAs were declared as GMAs with stricter hunting controls.

B. WILDLIFE UTILIZATION IN GMAs

Consumptive utilization of wildlife in Zambia's GMAs includes hunting and to a lesser degree live capture. Safari hunting is carried out by international clients under the guidance of licensed professional hunters in hunting blocks in specific GMAs (see Annex 3). Resident hunting, predominantly for meat, is carried out by citizens of Zambia, bonafide district residents and expatriate residents. ZAWA is the licensing authority except for special licenses issued by the Minister of Tourism, Environment & Natural Resources for research, game capture, traditional ceremonies, dignitaries and for management of problematic animals.

Illegal poaching increasingly constitutes a form of exploitation of wildlife. With human population densities on the rise, the demand for bush meat has progressively transformed subsistence hunting into commercial poaching.

Non-consumptive use of wildlife (game viewing) is so far limited to relatively few lodges and camps. Only 10 out of 36 GMAs attract this kind of tourism.

C. THE EVOLUTION OF COMMUNITY INVOLVEMENT IN GMAs

In the 1940s, ownership of wildlife changed hands from traditional control to state control. The creation of wildlife estates resulted in displacement of communities and restricted traditional hunting and access to protected areas by local people. Most communities considered the wildlife legislation discriminatory and hence few cooperated with the state authorities.

However, from the early 1980s, heavy poaching opened a new debate on conservation practices. It was progressively recognized that wildlife conservation can only succeed if resident communities derive benefits from the use of wildlife. Such benefits should, theoretically, be of sufficient magnitude to discourage detrimental land uses.

With support from WWF (USA), the Lupande Development Project was born in 1983 to test the feasibility of letting local people participate in the management of wildlife resources in partnership with the Department of National Parks & Wildlife Service (later transformed into ZAWA). Eventually, the Luangwa Integrated Resource Development Project (LIRDP) and the Administrative Management Design (ADMADE) program followed.

LIRDP adopted an integrated approach combining agriculture, infrastructure development, and community development projects with conservation support. Revenues from wildlife use were given to the community institutions for community projects. ADMADE ensured that revenues generated from wildlife in a GMA were shared between the residents of that particular GMA and the basic wildlife management costs. Residents benefited through employment opportunities and community projects such as schools, clinics and water wells.

ADMADE and LIRDP were credited for stimulating local people's support, which in turn reduced poaching, minimized land use conflicts and stabilized habitat encroachment. This triggered policy discussions and ultimately the enactment of the Zambia Wildlife Act number 12 of 1998.

D. GMA MANAGEMENT UNDER THE 1998 WILDLIFE ACT

POLICY AND INSTITUTIONAL FRAMEWORK

In 1998, the National Parks and Wildlife Act, Chapter 316, was repealed and replaced with the Zambia Wildlife Act Number 12, which also allowed for the transformation of the Department of National Parks & Wildlife Service into the Zambia Wildlife Authority (ZAWA). Key innovations under the Zambia Wildlife Act included the explicit formalization of community-based natural resources management and the introduction of Community Resources Boards (CRBs) as democratic local institutions to work in partnership with ZAWA.

ZAWA facilitates and supervises community-based wildlife management through its GMA Unit in the Conservation Directorate. The GMA Unit mainly provides policy guidance and extension support to CRBs and promotes partnerships with community, private sector and other institutions in the management of GMAs.

COMMUNITY RESOURCES BOARDS

Communities wishing to form CRBs must fulfill a set of specific conditions specified in the Wildlife Act. Firstly, the local community must have common interest in the wildlife and natural resources of its area and be resident in an area defined as a chiefdom. In addition the CRB must have members elected by the local community. The local authority and the Chief are represented by one person each with the Chief serving as a patron of that Board. CRBs are assisted by their village representation, the Village Action Groups (VAGs).

The formation of CRBs has had two positive impacts. CRBs have provided platforms for development organizations who wish to help improve communities' welfare. Communities in turn have a forum in which to participate in development planning. Furthermore, ZAWA has returned hunting revenues (see Table 2.1), which, in most GMAs, were not available to the communities before.

In reality, however, the performance of CRBs has been generally unsatisfactory. CRBs are meant to be conduits of sharing benefits of wildlife management with residents of GMAs. However, audits have revealed gross financial misapplication of community funds, lack of transparency in the administration and unfavorable influence by chiefs on expenditure of community funds.

CRBs lack technical capacity to perform their functions. No single CRB has negotiated an agreement with a company in wildlife enterprise. Not a single management plan has been implemented although efforts are being made to produce some with assistance from ZAWA's partners. Management plans have been completed for Nkala and Kafinda GMAs. The capacity to administer CRB has been weak or virtually non existent for some GMAs. In many GMAs, recruitment of qualified staff for CRB secretariats has not been possible because revenues are considered too low to accommodate wages.

Only 29 out of 68 CRBs have had sufficient revenues to employ village scouts. Regardless, all CRBs are required to finance conservation programs. Their low performance is therefore not surprising.

OTHER STAKEHOLDER ASSISTANCE

Currently, direct financial support is given to CRBs in about six GMAs by DANIDA, NORAD and UNDP, and a further 10 GMAs receive NGO support (see Annex 4). NGOs work with communities to stimulate conservation awareness and support protection of wildlife. They also catalyze support from the private sector and donors for livelihood activities and community development projects such as schools. The low level of assistance is attributed to lack of confidence in the suitability of the current GMA policy and in ZAWA's approach to its implementation.

The CBNRM Forum is an umbrella organization for community-based organizations with interest in natural resources management. It was established with WWF assistance to help communities voice at the national level their concerns and wishes for the management of wildlife and other natural resources. Even though CRB representative from various regions were elected, the forum has remained dormant, possibly because of insufficient buy-in at the grassroots level. Also, given the low revenues of CRBs, the forum's existence depends on donor support, which has not materialized.

The private sector is involved through safari hunting operators. Furthermore, investors are increasingly becoming interested in establishing tourist lodges in GMAs on the boundary of National Parks. Under the present arrangements, however, the GMA policy does not enable CRBs to tap effectively the private sector, especially their know-how and capital for investment in wildlife management.

E. OTHER NATURAL RESOURCES IN GMAs

GMAs are endowed with a variety of natural resources, including land, water, forests, minerals, fishes, wildlife, etc. The management and user rights of the various natural resources are governed by separate legislations and government institutions. Although in principle natural resources are vested in the President, in practice the use of natural resources on customary land is determined by traditional authorities. This dual tenure system coupled with multiple legislations/institutions hinders coordination. The consequence is uncoordinated planning and development, incompatible land or resource uses, and insufficient monitoring of resource exploitation.

F. NEW APPROACHES

There have been several attempts at devising new approaches to enhance wildlife conservation by promoting local people's participation:

The CBNRM project is a Danida-funded development project that operated in Mumbwa and Itezhi-tezhi Districts until 2007. Field operations included (1) providing skills, administrative and material support to community-based institutions; (2) initiating income-generating activities such as beekeeping for groups of households; and (3) establishing linkages with urban markets. With Danish and Norwegian support, progress was made in terms of more inclusive and meaningful multi-stakeholder processes for land use planning, primarily in Nkala and Namwala GMAs. The identification of conservation zones was initiated in six additional GMAs. Conservation zones are designed and coordinated in relation to similar zones in neighboring GMAs and National Parks.

Designed by the NGO Wildlife Conservation Society, the Community Markets for Conservation (COMACO) addresses the causes of land degradation and biodiversity loss around protected areas. It operates in Rufunsa, Sandwe, Lupande, Munyamadzi, Lumimba and Musalangu GMAs. Realizing that the market economy exerts pressure on natural resources and influences the community choice of land uses, COMACO focuses on households, on livelihoods and on market linkages. Under COMACO, farmers organize themselves in producer groups. They adopt farming and land use practices compatible with wildlife production and watershed protec-

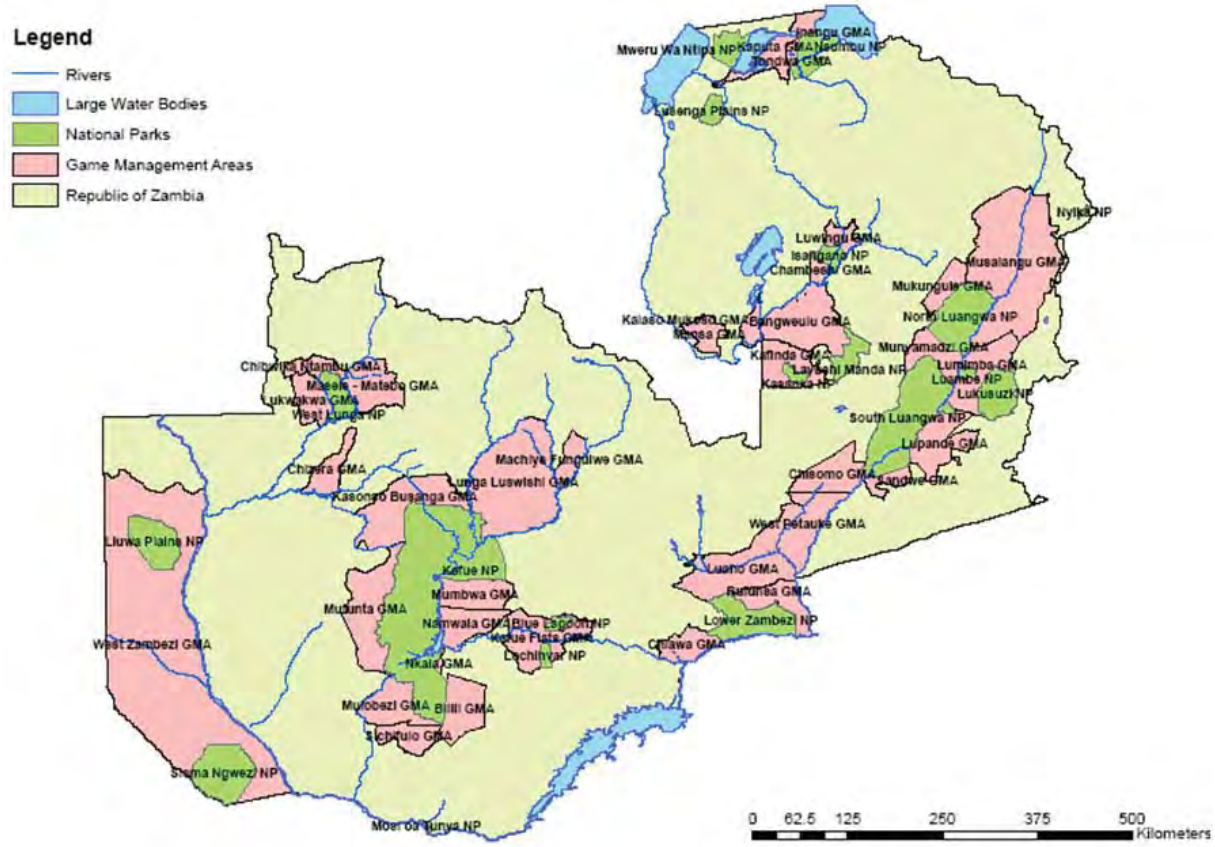
tion. In return, COMACO offers better market access and prices. COMACO also helps community organizations entering the tourism sector by assisting in the management of three bush camps. Success has been reported in conservation and livelihood improvements.

Since 2005, the Luawata Conservation Limited, a hunting safari company based in Munyamadzi GMA in the Luangwa Valley, has combined its operations with support to a range of wildlife projects through an NGO called the Conservation Foundation Zambia financed by the same investors. The NGO's mission is to provide financing and technical support to ZAWA and other government and non-governmental agencies and rural communities that are involved in natural resources conservation, management and sustainable utilization. Some of these include: (1) a scout field training program that has trained over 250 scouts and 10 instructors; (2) a scout housing program in North Luangwa; (3) rehabilitation of park buildings; (4) air support to rainy season patrols in North and South Luangwa National Parks; and (5) re-introduction of 16 black rhinos in North Luangwa.

The Reclassification and Effective Management of the National Protected Areas Systems Project (REMNPAS) has been initiated with financial assistance from the Global Environment Facility (GEF) and the UNDP to run from 2006 to 2011. The goal is to establish a new protected area system comprising a representative sample of Zambia's ecosystems effectively safeguarded from human-induced pressures through effective management partnerships, and which establishes Zambia as a tourism destination of choice. This calls for creation of new categories of protected areas where public/private/community partnerships will embrace new management responsibilities and benefit-sharing mechanisms. Models of community/private parks are being developed to be tested in Bangweulu and Chiawa GMAs. The REMNPAS project still has a mammoth task ahead of it in developing the partnership models. Many issues related to restriction of land uses in order to protect wildlife resources need to be addressed as they affect local people's basic livelihoods such as fishing, hunting and other natural resource uses.

In all cases, even when the new approaches are promising, sustainability remains an issue of concern when only external donor or NGO funds or initiatives are mobilized to assist communities in managing their GMAs.

FIGURE 1.1: National Parks and Game Management Areas of Zambia.



Source: ZAWA Information Department.

2. ECONOMIC PERFORMANCE OF GMAs

A. CONSUMPTIVE WILDLIFE USE

The principal economic activity for which GMAs were created is hunting (consumptive wildlife use). Many GMAs are so large and/or contain such varying densities of huntable species that they are divided into separate hunting blocks that are concessioned separately to safari hunting operators (see Annex 3).

HUNTING REVENUES

In 2003, after a two-year moratorium of hunting in Zambia, ZAWA and the local communities in GMAs granted hunting blocks to safari hunting operators. The safari hunting companies signed 10 to 15-year lease agreements known as Hunting Concession Agreements (HCAs). The HCAs provide for specific obligations that safari hunting companies are expected to fulfill in addition to the community pledges that they make. The HCAs further provide for the annual review of the safari hunting operators to determine their status and continued operations.

Safari hunting is the major source of wildlife revenue in GMAs. ZAWA disburses 50% of animal fees and 20% of concession fees to local communities in GMAs through their CRBs for resource protection and the improvement of livelihoods (see Table 2.1).

TABLE 2.1: Mandatory allocation of hunting revenues.

	Animal fees	Concession fees
ZAWA	50.00%	80.00%
Village scouts	20.25%	6.75%
Chiefs	5.00%	5.00%
CRB administration	9.00%	3.00%
Community projects	15.75%	5.25%
Total	100.00%	100.00%

Source: Hamilton et. al., 2007.

In comparison, the LIRDP released 100% of the hunting revenue generated in the Lupande GMA from 1997 to 1999 (see Table 2.2), although this was reversed under the 1998 ZAWA Act to maintain uniform sharing proportions for all GMAs.

TABLE 2.2: Disbursed revenues under LIRDP in Lupande GMA (1992-1999).

Year	GMA income (US$)	Community disbursement (US$)	Share (%)
1992	79,784	61,737	77
1993	123,490	116,014	94
1994	140,333	56,133	40
1995	175,578	153,495	87
1996	198,838	153,846	77
1997	241,807	241,807	100
1998	227,273	227,273	100
1999	225,000	225,000	100

Source: Compiled by authors.

Table 2.3 shows ZAWA's disbursements to communities in GMAs with hunting blocks.

TABLE 2.3: Community hunting revenue disbursements 2002-2006 (rounded to nearest ZMK).

GMA	2001 – 2002*	2003	2004	2005	2006
Lumimba	53,519,258	215,127,945	678,977,003	493,107,796	464,561,250
Bangweulu	129,272,659	91,316,025	433,216,875	237,949,772	211,142,405
Munyamadzi	170,340,600	177,042,695	416,511,805	444,790,670	357,055,709
Musalangu	116,296,147	229,360,783	396,995,128	354,845,346	358,969,785
Lupande	61,448,450	161,351,015	332,930,795	514,379,722	588,141,417
Mumbwa	52,078,202	59,607,860	246,254,498	265,116,600	275,089,920
Kafue Flats	66,891,280	199,124,030	244,165,632	158,673,047	157,291,660
Lunga Luswishi	0	118,158,280	191,113,313	170,978,876	150,488,775
West Petauke	83,202,500	46,993,090	148,928,365	59,251,900	75,586,475
Kasonso Busanga	49,575,100	77,852,480	145,355,565	163,897,126	145,971,715
Mulobezi	127,914,498	46,472,320	128,559,308	127,748,476	195,712,295
Kasonso Busanga	104,731,612	55,594,435	120,548,080	100,584,976	54,592,900
Bilili/Nkala	39,822,358	120,333,154	72,312,201	117,623,924	104,767,425
Tondwa	14,237,423	25,029,875	69,450,730	56,045,826	61,512,250
Namwala	20,740,945	60,930,863	52,920,170	45,255,651	48,942,075
Sichifulo	104,224,634	23,597,697	48,911,404	41,694,336	34,434,508
Sandwe	9,800,535	0	37,398,920	58,562,976	11,424,750
Chiawa	91,904,595	2,625,150	29,154,425	81,882,516	122,075,515
Rufunsa	41,836,275	5,228,100	26,111,240	62,178,052	91,043,850
Luano	386,790	0	12,087,175	10,764,000	7,314,000
Chisomo	203,002	0	4,266,500	47,168,550	0
West Zambezi	22,579,400	66,627,590	250,268	19,122,676	30,974,038
Kalasa Mukoso	932,600	0	0	0	0
Mukungule	0	0	0	21,879,000	54,333,700
Chizera	0	0	0	12,033,450	15,801,978
TOTAL	1,361,938,863	1,782,373,386	3,836,419,397	3,665,535,264	3,617,228,394

* In 2001/02 international safari hunting was suspended in Zambia.
Source: Compiled by authors.

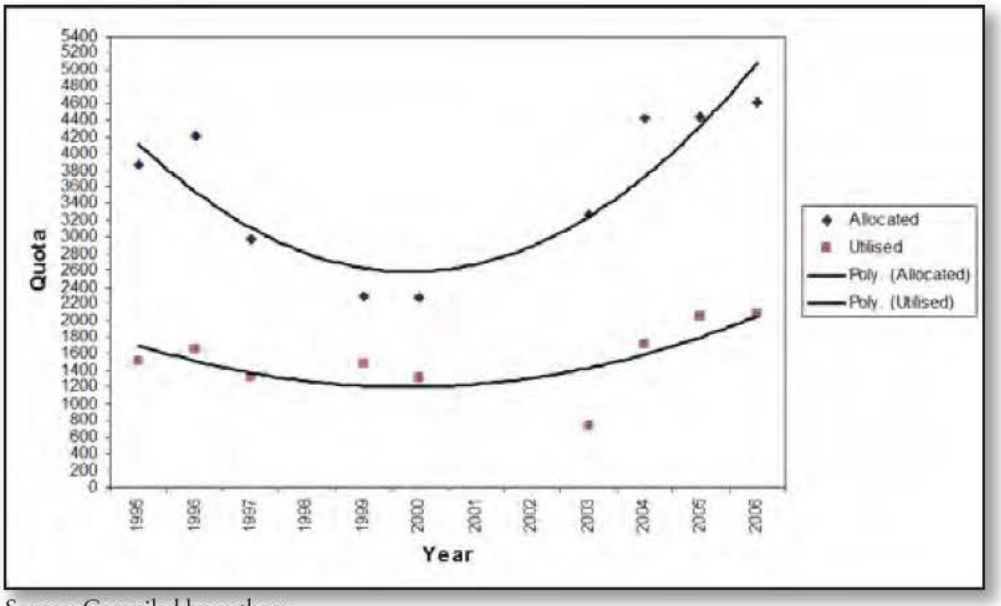
As illustrated in Table 2.3, the revenues increased from 2003 to 2004, because ZAWA split the hunting blocks and increased quotas – despite declining trends in animal populations as demonstrated in the next chapter of this report. From 2004 onwards, however, the revenues have been declining with about K170 million in 2005 and K50 million in 2006 - and when inflation is taken into account, the decrease is much sharper. This trend is linked to the decrease in quota utilization.

HUNTING QUOTA UTILIZATION

Between 1995 and 2000, National Parks & Wildlife Service steadily reduced the safari quota allocation to respond to the low utilization levels (see Figure 2.1). After 2003, ZAWA increased quota allocation and decreased the sizes of hunting blocks. Because of low utilization levels, ZAWA also introduced performance bonds based on 75% minimum quota utilization. Regardless, as demonstrated in Figure 2.1, overall quota utilization has remained low at about 40% since 2003. This indicates that there are not enough trophy animals in the GMAs to fill out the quotas implying that the quotas were inflated against the principle of sustainability.

Currently, a total of 41 species are being harvested on the safari hunting quota. Citizens and established residents take 16 species, mainly for meat, not including species such as lion, leopard, sable, roan, eland, zebra and elephant. In 2006, from a total hunting quota of 10,073 animals, 46% was harvested by international clients, 35% by residents, 13% for animal capture, 3% for special license and 3% for culling.

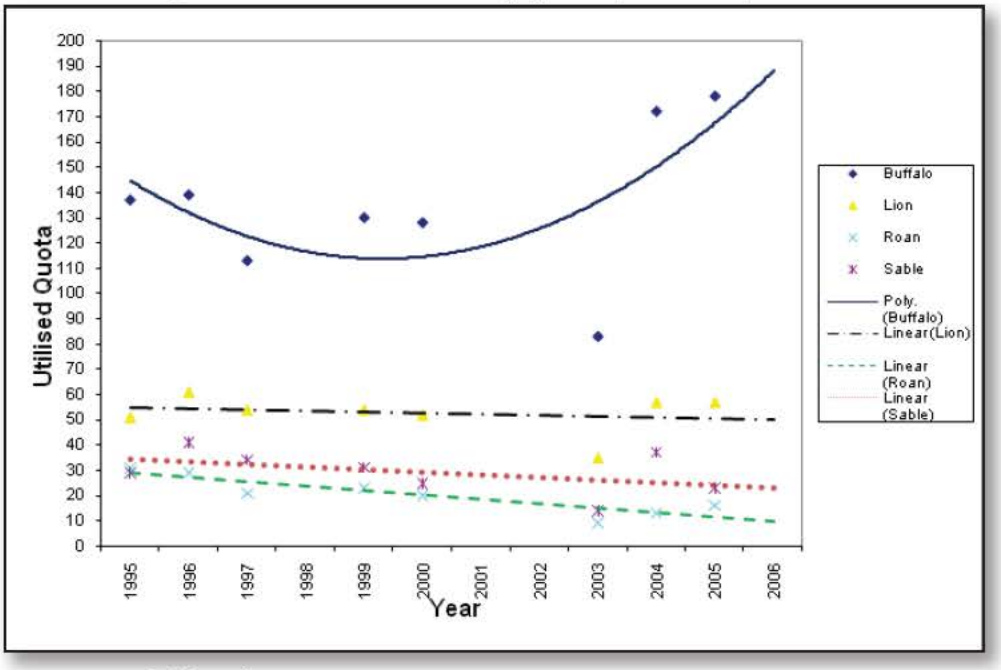
FIGURE 2.1: Total safari quota allocation and utilization between 1995 and 2006.



Source: Compiled by authors.

An analysis of safari quota utilization of key species in the hunting packages (lion, leopard, sable, roan and buffalo) for the period 1995 to 2006 (see Figure 2.2) shows that buffalo is the only larger mammal whose numbers are sufficient to be targeted for both trophy and meat. Figure 2.2 shows that the quota utilization of buffalo increased in 2004 and 2005. The number of leopard collected increased slightly, whereas the other three species show declining trends.

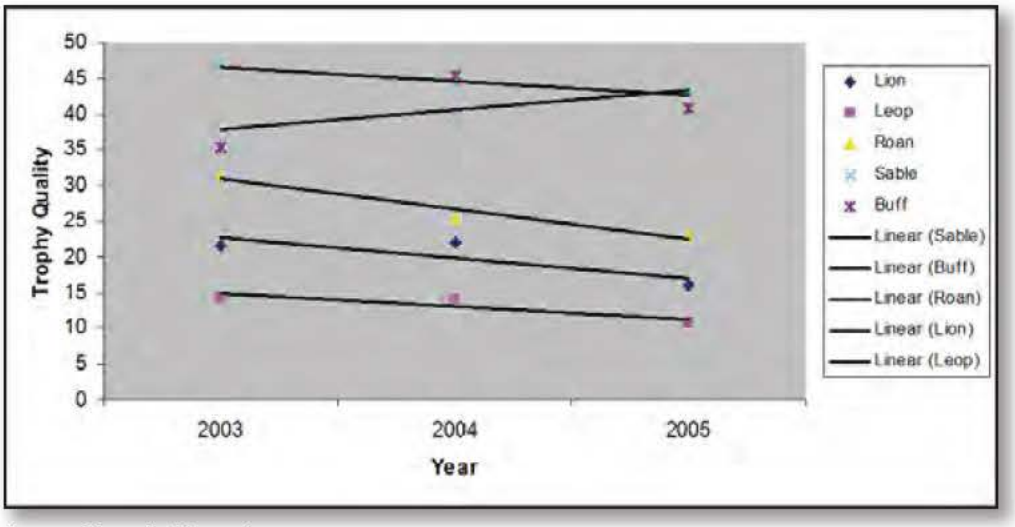
FIGURE 2.2: Quota utilization trends for key species (1995-2005).



Source: Compiled by authors.

TROPHY QUALITY

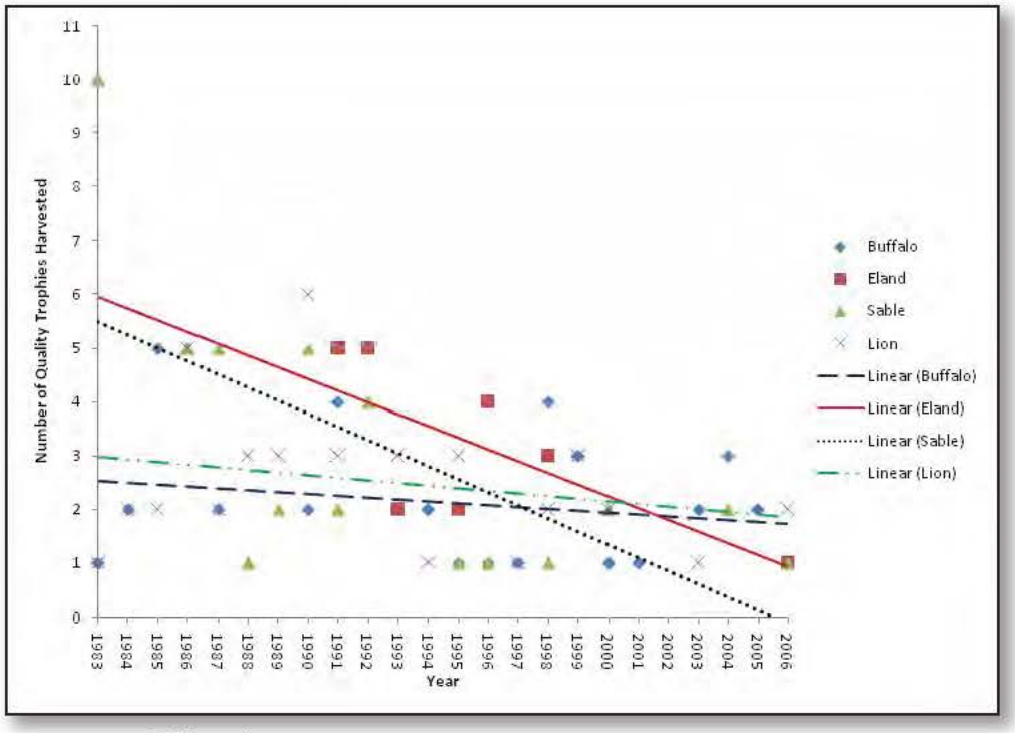
Trophy quality is a suitable way of monitoring wildlife populations that are being hunted. However, ZAWA's database on trophy quality is scanty and cannot provide a fully accurate picture. Still, indications of trophy quality for major species except buffalo show a steady declining trend between 2003 and 2005 (see Figure 2.3).



Source: Compiled by authors.

Not surprisingly, declining trophy quality is resulting in a similar decline in the number of quality trophy animals being harvested (see Figure 2.4). Declining trophy quality translates into increased hunting effort as more time is being spent and larger areas are being searched to find good trophy animals.

FIGURE 2.4: Trends in number of quality trophies harvested (1983-2006).



Source: Compiled by authors.

Table 2.4 reveals that the Luangwa Valley system surpasses all other areas in Zambia when it comes to trophy quality of all species except Sable. In fact, Sable can only be harvested from the Kafue National Park system to a minimum quality set by the Professional Hunters Association of Zambia.

TABLE 2.4: Top quality trophies harvested between 2000 and 2006.

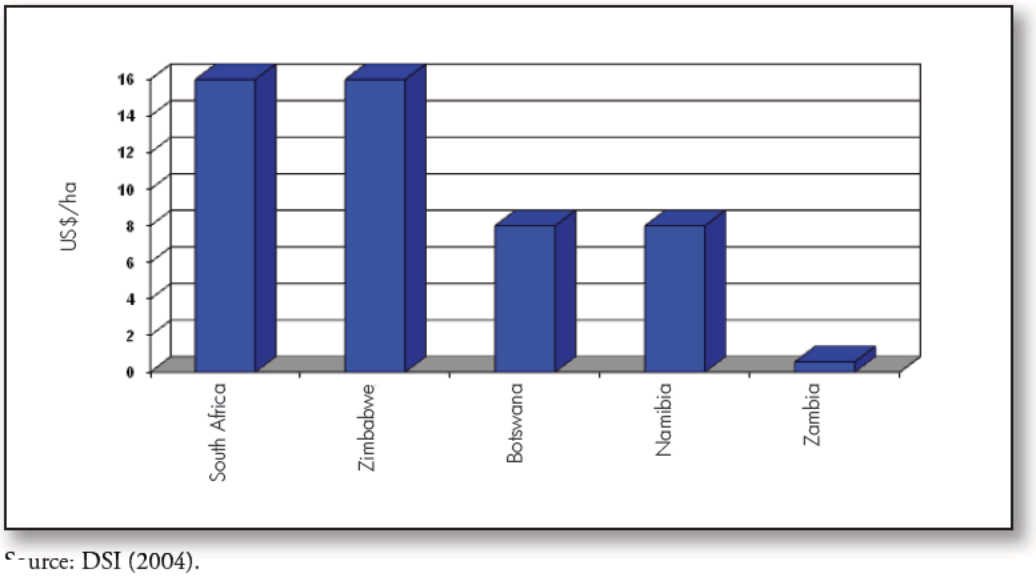
	Buffalo	Eland	Leopard	Lion	Roan	Sable
Luangwa Valley System	8	1	4	4	4	0
Kafue National Park System	1	0	2	1	1	5
Lower Zambezi NP System	0	0	0	0	0	0
Bangweulu System	1	0	0	0	0	0
Mweru Wa Ntipa System	0	0	0	0	0	0
Upper Zambezi System	0	0	0	0	0	0

Source: Compiled by authors.

INCOME FROM HUNTING

Zambia has significantly underperformed on generating income from hunting compared to its neighboring competitors (see Figure 2.5). Contributing factors have included poor allocation of quotas, under-pricing of animals, poaching and weak law enforcement.

FIGURE 2.5: Comparative annual income from safari hunting in Southern Africa.



Source: DSI (2004).

A comparison of hunting on public land in Zambia and Zimbabwe (see Table 2.5) shows that, in spite of higher human density and smaller huntable areas, Zimbabwe generates far more hunting revenue per unit area. Among possible explanations is the fact that Zimbabwe auctions quotas for a larger number of some of the valuable big game species such as elephant. Higher quotas and higher prices have been made possible by a relatively better management performance and thus a better wildlife product.

TABLE 2.5: Annual income from GMA hunting sector in Zambia and Zimbabwe.

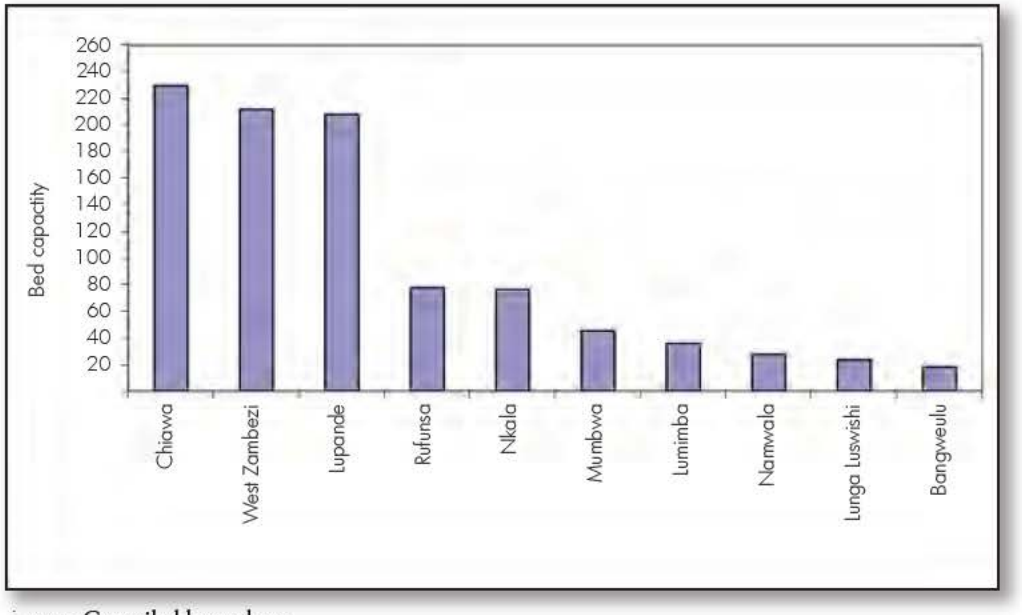
	Area (km²)	Income (US$)	Income (US$/km²)
Zambia	162,311.0	1,304,568	8.0
CAMPFIRE Zimbabwe	19.5	2,000,000	102.4

Adapted from DSI (2004).

B. NON-CONSUMPTIVE WILDLIFE USE

In some GMAs, hunting operators share the wildlife with safari lodges offering game viewing on titled land. However, only 10 out of 36 GMAs provide non-consumptive wildlife use (see Figure 2.6).

FIGURE 2.6: Bed capacities in GMAs (2006).



Source: Compiled by authors.

These GMAs are concentrated around in particular the Lower Zambezi National Park (Chiawa and Rufunsa GMAs) and to a lesser degree the South Luangwa (Lupande GMA) and Kafue National Parks (Nkala, Mumbwa, Namwala and Lunga Luswishi GMAs) as well as West Zambezi offering fishing on the Upper Zambezi.

Chiawa and Bangweulu are the only two GMAs, where a percentage of the fixed lease fees and variable fees is given to the community from the lodges. Otherwise, photographic safari operators contribute to the local economy through salaries and the purchase of goods and services. Other indirect benefits include social programs mainly in health care and education, but increasingly also through community tourism ventures. In GMAs such as Chiawa, the photographic safari operators are probably the biggest contributor to the local economy.

Nevertheless, although the tourism sector is the world's largest employer, the magnitude of employment in two of Zambia's most popular National Parks, the Lower Zambezi and the South Luangwa, is insignificant (Pope, 2005). Mfuwe, for example, which is the gateway to South Luangwa, had some 700 permanent and temporary staff in 2005, up from approximately 80 employees in 1990. The spin-off benefits amounts to roughly 6 household individuals being provided with a livelihood per employee, and through the economic multiplier (NRCF, 2007) about 800 additional jobs are created.

3. ECOLOGICAL PERFORMANCE OF GMAs

A. WILDLIFE RESOURCES IN GMAs

Wildlife in GMAs is described by Jachmann (2000) and Simwanza (2001, 2002, 2003, 2004 and 2005) and is presented in Annex 5.

B. PAST TRENDS IN WILDLIFE POPULATIONS (BEFORE 2002)

A report on the status of wildlife and hunting in the Western Region stretching from the Kafue Flats to the border of Angola (Simwanza, 2001) show that already in 2001 very few species, in some cases none, were abundant and common. The majority of species were either rare or of unknown status as demonstrated in Table 3.1. A similar situation prevails in other GMAs.

TABLE 3.1: Abundance status of species in the Western Region, 2001.

GMA	Number of species				
	Abundant	Common	Rare	Unknown Status	Total
West Zambezi	2	3	7	19	31
Chibwika Ntambu	1	1	1	11	14
Lukwakwa	1	0	3	1	5
Musele Matebo	0	0	0	5	5
Chizera	0	2	2	15	19
Bilili Springs	0	0	7	8	15
Nkala	3	3	11	7	24
Namwala	4	4	7	10	25
Mumbwa	5	3	9	5	22
Lunga Luswishi	0	2	4	14	20
Kasonso Busanga	1	5	7	17	30

Abundant: Frequently observed in large numbers but may be restricted in distribution.
Common: Widely distributed and frequently observed.
Rare: Will be seen only through special search.
Unknown: Present, not abundant, but not established whether common or rare.
Source: Compiled by authors.

In the 1990s, a number of large ungulate species, including hartebeest, roan, waterbuck and wildebeest steadily and significantly declined in Lupande, Lumimba, Munyamadzi, Sandwe, Chisomo and West Petauke GMAs (Jachmann & Phiri, 1999). Although the buffalo population increased between 1994 and 1999 in South Luangwa National Park and Lupande GMA, Duhnam & Simwanza (2002) observed a decline in 2002 (see Figure 3.1).

C. CURRENT TRENDS IN WILDLIFE POPULATIONS (AFTER 2002)

Because of lack of monitoring and subsequent absence of data on occurrences and population sizes for most species in most GMAs, it is difficult to establish an up-to-date picture of the animal status in Zambia's GMAs.

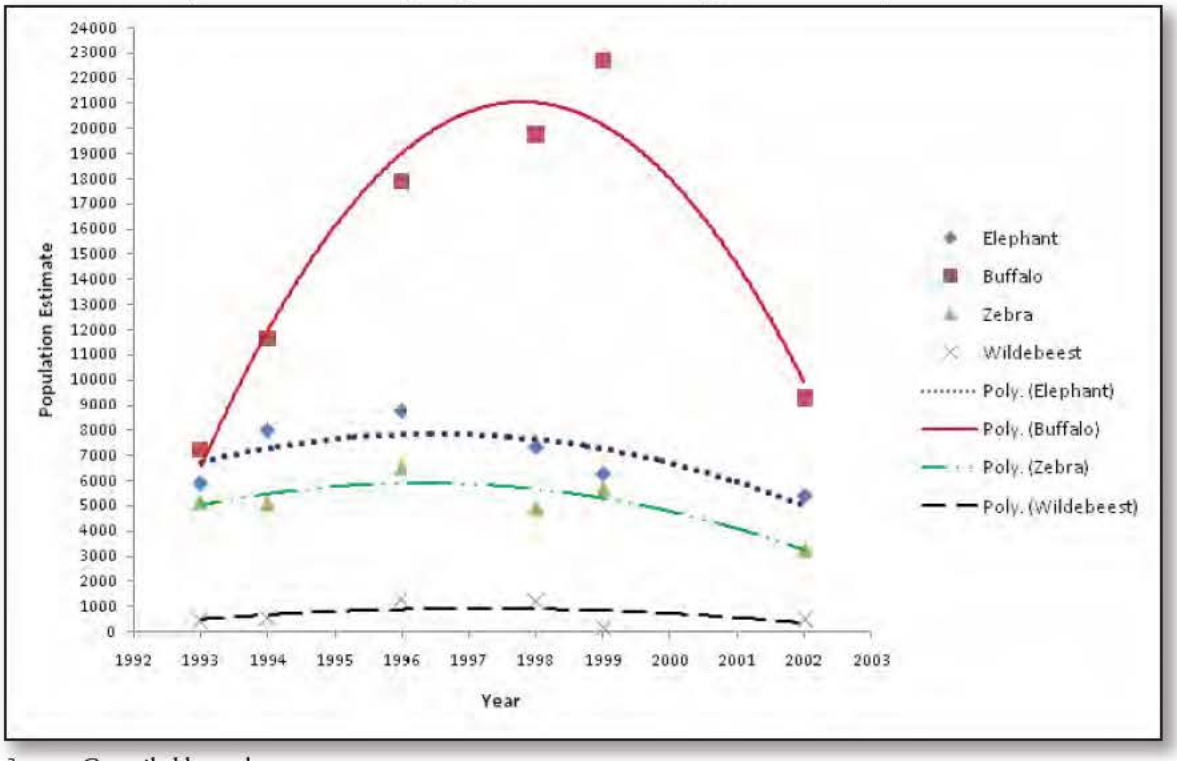
A number of aerial surveys have been conducted between 2002 and 2006 in the Kafue Flats (Kamweneshe et.al., 2003; ZAWA & WWF, 2005), Zambezi Heartland (Simwanza, 2005 & 2003), Kafue Ecosystem, West Lunga Ecosystem and Upper Luano (Simwanza, 2004), Mweru Wa Ntipa Ecosystem (Simwanza, 2003 & 2005) and Lupande GMA (Duhnam & Simwanza, 2002) and important information has been collected leading to the

review of the abundance and distribution status of some species. The results show declining trends in species such as elephant, buffalo, impala, puku, warthog, zebra, Kafue lechwe and Tsessebe, and generally a decline in many of the other species. Even though the animal status in some GMAs is unknown, the quantitative evidence suggests that more than half of Zambia's GMAs have low population levels.

The GMAs that contain significant wildlife populations are either part of the Kafue National Park system, the Luangwa Valley system or the major wetland systems of the Kafue and Bangweulu as seen from the aerial surveys mentioned above. There seems to be a correlation between the abundance of wildlife in GMAs and the presence of donor-funded projects.

It has been observed that in almost all areas the populations of some of the animal species has decreased due to poaching which occurs in almost all GMAs (ZAWA, 2004, 2005 & 2006).

FIGURE 3.1: Population trends large ungulates in South Luangwa NP and Lupande GMA (1993-2002).



Source: Compiled by authors.

D. CATEGORIZATION OF GMAs

Another way to examine population trends is to analyze the evolution of ZAWA's own rating of the GMAs. ZAWA classifies GMAs according to their viability, i.e. their performance in producing revenue from hunting. In this regard GMAs are classified as prime, secondary, specialized, understocked and depleted as follows:

- Prime: areas with species that are fairly abundant and include highly valued trophies namely lion, leopard, roan and sable, that can accommodate five or more classical safaris and seven or more mini safaris per hunting season. Classical safaris include trophies of lion, leopard, roan and sable as well as many other species. A mini safari limits the hunter to seven animals of different species excluding lion, leopard, roan and sable.

- Secondary: areas with species not so abundant but that generally can sustain safari hunting of three to four classical safaris and a minimum of five mini safaris per hunting season.

- Specialized: wetland areas where any of the three species lechwe, sitatunga and tsessebe dominate and are restricted in their distribution.

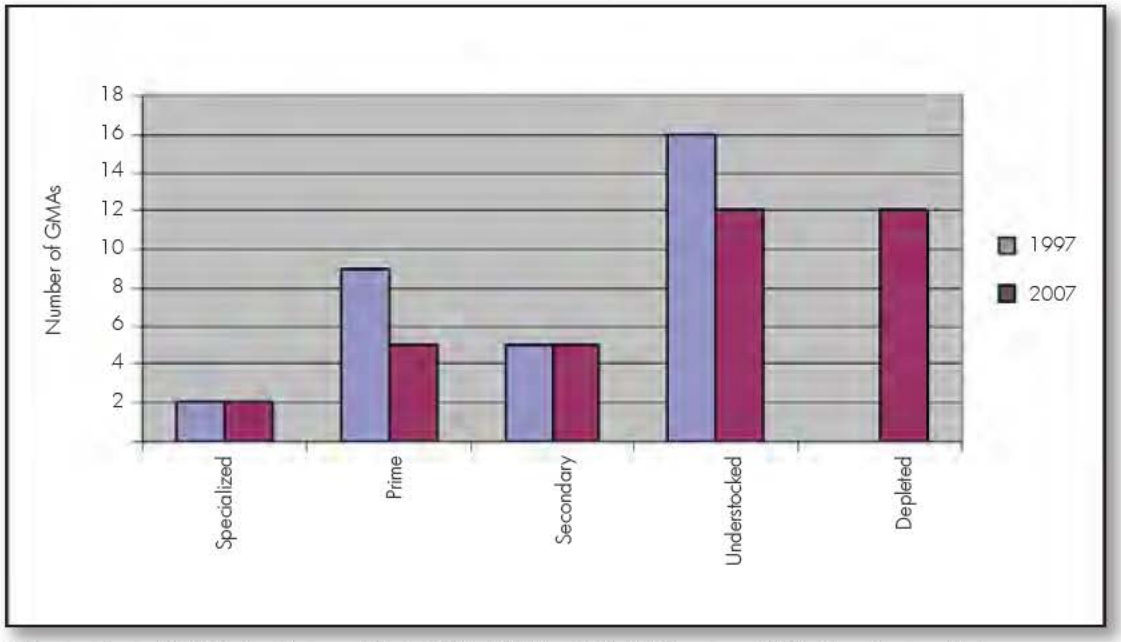
- Understocked: areas with species assemblages that are intact but populations are too sparse. Sometimes one or more species may be exterminated while other species are available. Such areas have room for a minimum hunting quota.

- Depleted: areas with species assemblages that are fragmented and much of the wildlife generally demised. The recommendation is that safari hunting and indeed any other form of hunting should not take place in these areas, e.g. Bilili Springs and Chibwika Ntambu GMAs.

In 1997, ZAWA classifed 14 GMAs as prime or secondary (see Figure 3.2), but an analysis of the hunting returns 10 years later indicates that this number has decreased with 30% to 10 GMAs. Apparently, Kasonso Busanga, Nkala, Mulobezi, Lupande and West Petauke GMAs have degenerated from prime to secondary, while Sichifulo, Msoro-Lupande, Sandwe and Lower Luano GMAs have slipped from secondary to under-stocked (see Annex 3 for classification of current hunting blocks).

On the other hand, 16 GMAs were classified as understocked or depleted in 1997 against seemingly 24 in 2007 (up by 50%). In fact, no GMAs were classified as depleted in 1997, whereas this figure has increased to 12 in 2007, including Luwingu, Kaputa, Chambeshi, Mansa, Chibwika Ntambu, Musele Matebo, Chizera, Kafinda, Bilili Springs, Kalasa Mukoso, Machiya Fungulwe and Lukwakwa GMAs.

FIGURE 3.2: Categorization of GMAs 1997 and today*.



* The number of GMAs has increased from 32 in 1997 to 36 in 2007 as new GMAs have been added.
Source: Compiled by authors.

E. HABITAT TRANSFORMATION IN GMAs

Even more important than wildlife is the availability of natural habitat to support wildlife. It is therefore essential to analyze its status. Although there is very little readily available information to show a clear picture of the condition of the range and how much of it in spatial terms remains in each GMA, a snapshot survey shows that the habitat is shrinking due to increased settlements and cultivation.

Encroachment induced by traditional claims to land or by uncoordinated planning by government departments are resulting in accelerated loss of habitats. Population increase, hunger, poverty and lack of education fuel poaching, charcoal burning and an extensive slash-and-burn farming system; all are threats to natural habitats, and the emergence of commercial farming is jeopardizing natural habitats, wildlife and other natural resources in Zambia's GMAs.

Over the past decade, law enforcement has generally failed to control the harmful impact of these threats. On the other hand, ZAWA only has authority over wildlife in GMAs and is legally powerless at controlling human settlement and habitat degradation.

F. SETTLEMENT PATTERNS IN GMAs

GMAs attract settlements (see Table 3.2) because of their relatively abundant land and natural resources vital to the sustenance of rural livelihoods – assisted by deliberate attempts at attracting immigrants. The Department of Agriculture has set up farm settlement schemes resulting in extensive human encroachment in Bilili Springs and Namwala GMAs, and Chiefs encourage immigrants to settle as a way to claim authority over lost lands, which has affected Mumbwa GMA in particular.

TABLE 3.2: Percentage of settled and cultivated land for selected GMAs.

GMA	Size (km²)	Size of settled & cultivated land (km²)	%
Bilili Springs	3,080	2,662	86
Mufunta	6,411	1,150	18
Sichifulo	3,600	645	18
Kaputa	3,600	632	18
Kasonso Busanga	7,780	213	5
Mulobezi	3,420	181	3
Lunga Luswishi	13,340	134	1
Nkala	194	0	0
Tondwa	540	0	0

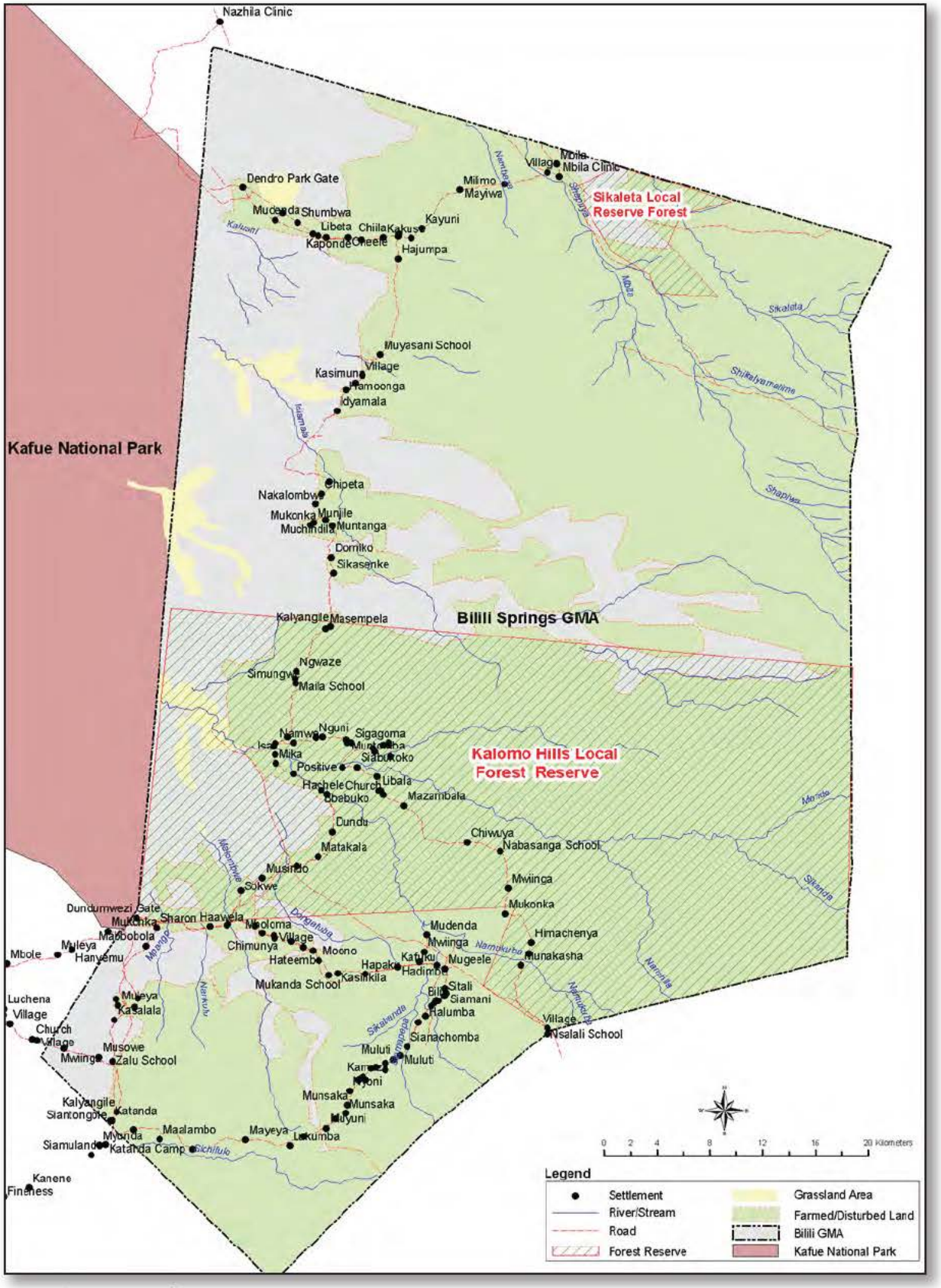
Source: ZAWA Information Department, 2007.

Currently, Bilili Springs is the most heavily settled GMA in Zambia with almost no land left for conservation (see Figure 3.3). Close behind, however, are Namwala, Mumbwa, Sichifulo and Kaputa GMAs. In the latter, the corridor for movement of animals between Mweru Wa Ntipa and Nsumbu National Parks has been completely disrupted by heavy settlements (see Figure 3.4).

Population sizes in GMAs are highly variable, ranging from about 2,000 people in for instance Chisomo GMA, to over 70,000 people in GMAs such as Bangweulu, Kaputa, Musalangu and West Zambezi. GMAs that encompass districts within their boundaries have very large populations and a mixture of rural and urban economies. Examples are Kalabo and Shangombo in Western Province and Chama, Lundazi and Mambwe in Eastern Province.

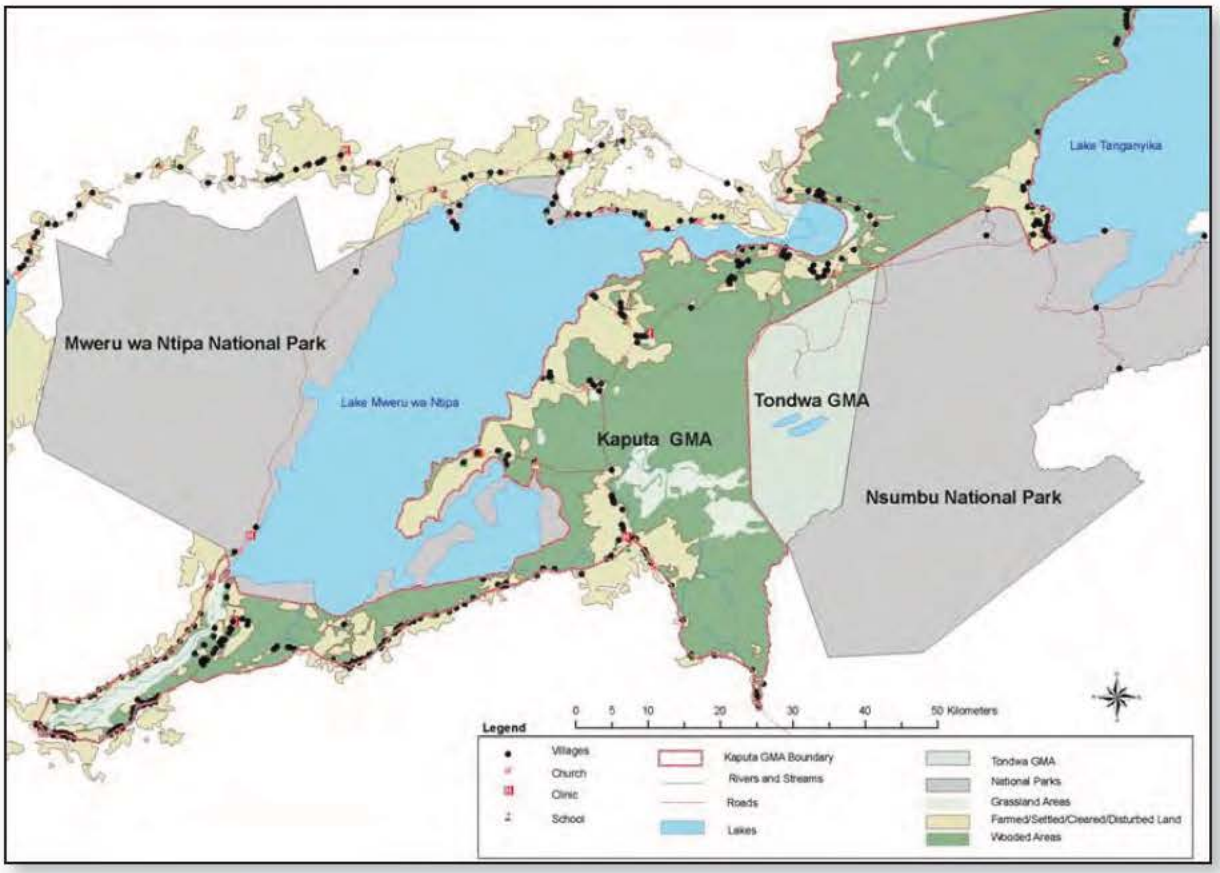
It is interesting to note that the districts with the highest annual population growth rates are either within GMAs or adjacent to GMAs and National Parks. For example, Chongwe adjacent to Rufunsa and Luano GMAs, has an annual growth rate of 3.7%, which is higher even than Lusaka at 3.6%, while the provincial average annual growth rate is 3.5%. Mpongwe near Machiya Fungulwe and Lunga Luswishi GMAs, has the highest annual growth rate on the Copperbelt at 5.2%. Not surprisingly, Machiya Fungulwe GMA is now classified as depleted, while Lunga Luswishi has degraded from prime to secondary status.

FIGURE 3.3: Settlements and distributed farmland in Bilili Springs GMA.



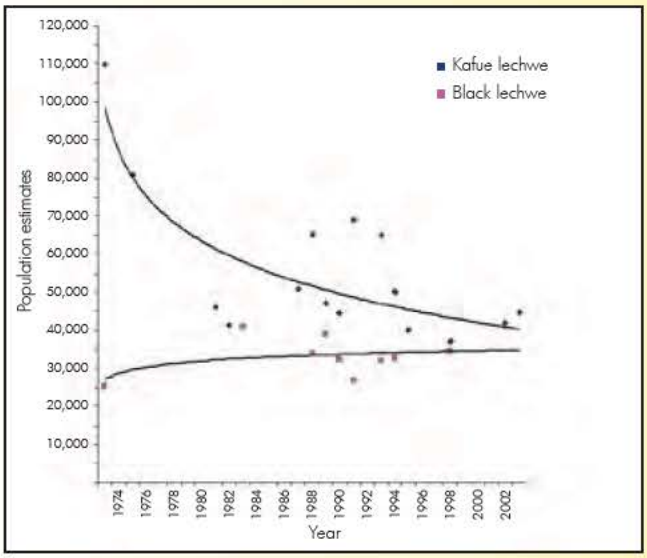
Source: ZAWA, 2006 (b).

FIGURE 3.4: Settlements in Kaputa GMA.



Source: ZAWA, 2007 (b).

BOX 3.1: THE SPECIAL CASE OF THE LECHWE



The decline in the Kafue lechwe population in the Kafue Flats is a cause for concern. Assuming that environmental conditions are not limiting and that natural predation is insignificant it is reasonable to assume an annual 10% increase in population. If the population is stable at 40,000 animals, as indicated in later years, it should increase by 4,000 annually. Since legal off-take has amounted to about 800 lechwe a year, and as there is no evidence of large-scale mortality from disease, it is likely that poaching is responsible for the decline taking more than 3,000 animals per year. In comparison, the Black lechwe population in the Bangweulu Swamps appears to be increasing.

4. SOCIOLOGICAL PERFORMANCE OF GMAs

A. SOCIO-ECONOMIC CHARACTERISTICS OF GMAs

Poverty trends in the Fifth National Development Plan show that 68% of Zambia's population live below the national poverty line earning less than ZMK 111,747 per month with rural small-scale farmers being the poorest. Levels of poverty are highest in remote provinces such as Western, Luapula and North-Western with 83%, 79% and 76% of their populations respectively living below the national poverty line.

The incidence of poverty is highest among female-headed households (see Box 4.1), among large households of seven or more members, and among households where the household head has less than seven years of formal basic education (LCMS, 2004). School attendance rate is lowest among rural small-scale agricultural households and fishing communities (LCMS, 2004).

Data from the Central Statistical Office (LCMS, 2004) confirm that GMA communities have high poverty levels typical of rural small-scale producers with similar characteristics.

B. THE NATIONAL GMA HOUSEHOLD SURVEY

In 2005, the Central Statistical Office conducted a national GMA household survey to determine the impact of nature tourism on poverty in areas close to protected wildlife areas (see Annex 6). The objective was to determine the impact of the current GMA-specific policies and regulations on GMA households (the so-called GMA effect).

The survey compared welfare of communities and households in GMAs with those in non-GMA control areas adjacent to some of Zambia's most visited national parks. Welfare was measured in terms of per capita consumption expenditure (pcexp) comprising food and nonfood consumption, including own produced goods and natural resources collected and consumed. An alternative indicator of welfare is household or per capita income. However, since income is more volatile than consumption and is reported less accurately in surveys, this survey used consumption-based measure of welfare and asset-based measure of wealth and poverty.

The sampled GMAs included Bangweulu, Chambeshi and Kafinda in the Bangweulu system; Kafue Flats North, Kasonso Busanga, Lunga Luswishi and Mumbwa in the Kafue National Park system; Chiawa and Rufunsa in the Lower Zambezi system; and Chisomo, Lumimba and Lupande in the South Luangwa system.

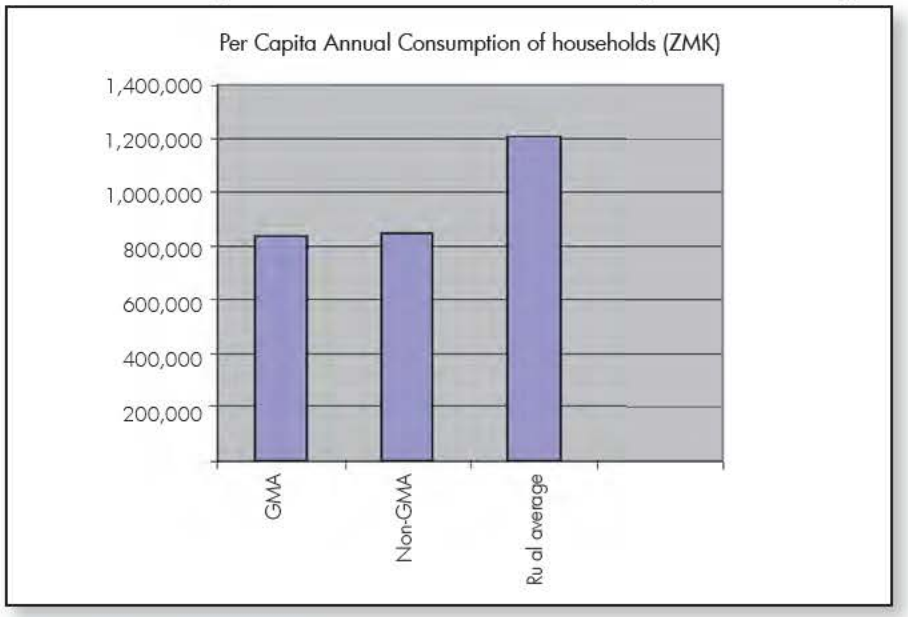
RESULTS OF GMA HOUSEHOLD SURVEY

Even if nature tourism contributes significantly to the country's economy, the GMA household survey demonstrated that the scale of its contribution to poverty alleviation in communities is minor and highly variable from area to area. The survey found that the average annual per capita consumption (PCC) of communities living in GMAs and non-GMAs is ZMK 839,000 (approximately US$ 250) and ZMK 850,000 respectively (see Figure 4.1). In comparison, the Central Statistical Office reports that the average rural community in Zambia has a PCC of ZMK 1.2 million. In other words, the welfare of communities living around national parks is about 70% of the national rural average.

While the survey was unable to provide a statistically sound explanation, it can be inferred that households living around national parks are poorer because they reside in remote areas lacking basic infrastructure. The survey found that each extra kilometer of distance from the nearest all-weather road is associated with 0.5% less consumption welfare for the average household in the sample. The implication is that households in GMAs have limited access to various inputs and output markets as well as public services. Their isolation coupled with the fact that they live in areas of low agricultural potential (one of the reasons why GMAs were demarcated as GMAs) constrain economic productivity and adversely affect household welfare.

Certain GMAs fare better than others. For example, tourism in the Luangwa Valley is contributing significantly to poverty alleviation. After 20 years of community-based natural resources management (CBNRM), the average PCC in the Luangwa Valley is ZMK 1.18 million in GMAs and ZMK 810,000 in non-GMAs.

FIGURE 4.1: Comparison of welfare of households living around national parks with national average.

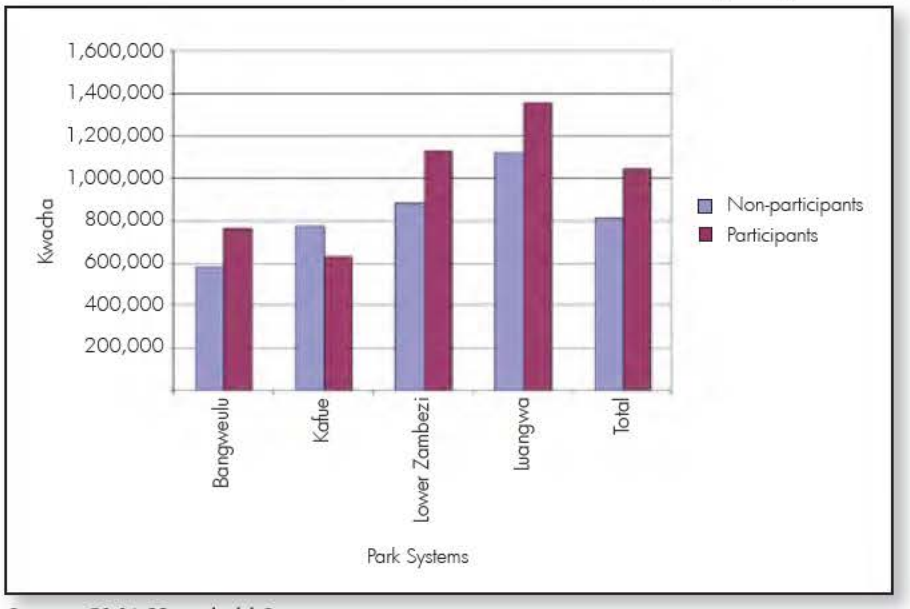


Source: GMA Household Survey.

Hence, nature tourism has some impact on poverty alleviation. Interestingly, this becomes even more obvious when statisticians analyze what the PCC would have been if a GMA had not been established. This analysis shows that communities currently living in GMAs would have had a PCC of about ZMK 280,000 if their GMA did not exist. In other words, they would have been much worse off.

Welfare is also related to participation in community organizations. Figure 4.2 shows the differences in per capita consumption expenditure between households participating in VAGs and CRBs (used as a proxy for participation in CBNRM activities) and those that do not. The welfare of the non-participating households is slightly lower than that of the participating households in all park systems except Kafue.

FIGURE 4.2: Differences in welfare between households participating or not in VAGs/CRBs.

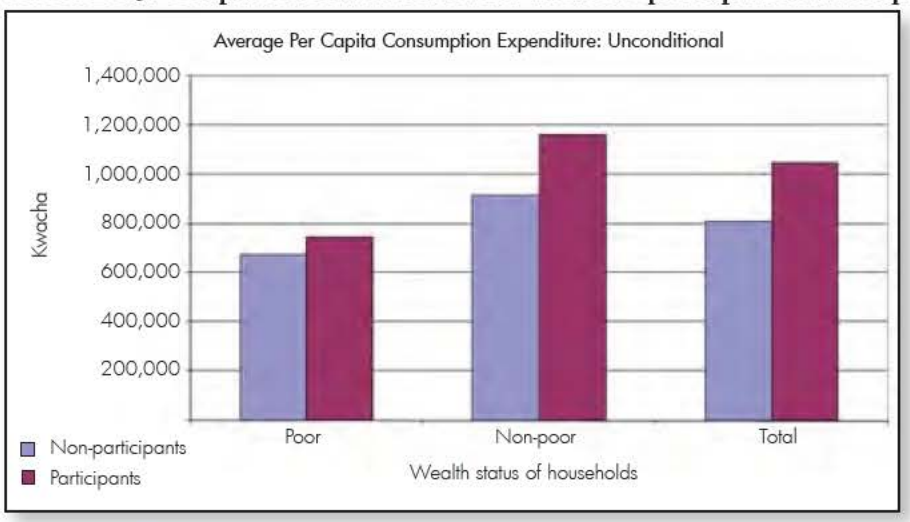


Source: GMA Household Survey.

The survey found that the level of participation in VAGs and CRBs is influenced significantly by the level of education of members of the household. A household that is involved in other co-operatives in the GMA is more likely to participate in VAGs and CRBs. Non-poor households, i.e. with high consumption and owning many assets, are more likely to have a member participating in VAG and CRB activities than poor households.

Although all households with a member engaged in VAGs/CRBs gain from this participation, Figure 4.3 shows that the non-poor are getting substantially larger benefits than the poor. Non-poor households would be significantly worse off if they did not have a household member participating in VAG/CRB activities.

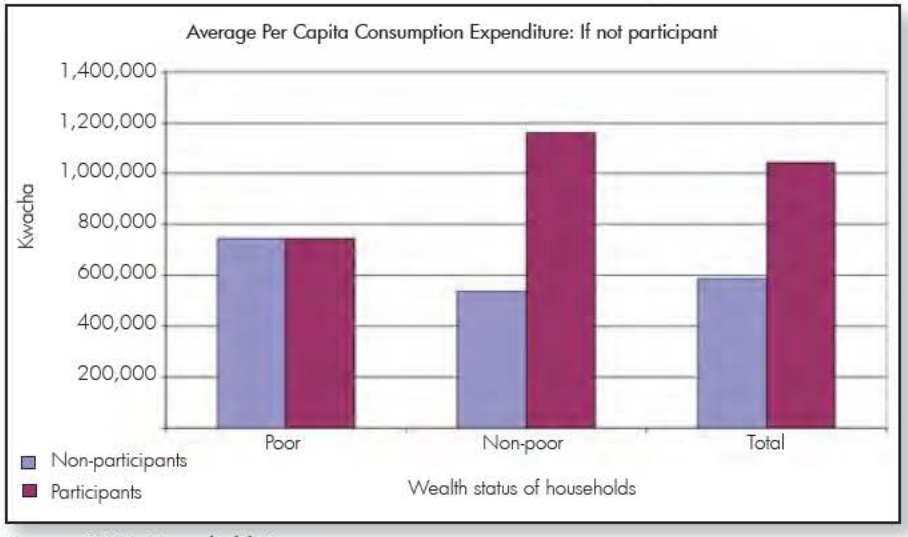
FIGURE 4.3: Comparison of welfare between VAG/CRB participants and non-participating households.



Source: GMA Household Survey.

Figure 4.4 shows how the welfare of households that participate in VAGs/CRBs would be if the same households were not participating in these activities. While there is virtually no change in welfare among poor households, the non-poor households would lose more than half of their current consumption welfare level.

FIGURE 4.4: Welfare of the <u>same</u> households whether they participate or not in VAGs/CRBs.



Source: GMA Household Survey

The survey concluded that benefits from participating in VAGs/CRBs are captured by the elite and relatively non-poor stratum of the community. The elite capture of benefits is supported by audit reports of some CRBs, which show that large proportions of CRB funds are spent on travel allowances, accommodation and meeting costs.

BOX 4.1. FEMALE-HEADED HOUSEHOLDS IN GMAs

The survey found that 28% of GMA households are female-headed compared to 22% in non-GMAs. Furthermore, female-headed households living near national parks, either in GMAs or in non-GMAs, on average enjoy 19% less per capita consumption than male-headed households. When considering GMA households only, the loss in welfare attributable to female headedness is slightly lower at 15 percent. The reasons for these discrepancies were discussed at three regional stakeholder consultative workshops in Mpika, Mfuwe and Mumbwa. Several hypotheses emerged from these discussions:

- Higher rates of polygamous relationships in remote areas such as GMAs may result in higher incidences of female-headed households if different wives live in separate households.
- Male heads may be spending long periods away from home while engaging in poaching resulting in the house being headed by the female spouse. The survey data were unable to provide useful information about illegal hunting as an economic activity.
- Relatively long periods of separation during male head's absence in GMAs may result in higher divorce rates.
- Higher rates of promiscuity in the GMAs may have resulted in more males dying mainly due to HIV/AIDS related causes leaving their widows as household heads.
- Lower levels of education for girls in GMAs may be responsible for more teenage pregnancies and single-mother families. The more educated men may leave GMAs in search of better economic opportunities leaving female-headed families behind.

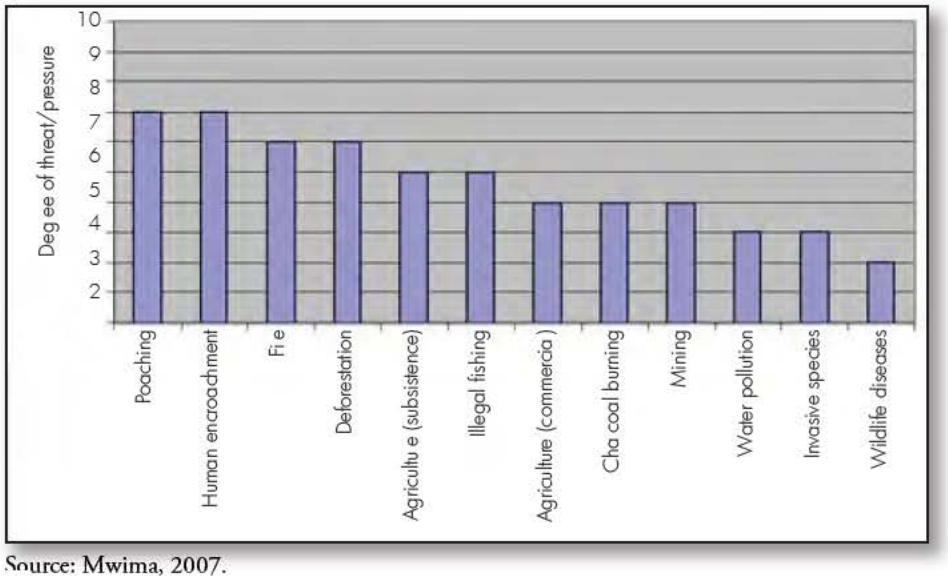
Some of these hypotheses are testable with the survey data and future research may provide explanations that will enable policy-makers to target this disadvantaged group of households.

5. FACTORS AFFECTING THE PERFORMANCE OF GMAs

A. IDENTIFICATION OF THREATS

Mwima (2007) has analyzed the management effectiveness of Zambia's protected areas. The degree of threats and pressures was based on scores ranging from 1 (not very serious) to 10 (very serious). The outcome of the analysis of all Zambia's GMAs is presented in Figure 5.1. It confirms that the most serious problems are poaching, human encroachment, fire, deforestation, subsistence agriculture and, not the least, illegal fishing. These threats emanate from a combination of factors analyzed in subsequent sections.

FIGURE 5.1: Assessment of threats and pressures in GMAs.



Source: Mwima, 2007.

B. UNSUSTAINABLE LIVELIHOOD ACTIVITIES

Poverty in GMAs is linked to a high incidence of conflicts between humans and wildlife. Firstly, conflicts result in loss of human lives. In 2005, a total of 56 people were killed by wild animals with crocodile (34 victims), hippo (12), elephant (7), lion (2) and hyena (1) taking the largest tolls. Secondly, crops are destroyed, which lead to low agricultural productivity. Food insecurity is high in some GMAs, particularly those with populations of elephant and hippo such as Chiawa, Luano, Rufunsa and West Zambezi GMAs as well as GMAs of the Luangwa Valley. Livestock productivity suffers in several ways, as domestic animals compete for grazing and water resources, are susceptible to disease outbreaks and get killed by carnivores.

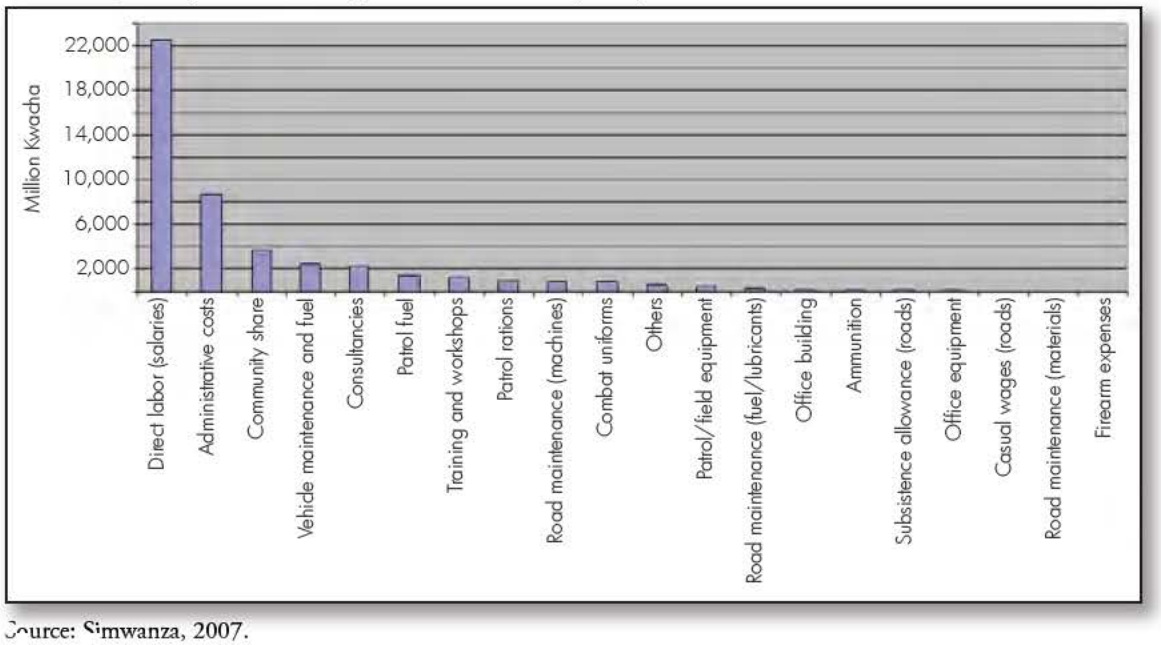
In this context, it is not surprising that local communities generally are indifferent towards conservation efforts due to lack of tangible benefits from their natural resources. As demonstrated in earlier chapters of this report, the lack of formal jobs, income-earning opportunities, access to markets and general lack of economic development has driven people to exploit readily available natural resources. Food insecurity attributed to floods, poor soils, poor farming practices, poor support services and poor performance of the liberalized marketing system has compounded the problem of poaching, creating conditions where a growing number of people are relying on illegal use of wildlife to make up for livelihood shortfalls.

Another cause of habitat destruction is commercial charcoal production. Without alternative sources of income, charcoal has become one of the most popular ways of generating income by taking advantage of the ready markets in urban centers. Mumbwa, Namwala and Rufunsa GMAs are the worst affected.

C. LOW MANAGEMENT PERFORMANCE

In 2006, ZAWA's expenditure for National Parks and GMAs totaled ZMK 47 billion. About 8% of the expenditure went to CRBs as their share of community funds (Simwanza, 2007). In short, about 8% of ZAWA's budget is spent in GMAs in spite of the fact that these generate more than 50% of ZAWA's revenues and constitute more than 70% of the land under their stewardship (Simwanza, 2007). ZAWA spend most of its money on salaries and other administrative costs amounting to 48% and 19% respectively of its expenditure in 2006 (see Figure 5.2).

FIGURE 5.2: Expenditure components for ZAWA (2006).



Source: Simwanza, 2007.

The consequences of insufficient financing in GMAs become obvious when analyzing the management effectiveness of protected areas (Mwima, 2007). Based on six management functions, including context, planning, inputs, processes, outputs and outcomes, the analysis suggests that only three GMAs (in order of descending management effectiveness): Lupande, Chiawa and Sandwe, meet the minimum requirements. This situation is exacerbated by the lack of GMA management plans. The management of wildlife and habitat in GMAs is only enforceable with a management plan prepared by the CRBs and approved by the ZAWA Board. As of now, only a few GMAs have a draft Management Plan, for example Mukungule, Namwala and Nkala, but none has been approved by the ZAWA Board.

D. UNCOORDINATED GOVERNANCE

While the conservation and use of wildlife in GMAs are regulated by law, the land that supports these activities is not. The land itself can be alienated by Chiefs and district authorities. Land held under leasehold title within the boundaries of a GMA is excluded from the GMA except by consent of the leaseholder according to the Wildlife Act. With the liberalization of land acquisition, parcels of land are being acquired in GMAs for farms and lodges, and lack of coordination has made it difficult for ZAWA to manage the situation.

The lack of broad development in GMAs is further caused by the absence of District Development Plans that integrate all of a district's land and resources.

Better integrated planning may also help to address the political interference in the management of protected areas. Politicians sometimes tolerate unlicensed use of resources by local people, and they influence decision-making processes thereby preventing managers from making technically correct decisions.

6. COMPARATIVE ANALYSIS OF CBNRM PROGRAMS

In Southern Africa, Community-based Natural Resources Management (CBNRM) started in the 1980s with the support of donors. CBNRM is based on the assumption that communities will manage wild resources sustainably if these resources provide direct and significant benefits surpassing gains from alternative land uses.

A. ZIMBABWE: CAMPFIRE

In Zimbabwe, the Communal Areas Management Program for Indigenous Resources (CAMPFIRE) has decentralized wildlife management by bestowing appropriate authority on rural district councils (RDCs) through a legislation change. CAMPFIRE revenues were derived from trophy hunting of big game including elephant. Revenue from hunting fees goes to the RDCs, which distribute a portion to the Ward Development Committees or the Village Development Committees and/or individual households as determined by the RDC policy. Each RDC determines its own policy for use and distribution of funds, and direct payments to households vary depending on the RDC policy and the capacity to earn substantial revenues.

The CAMPFIRE Association, a grouping of NGOs, the University of Zimbabwe's Centre for Applied Social Sciences and Government ministries and departments play various roles such as advocacy, information dissemination, research and coordination. Success is measured in increase in wildlife populations, retention of habitats and financial revenues from hunting and lodges.

One of the biggest challenges to CAMPFIRE is to deliver convincing benefits to households. While the RDCs get between 50% and 90% of revenues amounting to thousands of US Dollars, each households would receive as little as US$1 to US$3 per year (Campbell, 2000). Furthermore, the councils represent broad spectrums of political and economic interests, which tend to overshadow the interest of wildlife producer communities.

B. BOTSWANA: TRUSTS

In Botswana, CBNRM is implemented on tribal lands which are administered by District Land Boards. Communities can obtain the right to engage in resource utilization in Controlled Hunting Areas by fulfilling requirements set by government, which include: (1) forming a legally registered community-based organization such as a trust, society or cooperative; and (2) having defined membership.

The common legal entity on tribal lands is the Community Trust. In a trust, members or trustees hold interest in the property but are subject to an equitable obligation to use or keep the property for the benefit of the beneficiary group. Trusts members include all adult village residents who have resided in the local area for at least five years. Community Trusts are reported to have been successful at managing local natural resources due to their strong legal status, flexibility and democratic principles. Furthermore, they comprise a suitable forum for education and training of communities.

Success is recorded in decreased resource degradation, income-generation for local development and increased livelihood opportunities for participating households. The disadvantages are mainly associated with lack of education, training and skills among trust members to perform responsibilities of institutional management, particularly financial and technical aspects.

C. NAMIBIA: CONSERVANCIES

In Namibia, CBNRM is implemented in conservancies formed by resident communities. The Nature Conservation Amendment Act of 1996 granted communities the rights to utilize, manage and benefit from consumptive and non-consumptive use of wildlife within these communal lands in order to complement their existing land uses and livelihoods. The conservancies are implemented in partnership between different levels of government, non-governmental organizations, private sector and rural communities.

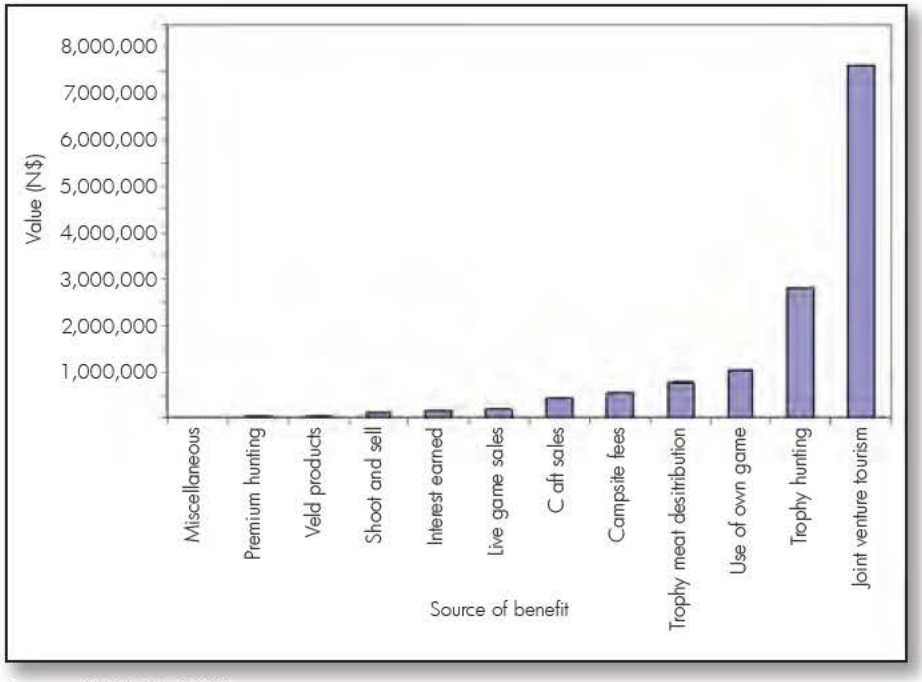
Successes include an increase in wildlife populations, increased economic benefits to local people and direct and indirect contribution to the national economy. Accordingly, more communities are attracted to form conservancies. In 2005, there were 44 registered conservancies managing more than 10.5 million hectares or 35% of all communal land in Namibia, and 26 other communities are at various stages of forming conservancies (NACSO, 2006).

Two factors have been important to the success of this model: (1) assistance from international community; and (2) rapid growth in the tourism industry coupled with a government policy emphasizing that local communities should have rights over major tourism activities (NACSO, 2006). The growth enabled the establishment of new trophy hunting concessions, lodges and campsites.

The Namibian government is now striving to further increase the economic impacts of CBNRM for the poor by revising wildlife legislation and introducing new policies on concessions, parks and neighboring communities and human/wildlife conflicts.

Namibian conservancies provide a model of progressive diversification of wildlife utilization (See Figure 6.1). Income comes mainly from community/private joint venture tourism and to a lesser degree use of own game, trophy hunting, campsite fees and craft sale. In fact, joint venture tourism represents 56% of all conservancy income, as conservancies will negotiate a levy or income-sharing agreement with all camps and lodges in their areas. In addition some benefits are non-financial such as meat from hunting or other contributions (computers, education materials, equipment, etc.) to local or economic development activities, primarily made by joint venture partners.

FIGURE 6.1: Main sources of benefits in Namibian conservancies in 2005.



Source: NACSO, 2006.

D. LESSONS FROM NEIGBORING COUNTRIES

Valuable lessons can be learned from the CBNRM efforts in Zambia's neighboring countries:

- These countries have deliberate policies to empower communities to manage wild resources themselves and participate in the hunting and tourism industry.
- Community structures are registered legal entities under 'common law' with clearly defined membership.
- Community structures have defined user rights exercised in a well-defined geographical area.
- Rights are granted to community structures upon fulfilling requirements set by government.
- Collaboration with external private or NGO partners enhances the capacity to harness knowledge, financial resources and market linkages as well as optimizes businesses practices for effective management.
- Decentralization to community structures is not effective without capacity building.
- When local authorities or local governments have wider mandates than wildlife or tourism they become a disincentive for conservation in communities.
- Diversification through tourism development and other forms of natural resources use, in addition to hunting, increases community income.
- Research on benefit sharing and impacts on livelihoods is necessary to adapt policies and devise strategies that bring genuine and more equitable distribution of wealth.
- Economic activities in remote wildlife areas require extra incentives to stimulate growth.
- Conservation areas are more likely to succeed when their establishment is initiated by the community.

E. LESSONS FROM ZAMBIA

The GMA household survey (discussed earlier in this report) along with most financial models examining CBNRM indicate that farming is more profitable and benefits more households than CBNRM. **The lesson here is that CBNRM cannot succeed unless it is combined with other non-conservation-related economic activities, which themselves are optimized as a consequence of CBNRM**. The COMACO experience (see Section 1.D) makes Zambia a pioneer in the reconciliation of the two.

When shared between community members, revenues from wildlife are negligible. In fact, as shown by the GMA household survey, in most GMAs wildlife revenues do not balance the opportunity cost of farming; these communities are the poorest in Zambia. **The lesson here is that more economic opportunities must be identified.**

With the population on the increase and the associated need for agricultural land, the land management system in the current GMA model has failed. **The lesson here is that the Government of Zambia must introduce a much stronger legal status of land in GMAs that guarantees the preservation of natural habitat**.

Under ADMADE, ZAWA's predecessor, National Parks & Wildlife Service, allocated funds to the management of understocked GMAs from revenues made in prime GMAs. Furthermore, community institutions were provided with technical assistance, and qualified staff and community representatives were recruited through extensive networking both within the country and with projects abroad. **The lessons here are on the importance of an external regulatory mechanism for accountability and good governance in community structures.**

The GMAs in the Luangwa Valley have performed way beyond all others in terms of wildlife population, commercial revenues and community welfare. The main difference between the valley and other areas of Zambia is the long-term involvement of various cooperating partners, NGOs and private investors. **The lesson here is the importance of long-term involvement of a critical mass of assistance.**

Newer approaches (see Section 1.F) have successfully combined land use planning, active conservation, livelihoods support at household level and market integration of local income-generating activities with positive results for both conservation and welfare improvement. A combination of the land use planning and institution building proposed through the reclassification project as well as the community market approach proposed by the COMACO is emerging as a good combination which deserves the full attention of researchers and decision makers.

7. A WAY FORWARD

A. CONCLUSIONS

Zambia has set aside vast tracts of land in the form of GMAs for wildlife management. However, in the process rural communities have been disadvantaged by wildlife management policies that limit their participation in the management of natural resources and by the general lack of economic development in their areas. In addition, the policies have failed to uphold the objectives for which GMAs were established in the first place, i.e. to act as buffer zones to national parks while at the same time supporting a viable hunting industry capable of contributing to the national economy. GMAs have therefore failed to fulfill their purpose for a variety of reasons described below.

While the Zambian Government has accepted CBNRM approaches that provide rural communities with secure tenure of their natural resources, the commitment to develop appropriate supporting legislation and technical capacity has been lacking. In fact, even where legislation is in place, rights of access to and use of natural resources have not been clearly defined. Communities have not received the necessary assistance to develop capacity to independently manage their activities. The result is that communities are unable to realize the optimal benefits from the wealth of resources on their lands.

Until now the commercial use of wildlife has focused on hunting, with international trophy hunting accounting for most of the income in GMAs. Only about 10 out of 36 GMAs have tourist lodges – although they lack the mechanisms for revenue sharing. Unfortunately, the Zambian safari hunting industry is under-performing compared to other countries in Southern Africa, and employment figures in both consumptive and non-consumptive tourism are insignificant.

GMAs are characterized by high poverty levels well above national level. Despite community development interventions in the wildlife sector, the general welfare status has not improved. Beneficiaries of wildlife management policies are those community members who are actively involved in CRBs and their management, but as these organizations are dominated by the elite in the community, who are already relatively well off, the benefits of wildlife management policies are inequitable distributed. In short, the poor continue to be left out.

Furthermore, GMAs have poor infrastructure, schools and health facilities, and faced with these disadvantages, GMA communities continue to experience depressing effects of wildlife management policies that are restrictive to agricultural development and alternative use of natural resources.

These policies together with an economic development skewed to urban areas have contributed to the degradation of GMAs in general and the depletion of wildlife in particular, as wildlife management not necessarily is the communities' preferred land use option.

Experiences from other Southern African countries demonstrate that CBNRM can contribute to poverty reduction in GMAs, provided it is effectively implemented through an integrated approach and facilitated by an enabling policy environment with adequate support for implementation.

B. POLICY RECOMMENDATIONS

The authors of this report recommend identifying and developing a new wildlife management policy with sufficient flexibility to respond to the specific needs of people in specific areas by being able to address different socio-economic, cultural and environmental conditions. An enabling policy environment would include: (1) economic incentives for communities; (2) emphasis on results; and (3) mobilization of stakeholders according to their comparative and competitive advantages. The revision should among many other issues consider the following:

EXPLORE PARTNERSHIPS

Public Private Partnerships (PPPs) added various community associations are now part of the government's policy in natural resources management. However, their success requires improvements to existing and sometimes outdated policies and legal frameworks.

Legislation should establish an unequivocal incentive framework to stimulate communities to contribute to, and appreciate, the objectives of the partnerships. Furthermore, it should provide for a clearer definition of communities' rights to natural resources, and this improved security of tenure should be legally enshrined in the agreements and policies.

While private partners in PPPs may bring in capital, government must boost its investment into infrastructure such as roads and basic services such as schools and health centers to make GMAs attractive to private sector investors.

The policy framework for partnerships should be formulated through a consultative process involving a cross-section of stakeholders.

BUSINESS-ORIENTED APPROACH

While donors will continue to support some activities, such investments are rarely long-term enough to allow methodologies to mature and local capacity to be installed. Rather a business-oriented approach should be adopted in order to guarantee continued investments into community development activities.

Accordingly, local people must be encouraged to engage in business. Government has expressed concerns about the low level of community participation in past efforts, but a recently enacted law, the Zambia Citizen's Empowerment Act, is expected to enhance local participation in business.

LEGALIZED COMMUNITY STRUCTURES

Community participation must be formalized through legal entities at community level. Community structures should be registered under the relevant legislation to grant them legal status enabling them to deal with other entities as equal partners and enter into legally binding agreements.

Resource ownership should only be given upon a community showing proof of interest, capacity and the means to assume responsibility for the management of the resources. As such, communities must define their boundaries, membership, roles and responsibilities, produce action plans and define benefit-sharing mechanisms.

Upon fulfilling laid down conditions, they should be granted rights to natural resources in their areas. Devolved rights should also include adequate authority and responsibility for the management, benefit and disposal of resources within agreed frameworks as well as the right to exclude others who are not defined participants.

DIVERSIFICATION AWAY FROM WILDLIFE

A new wildlife management policy must address communities' access to other natural resources than wildlife, which the majority of poor households depend upon. The policy should provide all recognized community structures with rights to all resources in their area of jurisdiction. Apart from harmonization of legislation, the policy should also harmonize approaches and provide for improved coordination.

Government has prioritized the agricultural sector as a vehicle for reducing rural poverty and is providing incentives for agricultural development. This agricultural expansion however should be implemented in a manner that does not compromise the objectives of GMAs.

ZONING AND RECLASSIFICATION

The need to diversify economic activities in GMAs calls for new approaches to land use. This may even justify the reclassification of some GMAs. As a minimum land use or management plans will have to be implemented to ensure that wildlife habitats are better safeguarded and non-habitat parts of the GMA are released for other economic activities, which are currently restricted such as intensive market-oriented livestock and crop production or rearing of small game animals. Restricting essential economic activities for the sustenance of local people simply worsens the prevailing poverty conditions.

MANAGEMENT PLANS

The economic activities in GMAs should be outlined in integrated management plans to ensure that they are compatible with wildlife conservation in the long term. Management Plans may provide suitable planning instruments for selection of profitable enterprises with low environmental impact. Community structures should be granted enough authority to control access and use of all natural resources within their areas of jurisdiction within the agreed management or land use plan.

ZAWA: IMPLEMENTER OR REGULATOR?

The sheer scale of managing a wildlife estate that includes 19 national parks and 36 GMAs covering more than 30% of the country's territory is daunting. As ZAWA only maintains the national parks with difficulty, it is not surprising that it can allocate very little of its budget and human resources to GMAs. In short, the task given to ZAWA is too ambitious for a single institution unless its function evolves from *hands on* to regulatory.

Additionally, ZAWA is not the best equipped to implement the community support function required in GMAs. ZAWA's staff comes from a culture of conservation and wildlife management rather than community development. As a consequence, ZAWA tends to allocate its resources to the most pressing conservation needs, which is the surveillance of its national parks.

ANNEX 1.

GAME AND PROTECTED ANIMALS

Game Animals	Protected Animals
Baboon	Aardwolf
Buffalo	Ant Bear
Bushbuck	Antelope, Roan
Bush pig	Antelope, Sable
Cat, Serval	Caracal
Cat, wild	Cheetah
Crocodile	Civet
Duiker, common	Elephant
Duiker, yellow-backed	Genet
Duiker, blue	Giraffe, Thornicroft's
Eland	Hippopotamus
Grysbok	Klipspringer
Hartebeest	Lechwe, black
Honey Badger	Lechwe, Kafue
Hyena	Lechwe, red
Impala	Monkey, colobus
Jackal	Pangolin
Kudu	Rhinoceros, black
Leopard	Rhinoceros, white
Lion	Sitatunga
Monitor Lizard	Steinbok
Monkey, all species except Colobus	Tsessebe
Oribi	
Otter	
Porcupine	
Puku	
Reedbuck	
Warthog	
Waterbuck, common	
Waterbuck, Defassa	
Wildebeest, blue	
Wildebeest, common	
Zebra	

ANNEX 2.

ZAMBIA ECOSYSTEMS WITH ASSOCIATED NPs AND GMAs

Ecosystem	NP	Size (km²)	GMA	Size (km²)
Bangweulu	Lavushi Manda	1,500	Bangweulu	6,474
	Isangano	840	Kafinda	3,860
	Kasanka	390	Mansa	2,070
			Luwingu	1,090
			Kalasa Mukoso	675
			Chambeshi	620
Kafue	Kafue	22,400	Lunga Luswishi	13,340
			Kasonso Busanga	7,780
			Mufunta	6,411
			Sichifulo	3,600
			Namwala	3,600
			Mulobezi	3,420
			Mumbwa	3,390
			Bilili Springs	3,080
			Machiya Fungulwe	1,530
			Nkala	194
Kafue Flats	Blue Lagoon	450	Kafue Flats	5,175
	Lochinvar	410		
Lower Zambezi	Lower Zambezi	4,092	Luano	8,930
			Rufunsa	3,179
			Chiawa	2,344
Luangwa	South Luangwa	9,050	Musalangu	17,350
	North Luangwa	4,636	Lumimba	4,500
	Lukusuzi	2,720	Lupande	4,480
	Luambe	254	West Petauke	4,140
	Nyika	80	Chisomo	3,390
			Munyamadzi	3,300
			Mukungule	1,900
			Sandwe	1,530
Mweru Wa Ntipa	Mweru Wa Ntipa	3,134	Kaputa	3,600
	Nsumbu	2,063	Tondwa	540
	Lusenga Plains	880	Inangu	43
West Lunga	West Lunga	1,684	Musele Matebo	3,700
			Lukwakwa	2,540
			Chizera	2,280
			Chibwika Ntambu	1,550
West Zambezi	Sioma Ngwezi	5,276	West Zambezi	38,070
	Liuwa Plain	3,660		
Mosi-oa-Tunya	Mosi-oa-Tunya	66		

ANNEX 3.

2007 HUNTING CONCESSIONS IN ZAWA'S HUNTING BLOCKS

GMA	Hunting Block	Classification of Hunting Block	Safari Hunting Operator	CRBs
Nkala & Bilili Springs	Nkala/Bilili	Prime	Nsonga Game Management & Lodges	Shezongo, Musungwa
Namwala	Namwala	Understocked	Nsonga Game Management & Lodges	Kaingu, Chilyabufu, Shimbizhi
Lumimba	Chanjuzi	Prime	Muchinga Adventures	Kazembe, Chitungulu
	Mwanya	Prime	SOFRAM	Mwanya
Tondwa	Tondwa	Understocked	SOFRAM	Nsama
Mulobezi	Mulobezi	Prime	Steel Fabricators	Moomba
Kasonso Busanga	Kasonso Busanga	Prime	Hunters and Guides	Mubambe
Chibwika Ntambu	Chibikwa Ntambu	Understocked	Hunters and Guides	No CRB
Munyamadzi	Luawata	Prime	Luawata Conservation Ltd	Nabwalya
	Nyampala	Prime	Re-advertised	Nabwalya
Sandwe	Sandwe	Secondary	Sable Transport	Sandwe
Chisomo	Chisomo	Understocked	Sable Transport	No CRB
Lupande	Upper Lupande	Prime	Mangomba Safaris	Nsefu, Jumbe, Mkhanya
	Lower Lupande	Prime	Kwalata Safaris Ltd	Malama, Msoro, Kakumbi
West Zambezi	West Zambezi Upper	Secondary	Maningi Safaris	No CRB
Musalangu	Chifunda	Prime	Luangwa Crocodile Safaris	Chifunda
	Chikwa/Fulaza	Secondary	Wild Cat Safaris Ltd	Chikwa
Chizera	Chizera	Understocked	Wild Cat Safaris Ltd	No CRB
Lunga Luswishi	Lunga Busanga	Secondary	African Experience	Kasempa
	Lunga Lushwishi	Secondary	Pro Hunt Zambia Ltd	Kasempa
West Petauke	West Petauke	Prime	Mbeza Safaris Ltd	Nyalugwe, Luembe
Luano	Luano	Secondary	Agro Fuel Ltd	Shikabeta
Rufunsa	Rufunsa	Understocked	Nyampala Safaris	Mphuka, Mpanshya, Mburuma
Mumbwa	Mumbwa	Prime	Swanepoel & Scandrol Safaris	Kabulwebulwe, Chibuluma, Mulendema
Sichifulo	Sichifulo	Prime	Alfa Recreational Safaris	Nyawa, Siachitema
Mukungule	Mukungule	Secondary	Baobab Safaris	Mukungule

ANNEX 4.

PARTNERSHIPS WITH NON-GOVERNMENTAL ORGANIZATIONSs

Organization	Area of assistance	Activities
African Parks	Liuwa NP, Upper West Zambezi GMA	Resource protection; community development
Conservation Lower Zambezi	Lower Zambezi NP, Chiawa GMA	Resource protection; conservation education
Conservation Foundation	South Luangwa NP, North Luangwa NP, Nyika Plateau NP, Kasanka NP, ZAWA HQ	Support to NGOs such as FZS, Kasanka Trust, South Luangwa Conservation Society; scout training; rhino translocation to North Luangwa National Park; Rehabilitation of airstrips and park building infrastructure
Kasanka Trust	Kasanka NP, Kafinda GMA, Bangweulu GMA	Resource protection; conservation education; community development
Frankfurt Zoological Society	North Luangwa NP, Musalangu GMA, Mukungule GMA	Resource protection; area rehabilitation by translocation of animals; conservation education; community development; CRB capacity building
South Luangwa Conservation Society	South Luangwa NP, Lower Lupande GMA	Resource protection; CRB support; resource monitoring; rescue/ treatment of injured animals
Wildlife Conservation Society	Rufunsa GMA, Lupande GMA, Lumimba GMA	CRB training; household income generation agricultural based; market linkages; rehabilitation of poachers
African Wildlife Foundation	Chiawa GMA	Community capacity building; human/wildlife conflict prevention strategies
Worldwide Fund for Nature	Kafue Flats GMA, Mwanachingwala Conservancy, Mukungule GMA, Bangweulu GMA	Facilitate private sector/community partnerships; animal translocation; resource protection; infrastructure development; livelihoods support; community capacity building

ANNEX 5.

CURRENT STATE OF WILDLIFE IN ZAMBIA'S 36 GMAs

Bangweulu (including Chikuni): Located between the border of the DRC in the west and the Luangwa Valley in the east. Home to the endemic black lechwe, sitatunga and tsessebe. Black lechwe numbers increased from about 15,000 in 1970 to about 40,000 in 1980. Since 1980, numbers have continued to increase.

Bilili Springs: Shares its boundary with Kafue NP on the south-east. Depleted and taken over by settlements.

Chambeshi: Located to the south of Isangano NP. Depleted.

Chiawa: On the western boundary of the Lower Zambezi NP with an escarpment to the north and the Zambezi River to the south. Appreciable numbers of elephants, buffalo and impala. Elephants move back and forth across the river into Mana Pools in Zimbabwe.

Chibwika Ntambu: Located to the north of the West Lunga NP. An intact Miombo habitat, but nevertheless depleted of wildlife.

Chizera: In the Chizera District, this is one of the very few GMAs that do not provide a buffer to a national park. Animal numbers are low and include sitatunga, kudu, bush pig, waterbuck and reedbuck.

Inangu: A small peninsula in Lake Tanganyika projecting out of Nsumbu NP. The smallest GMA in Zambia at 43 km2. Relatively rich in wildlife as it forms the most secure part of the Nsumbu estate. Elephant, waterbuck, puku, bushbuck and impala occur while a few other species are reported.

Kafinda: Due south of Bangweulu GMA. In spite of its low densities of wildlife it remains an important wetland area. Small numbers of black lechwe and sitatunga.

Kafue Flats: Due east of the Kafue National Park and one of the most important wetland areas in the country. Although both legal and illegal off-take have thinned out the population of Kafue lechwe, relatively large numbers of this unique antelope still remain, in addition to small numbers of Burchell's zebra, buffalo and wildebeest.

Kalasa Mukoso: To the west of Bangweulu GMA. Black lechwe survives in the area.

Kaputa: One of the most settled GMAs in Zambia with few or no wildlife except for animals in transit from Tondwa GMA and Nsumbu NP into Mweru Wa Ntipa NP.

Kasonso Busanga: Due north of Kafue NP. Its varied ecosystems, ranging from swamps, floodplains and dambos to dense Miombo woodlands, support a wide variety of wildlife. Large numbers of sitatunga occupy the swamps and floodplains, red lechwe survive on the floodplains, while the rare blue duiker and yellow-backed duiker occur in the woodlands together with the common Miombo species such as roan and sable antelopes and Lichtenstein's hartebeest. Furthermore, buffalo, eland, kudu, Defassa waterbuck and blue wildebeest are relatively common.

Luano: North of Rufunsa GMA, it borders West Petauke GMA to the east. Poaching has reduced animal numbers. Few kudu, warthog, zebra and impala still roam the area.

Lukwakwa: West of West Lunga NP. Has good habitat for woodland species but is generally devoid of game.

Lumimba: On the east bank of the Luangwa River, between Lukusuzi NP in the east and Munyamadzi GMA in the west. Prior to 1997, it contained the best hunting concessions within the Luangwa Valley system but most species have significantly reduced in number and only few animals use the area permanently. The populations of common waterbuck and Cookson's wildebeest have declined to a fraction of those in the early 1970s. Low densities of buffalo, eland, Lichtenstein's hartebeest, kudu, and Burchell's zebra still survive in the area.

Lunga Luswishi: North-east of Kafue NP and the third largest GMA in the country at 13,340 km^2. Sable antelope and roan antelope still occur, while the numbers of other wildlife species are declining.

Lupande: On the east bank of the Luangwa River, adjacent to South Luangwa NP, forming part of the SLAMU operational area. Especially the alluvial part, between the escarpment and the river, supports high densities of most of the common large ungulates, in addition to the main population of Thornicroft's giraffe.

Luwingu: North of Isangano NP. Depleted.

Machiya Fungulwe: East of Lunga Luswishi GMA. One of the neglected GMAs in Zambia. Very little is known about the state of wildlife.

Mansa: This GMA neither shares its border with another GMA nor a national park. Depleted.

Mufunta: To the west of Kafue NP, this GMA was recently gazetted. Not much is known about the state of wildlife but preliminary findings show the presence of sable, kudu, warthog and impala.

Mukungule: On the western boundary of the North Luangwa NP. The upper Muchinga escarpment and its foothills are under the umbrella of Miombo woodlands. Common animals include elephant, buffalo, eland, roan, sable, wildebeest, waterbuck and puku.

Mulobezi: South-west of Kafue NP. Used to be the second-best hunting area within the Kafue National Park system. Now supports low densities of buffalo, Lichtenstein's hartebeest, elephant, sable, roan, eland, kudu, blue wildebeest, Defassa waterbuck and Burchell's zebra.

Mumbwa: On the eastern boundary of the Kafue NP. Munga and Miombo woodlands harbor good densities of roan, sable and Lichtenstein's hartebeest in addition to low densities of elephant, buffalo, eland, kudu, Defassa waterbuck and Burchell's zebra.

Munyamadzi: Its location between North and South Luangwa NPs guarantees a continuous influx of wildlife, especially buffalo. Small numbers of elephant, Cookson's wildebeest, roan, Lichtenstein's hartebeest, common waterbuck and Burchell's zebra.

Musalangu: North-east of North Luangwa NP. Elephant, buffalo, zebra, wildebeest, hartebeest, kudu, puku and waterbuck. It is also a corridor for elephants that move between Malawi and Zambia. Second largest in Zambia.

Musele Matebo: To the east of the West Lunga NP. A good habitat for woodland species but is devoid of game. Small numbers of kudu, bushbuck and reedbuck.

Namwala: North-east of Lake Itezhi-tezhi on the boundary of the Kafue NP. Small numbers of elephant, buffalo, Burchell's zebra, roan, sable and Lichtenstein's hartebeest roam the Munga and Kalahari woodlands.

Nkala: A small GMA south-east of the Kafue NP. Predominantly Kalahari woodlands supporting low densities of buffalo, roan, sable, Lichtenstein's hartebeest, kudu and Burchell's zebra.

Rufunsa: To the north-east of the Lower Zambezi NP. An important corridor for elephants moving between Zambia and Mozambique. Other common animal species include buffalo, kudu, impala and zebra.

Sandwe: South of South Luangwa NP, this small GMA provides an important corridor for elephants moving between South Luangwa NP and West Petauke GMA. Although security is poor, small numbers of roan antelope, sable antelope, eland and impala still survive.

Sichifulo: Due south of Kafue NP. The Miombo woodlands support good densities of sable, with low densities of elephant, buffalo, eland, kudu, Lichtenstein's hartebeest, blue wildebeest and Burchell's zebra.

Tondwa: Established as a buffer for Nsumbu NP and a corridor for animals moving to and from the park into Kaputa GMA. An annual floodplain provides animals with fresh water and green vegetation almost year round. Waterbuck, puku, bushbuck, sable antelope, roan antelope, sitatunga and impala occur in appreciable numbers.

West Petauke: One of the most scenic areas within the Luangwa Valley, situated south-west of South Luangwa NP and adjacent to Sandwe and Chisomo GMAs. The mountain ranges with their steep slopes and narrow inaccessible valleys provide excellent cover for both elephant and buffalo, two species that are still relatively abundant in the area. Other species that occur at low densities in the valley trough are roan antelope, Lichtenstein's hartebeest, impala and Thornicroft's giraffe.

West Zambezi: A buffer to the Liuwa and Sioma Ngwezi NPs. The largest GMA in Zambia at 38,070 km^2. The plains are home to wildebeest migrating between Liuwa Plains NP and Angola. Other common species include red lechwe and elephant. Red lechwe are reported to move eastwards from Liuwa Plain to the Zambezi flood plain in the dry season.

ANNEX 6.

DATA SUMMARY OF GMA HOUSEHOLD SURVEY

The descriptive statistics for the variables used in the analysis are presented below based on the full sample (Column 1) and non-GMA (Column 2) and GMA (Column 3) sub-samples. About half (49 percent) of all the interviewed households (or 1,289 households) were in non-GMA control areas. Other than pcexp and a couple of distance variables, the rest of the variables are significantly different between non-GMAs and GMAs.

Comparison of factors characterizing households living in GMAs versus non-GMAs:

Variable description	Full sample	Non-GMA sub-sample	GMA sub-sample	
	(1)	(2)	(3)	
Number of sample households	2,649	1,289	1,360	
Per capita consumption expenditure (ZMK)	846,331	853,750	839,359	
Age of household head (years)	42.42	43.6	41.29	***
Female-headed household	25%	22%	28%	***
Education of the most educated household member (years)	6.87	7.45	6.33	***
Number of children below 15 years	2.55	2.66	2.44	***
Number of female members 15-60 years	1.27	1.3	1.24	*
Number of male members 15-60 years	1.19	1.22	1.15	**
Number of adults above 60 years	0.26	0.3	0.23	***
Distance to the nearest all-weather road (km)	5.25	3.58	6.86	***
Distance to the nearest basic school (km)	4.88	4.96	4.8	
Distance to the nearest health center (km)	11.52	11.27	11.77	
Value of consumer durable assets (million ZMK)	0.44	0.58	0.3	***

Significance: *=Significance at 10%; **=Significance at 5%; ***=Significance at 1%

Comparison of factors characterizing communities in GMAs versus non-GMAs:

Variable description	Full sample	Non-GMA sub-sample	GMA sub-sample	
	(1)	(2)	(3)	
Number of sample communities	133	65	68	
Number of projects in the community	2.01	1.84	2.16	***
CRB generated and got funds from ZAWA past three years	9%	5%	14%	***
Household participation in CRB/VAG	9%	6%	13%	***
Household participation in cooperatives	15%	19%	11%	***

Compared to control areas GMA households are characterized by having (1) significantly younger heads of households; (2) higher probability of being female-headed; (3) less educated members; (4) less consumer durables; and (5) they tend to be further away from the main roads and 6) participate less in community-based organizations such as cooperatives. Households that participate in cooperatives have 23.7 percent (GMA sub-sample only) and 35.7 percent (full sample) more per capita consumption expenditure than non-participating households. Female-headed households have 15 percent and 18.6 percent less pcexp than their male-headed counterparts. Larger household sizes are associated with lower welfare levels, regardless of the household composition. This is shown and confirmed by the unambiguously negative effects caused by additional members in all the four age/sex groups. The fact that additional working-age adults (15-60 years) have an adverse effect on welfare may imply that there are limited income-generating opportunities in these areas. However, children under 15 years and old members over 60 years old have greater welfare-depressing effects than the working-age group.

REFERENCES

Ashley C., (2000): The Impacts of Tourism on Rural Livelihoods: Namibia's Experience. Working paper 128. Overseas Development Institute.

Changa Management Services, (2007): Draft Strategic Plan 2008 – 2012, Zambia Wildlife Authority, Chilanga

Child, G. and D. Lee, (1993): Reorganization and Restructuring the Department of National Parks and Wildlife Service, WWF, Lusaka.

Central Statistical Office, (2004): Living Conditions Monitoring Survey Report, Republic of Zambia.

DCDM Consulting, (2006): Livingstone Tourism Survey, Support for Economic Expansion and Diversification Project, Ministry of Tourism, Environment and Natural Resources, Lusaka

Duhnam, M. Kevin & Hopeson I. Simwanza (2002): Aerial Census of Elephants and other Large Herbivores in South Luangwa National Park and Lupande Game Management Area, Zambia: 2002. WWF – SARPO & ZAWA, Occasional Paper.

EDF/National Parks and Wildlife Service Project, (1998): Draft Master Plan, Transtec

Grant Thornton Kessle Feinstein, (2003): Study for Development and Promotion of Tourism in Zambia.

Hachileka Excellent, Chundama M. (1999): The Effectiveness of Benefit Sharing Schemes in Community Based Wildlife Resources Management Programmes in Zambia. Study Fund, Social Recovery Project. Ministry of Finance and Economic Development, Lusaka.

Hamilton, Kirk, Gelson Tembo, Goodson Sinyenga, Sushenjit Bandyopadhyay, Adam Pope, Benjamin Guilton, Besa Muwele, Shaun Mann & Jean-Michel Pavy, (2007): The Real Economic Impact of Nature Tourism in Zambia. NRCF, Lusaka, Zambia. Edited by Camilla Hebo Buus.

Jachmann, H & C. M. Phiri (1999): Aerial Sample Survey of the Central Luangwa Valley, 1999. Animal Abundance, Distribution and Trends 1993 – 1999. Wildlife Resource Monitoring Unit. Environmental Council of Zambia.

Kamweneshe, B., C. Simukonda & E. K. Mwiya (2003): Survey of Large Mammals on the Kafue Flats, Zambia. Zambia Crane and Wetlands Conservation Project.

Manning, IPA (2005): Landsafe Investment Trusts for Customary Land and Protected Areas in Zambia. A preliminary guide prepared for customary leaders, Government and Community Resources Boards. Lusaka.

Ministry of Finance and National Planning, (2006): Fifth National Development Plan, Zero Draft

Ministry of Tourism, (1995): Medium Term Tourism Strategy and Action Plan, Lusaka

Murphy C. and Mulonga S. (2002): A profile of the Livelihoods of People in Two Conservancies in Caprivi. WILD working paper 7. Department for International Development/Namibia Ministry of Environment and Tourism

Mwima, H. K. (2007): Synthesis of completed management effectiveness tracking tool for protected areas managed by the Zambia Wildlife Authority for the year 2007. Report prepared for the Ministry of Tourism, Environment & Natural Resources.

Mwima, H. K. (2006): Wildlife Ecology of the Proposed Mufunta Game Management Area Adjacent to the Kafue National Park. Consultancy Report prepared for WWF Zambia Coordination Office.

NACSO (2006): Namibia's Communal Conservancies: A Review of Progress and Challenges in 2005. Namibian Association of CBNRM Support Organisations, Windhoek.

PHAZ (2006): The Professional Hunters Association of Zambia: Zambia's Top Forty. Trophy Records of Zambian Game Animals. Measurement of the top forty of each species taken in Zambia by safari hunting clients guided by a licenced Professional Hunter from 1983 to 31st December 2006. 6th edition.

Simwanza, H. I. (2007): Financial Viability of Current National Parks and Game Management Areas in Zambia: A Case for 2006 (2007). GRZ / GEF / UNDP funded project for the Reclassification and Effective Management of the National Protected Areas System.

Simwanza, H. I. (2005): Aerial Survey of Large Herbivores in the Zambezi Heartland, Zambia: September 2005. Country Report. A Technical Report submitted to Zambia Wildlife Authority and African Wildlife Foundation.

Simwanza, H. I. (2004): The Kafue Ecosystem: Aerial Survey of Large Wild Herbivores in Kafue National Park and Lunga Luswishi, Kasonso Busanga, Mumbwa, Namwala, Nkala, Bilili, Sichifulo and Mulobezi Game Management Areas, November 2004. A Technical Report submitted to Zambia Wildlife Authority and The Royal Norwegian Embassy, Zambia.

Simwanza, H. I. (2004): Aerial Survey of Large Wild Herbivores in West Lunga National Park and Chizera, Musele Matebo, Lukwakwa and Chibwika Ntambu Game Management Areas: September 2004. A technical Report submitted to Zambia Wildlife Authority and The Royal Norwegian Embassy, Zambia.

Simwanza, H. I. (2004): Aerial survey to establish the status of large herbivores in Upper Luano Hunting Block: August 2004. A document of Zambia Wildlife Authority, ZAWA.

Simwanza, H. I. (2003): Aerial Survey of Large Herbivores in Nsumbu, Mweru Wa Ntipa and Lusenga Plains National Parks, and Tondwa and Kaputa Game Management Areas: November 2003. A Technical Report submitted to Zambia Wildlife Authority and United Nations Development Program. May 2004.

Simwanza, H. I. (2003): Aerial Survey of Large Herbivores in the Zambezi Heartland, Zambia: September 2003. Country Report. A Technical Report submitted to Zambia Wildlife Authority and African Wildlife Foundation.

Simwanza, H. I. (2002): Aerial Census of Selected Large Mammals in Fulaza, Chikwa, Chifunda, Chanjuzi, Luawata and Nyampala Hunting Blocks of the Luangwa Valley, August 2002. A Technical Report submitted to Zambia Wildlife Authority.

Simwanza, H. I. (2001): Status of Wildlife and Hunting in Western Region Presented at workshop for the Western Region: An Inventory of Resources and Management Strategies held in Mumbwa, December 2001.

Sinyenga, G, Muwele, B and Hamilton, K, (2007): Draft Report on The Contribution of Nature Tourism to the Zambian Economy, World Bank, Washington

Sluich, Helen, Jonah Busch and Nathalie Barbancho, (2005): Economic Impacts of Transfrontier Conservation Areas: Baseline of Tourism in the Kavango-Zambezi TFCA, Conservation International, South Africa

Tembo G., Sushenjit P. (2007): Poverty Impact of Nature Based Tourism , draft report. World Bank, Zambia.

Whydah Consulting, (2006): Zambia Nature-based Tourism Supply-Side Survey, World Bank, Lusaka

World Tourism Organization, (2005): Tourism 2020 Vision, Madrid.

ZAWA, GEF, UNDP (2007): Current Protected Area Categories and the Institutions Responsible for their Management in Zambia. GEF/ UNDP funded project on the Reclassification and Effective Management of the National Protected Areas System. Zambia Wildlife Authority, Chilanga, Zambia. Draft Report.

ZAWA, (2007) a: Technical Report on the Rapid Assessment of the Kafue and Kafue Flats Ecosystems. A document of Zambia Wildlife Authority, Chilanga, Zambia.

ZAWA, (2007) b: Report on the Resource Mapping Exercise in the Mweru Wa Ntipa Ecosystem. A document of Zambia Wildlife Authority, Chilanga, Zambia.

ZAWA, (2006) a: Annual Report. Zambia Wildlife Authority, Chilanga.

ZAWA, (2006) b: Wildlife Conservation and Management in Zambia. A document of Zambia Wildlife Authority, Chilanga, Zambia.

ZAWA, (2006) c: Off Take Quotas for the year 2006. A document of Zambia Wildlife Authority, Chilanga, Zambia.

ZAWA, (2005): Annual Report. Zambia Wildlife Authority, Chilanga.

ZAWA, (2004): Annual Report. Zambia Wildlife Authority, Chilanga.

ZAWA, (2004): Audit of Zambia Wildlife Authority's Current Capabilities and Development of Project Proposals for Institutional Capacity Development Over a Five Year Period (2004 – 2008). Grant Thornton Associates Limited. Draft Report. A document of the Zambia Wildlife Authority, Chilanga, Zambia.

ZAWA & WWF (2005): Report on the Aerial Survey of the Kafue Lechwe, Wattled Crane and Cattle on the Kafue Flats, Zambia, 2005.

This publication has been made possible with support from
the Royal Danish Embassy, the Royal Norwegian Embassy, the
United Nation Development Program and the World Bank.

Photographs front page: Francois d'Elbée

Editor: Camilla Hebo Buus

Search for publications, researchers, or questions

Recruit researchers Join for free Log in

The Impact of Wildlife Management Policies on Communities and Conservation in Game Management Areas in Zambia: Message to Policy Makers

Article (PDF Available) *with* 42 Reads

1st Phyllis Simasiku

2nd Hopeson I Simwanza

3rd Gelson Tembo

+1

Last Jean-Michel Pavy

Show more authors

Discover the world's research

- **11+ million** members
- **100+ million** publications
- **100k+** research projects

Join for free



See all ›
20 Citations

Share Download full-text PDF

Download full-text PDF

The Impact of Wildlife Management Policies on Communities and Conservation in Game Management Areas in Zambia: Message to Policy Makers

by
Phyllis Simasiku, Hopeson I. Simwanza, Gelson Tembo, Sushenjit Bandyopadhyay And Jean-Michel Pavy

June 2008 – Published by the Natural Resources Consultative Forum (NRCF)

Introduction

Zambia has set aside vast tracts of land in the form of GMAs for wildlife management. In 1999, the government implemented the 1998 Zambia Wildlife Act as it realized that without viable natural resources, future generations would face increased risks of hunger and poverty, which would compel them to further exploit their diminishing natural resources. The enacted Policy for National Parks and Wildlife in Zambia instituted the concept of Community-Based Natural Resources Management.

Today, it appears that GMA governance through community institutions such as Community Resources Boards and Village Action Groups is failing to achieve the purpose for which GMAs were established; namely to act as buffer zones to National Parks in order to protect wild animals and their habitats to support a viable wildlife-based tourism industry, which contributes significantly to the national economy and to the improvement of welfare in GMAs. This is a summary of a larger report of a study that evaluated the ecological, commercial and sociological impacts of the community-based natural resource management (CBNRM) policies in the GMAs.

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

The study shows that, desp
Authority (ZAWA), the
degradation ecologically, ec
GMAs the populations of a

See all ›
20 Citations

Share Download full-text PDF

throughout the country due to increased settlements, cultivation, traditional land claims and uncoordinated planning by government departments. Bbilili GMA is the worst affected with almost no land left for wildlife.

The commercial performance of the GMAs is also largely unsatisfactory. Until now the commercial use of wildlife has focused on hunting, with international trophy hunting accounting for most of the income in active GMAs. Safari hunting is one of the least developed in southern Africa. Only 10 of the 36 GMAs have photographic tourism developments of which only two (Chiawa and Bangweulu) receive revenues from lodges. Employment figures in both consumptive and non-consumptive tourism are also very low. In

Mtuwe area, which is the most active GMA-based tourist hub in the country, there was only 700 permanent and temporary staff as of 2005. In general, utilisation and trophy quality of major species, such as lion, leopard, sable, roan and buffalo, have been and continue to be on

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

See all ›
20 Citations

Share

Download full-text PDF

the decline. Zambia ranks very low in the region as far as generating revenue from hunting is concerned. Hunting revenues disbursed by ZAWA to CRBs have been declining since 2004. For example, incomes declined by K170 million in 2005 and by K50 million in 2006.

The study also reveals that communities in the GMAs are characterised by high poverty levels. When compared to other rural communities, the welfare in GMAs is 30 percent lower than the national average for rural areas, with the exception only of the GMAs the Luangwa valley and Bangweulu. Monthly per capita expenditure of GMA residents is estimated at ZMK71,000 compared to the national average of ZMK112,000 and ZMK244,000 in rural and urban areas, respectively (LCMS, 2006). This is so partly because the GMA communities have continued to experience the depressing effects of wildlife management policies, which are restrictive to agricultural development and alternative uses of natural resources.

The most serious problems across all GMAs are poaching, human encroachment, fire, deforestation, subsistence agriculture and illegal fishing. Very little funding goes into resource protection in most places. Only three GMAs – Lupande, chiawa, and Sandwe – meet the minimum requirements for management effectiveness. The welfare status of most communities have not improved despite all the community development interventions in the wildlife sector. Only community members that are actively involved in affairs and management of active CRBs are able to benefit. These tend to be already relatively well off. Thus, the poor continue to be left out. GMAs also have poor infrastructure, such schools and health facilities.

Conclusions

The results show that Zambia's natural resource management policies have failed to uphold the objectives for which GI parks while supporting a welfare and national devel approaches that provide ru commitment to develop ap lacking. Moreover, even w communities are unable to realize the optimal benefits from the wealth of resources on their lands.

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

See all ›
20 Citations

Share

Download full-text PDF

These policies together with an economic development orientation that is skewed in favor of urban areas, have contributed to the degradation of GMAs in general and the depletion of wildlife in particular. Wildlife management is not necessarily the communities' preferred land use option. Experiences from other southern African countries demonstrate that CBNRM can contribute to poverty reduction in GMAs, provided it is effectively implemented through an integrated approach and facilitated by an enabling policy environment with adequate support for implementation. Lessons also demonstrate that blame must be placed, not with the unequivocal commitment and capacity of the government and its partners, but rather with

the wildlife management policy itself.

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

See all ›
20 Citations

Share

Download full-text PDF

It seems clear that rural communities have been disadvantaged by the existing wildlife management policies, which limit their participation in the management of natural resources, and by the general lack of economic development in these areas. The Zambian government needs to launch a national review of the GMA management policies and practices with the view to design and adopt a new policy framework within the broader context of protected areas and natural resources management. This policy framework should be drafted prior to modifying the Zambia Wildlife Act so it can influence its contents.

Policy recommendations

The proposed new wildlife management policy should be sufficiently flexible to respond to the specific needs of people in specific areas, and to address different socioeconomic, cultural and environmental conditions. An enabling policy environment would include: (1) economic incentives for communities; (2) emphasis on results; and (3) mobilization of stakeholders according to their comparative and competitive advantages. The revision should among many other issues consider the following:

Partnerships. Public-Private Partnerships (PPPs) that include various community organizations are now part of the government's policy in natural resources management. However, their success requires improvements to existing and sometimes outdated policies and legal frameworks. Legislation should establish an unequivocal incentive framework to stimulate communities to contribute to, and appreciate, the objectives of the partnerships. Furthermore, it should provide for a clearer definition of communities' rights to natural resources, and this improved security of tenure should be legally enshrined in the agreements and policies.

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

While private partners ir
investment in infrastructu
centers to make GMAs a
partnerships should be forn
stakeholders.

See all ›
20 Citations

Share

Download full-text PDF

investments are rarely long-term and do not allow methodologies to mature and local capacity to be installed. Rather a business-oriented approach should be adopted in order to guarantee continued investments in community development activities. Accordingly, local people must be encouraged to engage in businesses. The government has expressed concerns about the low level of community participation in past efforts, but a recently enacted law, the Zambia Citizen's Empowerment Act, is expected to enhance local participation in business.

Legalized Community Structures. Community participation must be formalized through legal entities at community level. Community structures should be registered under the relevant legislation to grant them legal status enabling them to deal with other entities as equal partners and enter into legally binding agreements. Resource ownership should only be given

upon a community showing proof of interest, capacity and the means to assume responsibility for the management of the resources. As such, communities must define their boundaries, membership, roles and responsibilities, produce action plans and define benefit-sharing

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

See all ›
20 Citations

Share

Download full-text PDF

mechanisms. Upon fulfilling laid down conditions, they should be granted rights to natural resources in their areas. Devolved rights should also include adequate authority and responsibility for the management, benefit and disposal of resources within agreed frameworks as well as the right to exclude others who are not defined participants.

Diversification away from wildlife. A new wildlife management policy must address communities' access to other, non-wildlife, natural resources, which the majority of poor households depend upon. The policy should provide all recognized community structures with rights to all resources in their areas of jurisdiction. Apart from harmonization of legislation, the policy should also harmonize approaches and provide for improved coordination.

The government has prioritized the agricultural sector as a vehicle for reducing rural poverty and is providing incentives for agricultural development. This agricultural expansion however should be implemented in a manner that does not compromise the objectives of the GMAs.

Zoning and reclassification. The need to diversify economic activities in GMAs calls for new land use approaches. This may even justify the reclassification of some GMAs. At the very minimum, land use or management plans will have to be implemented to ensure that wildlife habitats are better safeguarded and non-habitat parts of the GMA are released for other economic activities, which are currently restricted, such as intensive market-oriented livestock and crop production or rearing of small game animals. Restricting essential economic activities for the sustenance of local people simply worsens the prevailing poverty conditions.

Management plans. The economic activities in GMAs should be outlined in integrated management plans to ensure that they are compatible with wildlife conservation in the long term. Management Plans m
enterprises with low advers
enough authority to contr
jurisdiction within the agre

ZAWA: Implementer or

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

See all ›
20 Citations

Share

Download full-text PDF

the task given to ZAWA is too ambitious for a single institution unless its function evolves from *hands-on* to regulatory. Additionally, ZAWA is not the best equipped to implement the community support function required in GMAs. ZAWA's staff comes from a culture of conservation and wildlife management rather than community development. As a consequence, ZAWA tends to allocate its resources to the most pressing conservation needs, which is the surveillance of its national parks.

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

See all ›
20 Citations

Share

Download full-text PDF

Citations 20 References 0

Livelihoods, land use and land cover change in the Zambezi Region, Namibia

"The benefits derived from the sale of wild animals, jobs, training opportunities and the acquisition of new skills are shared equitably. Similarly, in Botswana, the Natural Resources Management Programme (NRMP) has decentralised wildlife management by bestowing appropriate authority on Rural District Councils (RDCs) and District Land Boards (DLB), in which communities can obtain the right to engage in resource utilisation in controlled hunting areas by fulfilling requirements (Simasiku et al. 2008). During the focus group discussions, discussants pointed out that the extension of forest land was negative from the agricultural perspective because it was associated with increasing populations of wild animals through creation of conservancies, which created problems for crop production (human–wildlife conflict). "

[Show abstract]

Full-text · Article · Mar 2015

Jonathan M. Kamwi Paxie W. C. Chirwa Samuel OM Manda

+1 more author ... Christoph Kätsch

Read full-text

Provisioning of Game Meat to Rural Communities as a Benefit of Sport Hunting in Zambia

"The recent moratorium on sport hunting throughout mu of Zambia created a crisis situa- tion [67]. Bushmeat poaching is a serious problem in Zambia [14],[37] and th severity and rate of poaching has escalated during the current hunting closure [68]. Similarly, accelerated loss o

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

See all ›
20 Citations

Share Download full-text PDF

[Show abstract]

Full-text · Article · Feb 2015

Paula A White Jerrold L Belant

Read full-text

THE WILDLIFE–LIVESTOCK–HUMAN INTERFACE, LEGISLATION AND ITS IMPACT ON COMMUNITIES AROUND MOSI–OA–TUNYA NATIONAL PARK IN ZAMBIA

"This was also supported by Fernández (2010). Such animal attacks tend to also result in damage to crops and other property, lending to more economic hardships (Simasiku et al, 2008). However, the indication by only 1.8% respondents that the impact of wildlife conservation was increased crop destruction may have been because livestock keepers focus more on their livestock than crop production. "

[Show abstract]

Full-text · Article · Jan 2015 · PLoS ONE

Emmanuel Kabali Girja Shankar Pandey Mashekwa Maboshe
Musso Munyeme

Read full-text

Show more

Recommended publications

Discover more publications, questions and projects in

Article

Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian Nati

February 2017

Gelson Tembo Sushenjit Bandyopadhyay Jean-Michel Pavy

Read more

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

Article

See all ›
20 Citations

Share Download full-text PDF

Sushenjit Bandyopadhyay Gelson Tembo

Read more

Article

THE I MPACT OF WI LDLI FE MANAGEMENT POLI CI ES ON COMMUN ITI ES AND CONSERVATI ON MANAGEME...

February 2017

PHYLLIS SIMASIKU HOPESON I. SIMWANZA GELSON TEMBO +1 more author... JEAN-MICHEL PAVY

Read more

Article

Household Consumption and Natural Resource Management around National Parks in Zambia

February 2017 · Journal of Natural Resources Policy Research

Sushenjit Bandyopadhyay Gelson Tembo

Read more

Discover more

Data provided are for informational purposes only. Although carefully collected, accuracy cannot be guaranteed. Publisher conditions are provided by RoMEO. Differing provisions from th or licence agreement may be applicable.

This publication is from a journal that may support self archiv

© 2008-2017 researchgate.net. All rights reserved. Abou

People who read this publication also read:

Article: Impact of Natural Resource Conservation Policies on Household Consumption Around Zambian National Pa...

Full-text · Jan 2009

See all ›
20 Citations

Share Download full-text PDF

PLOS ONE | TENTH ANNIVERSARY

A Metapopulation Approach to African Lion (*Panthera leo*) Conservation

Stephanie Dolrenry , Jennifer Stenglein, Leela Hazzah, R. Scott Lutz, Laurence Frank

Published: February 5, 2014 • http://dx.doi.org/10.1371/journal.pone.0088081

Abstract

Due to anthropogenic pressures, African lion (*Panthera leo*) populations in Kenya and Tanzania are increasingly limited to fragmented populations. Lions living on isolated habitat patches exist in a matrix of less-preferred habitat. A framework of habitat patches within a less-suitable matrix describes a metapopulation. Metapopulation analysis can provide insight into the dynamics of each population patch in reference to the system as a whole, and these analyses often guide conservation planning. We present the first metapopulation analysis of African lions. We use a spatially-realistic model to investigate how sex-biased dispersal abilities of lions affect patch occupancy and also examine whether human densities surrounding the remaining lion populations affect the metapopulation as a whole. Our results indicate that male lion dispersal ability strongly contributes to population connectivity while the lesser dispersal ability of females could be a limiting factor. When populations go extinct, recolonization will not occur if distances between patches exceed female dispersal ability or if females are not able to survive moving across the matrix. This has profound implications for the overall metapopulation; the female models showed an intrinsic extinction rate from five-fold to a hundred-fold higher than the male models. Patch isolation is a consideration for even the largest lion populations. As lion populations continue to decline and with local extinctions occurring, female dispersal ability and the proximity to the nearest lion population are serious considerations for the recolonization of individual populations and for broader conservation efforts.

Citation: Dolrenry S, Stenglein J, Hazzah L, Lutz RS, Frank L (2014) A Metapopulation Approach to African Lion (*Panthera leo*) Conservation. PLoS ONE 9(2): e88081. doi:10.1371/journal.pone.0088081

Editor: Alfred L. Roca, University of Illinois at Urbana-Champaign, United States of America

Received: August 1, 2013; **Accepted:** January 3, 2014; **Published:** February 5, 2014

Copyright: © 2014 Dolrenry et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Funding: The research was funded by National Science Foundation Fellowship Grant No. 2008058924 and Panthera Kaplan Awards. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist.

Introduction

African lions (*Panthera leo*) once roamed the greater part of the African continent. As habitat generalists, they occupied a wide range of biomes with the exception of tropical rainforests and the interior of the Sahara desert [1]. Over the past century, it is estimated that lions' range has been reduced by approximately 75% [2]. Across the majority of their present-day range, lion populations are now primarily associated with protected areas and managed hunting areas throughout sub-Saharan Africa [3].

Several strongholds of free-roaming lions remain in the East African countries of Tanzania and Kenya, home to more than half of the remaining lion population in Africa [2]. Lions are under threat in both countries, even though both countries have a strong tourism sector and Tanzania a strong trophy hunting sector, all based largely on lions [4], [5]. Lions are declining primarily due to indiscriminate killing by humans [6], [7], depletion of their prey base [8], [9], and overexploitation due to poor management of trophy hunting [5], [10]. Habitat conversion outside of protected areas has led to increasingly fragmented lion populations that are currently under threat of further isolation [11].

Although lions subsist in a wide variety of habitats, they are most successful in areas with low to medium human densities [12], [13], [14]. Due to anthropogenic pressures, the once nearly continuous network of lion populations across East Africa now exhibits a metapopulation structure: distinct populations within a wider landscape with limited migration between them [15], [16]. Monitoring of East African lion populations has shown that there is limited dispersal between the populations (i.e. observed dispersal between Tsavo West, Chyulu Hills and Amboseli National Parks and Namanga Forest Reserve, Kenya as well as between Serengeti National Park, Ngorongoro Conservation Area, Tanzania and the Masai Mara Reserve, Kenya [17], [18], [19]. Furthermore, lion populations have been observed to go extinct and recolonize (e.g. Amboseli National Park in the late 1990s [20], Sibiloi National Park (J. Harris, *pers. comm.*)) or to be 'rescued' by the immigration of new individuals after a population crash [19]. Although

broader scale range maps show lions as continuous across much of East Africa, finer scale country-wide maps of known breeding or permanent lion populations reveal a distinct metapopulation pattern [2], [21], [22], [23]. Conservation planning for lions across East Africa requires an understanding of this network of, and exchange between, lion populations (i.e., the metapopulation).

Metapopulation analysis is an effective tool to better understand broad area population dynamics and the effects of species-specific life-history traits on population connectivity [24]. Current wildlife conservation and management benefit from a metapopulation approach because numerous wildlife populations are becoming increasingly isolated with regional extinction imminent for many species [25]. A metapopulation functions at a larger scale than individual populations and can provide further insight into the dynamics of each component population in reference to the system as a whole [26], [27].

Migrating individuals can re-colonize suitable patches after a local extinction has occurred, as well as enable a "rescue effect" in which immigrating individuals protect a dwindling local population from extinction [28], [29]. Successful recolonization is dependent on the dispersing individuals surviving 'the matrix', an area between populations which is generally not suitable for long-term survival and reproduction [30], [31], [32]. Traversing the matrix poses the largest threat for dispersing migrants, especially for large carnivores that are inherently in conflict with humans [30], [33], [34], [35].

Understanding the broader population dynamics of large carnivores can be particularly challenging given their longevity, large home ranges, and the lack of empirical data on dispersal abilities, particularly dispersal between habitat patches [30], [36]. Reliable knowledge of the species' dispersal ability enables conservationists to maintain viable populations within proximity to other populations, thus ensuring sustainable exchange of individuals [37]. Although dispersal is one of the most important ecological processes, it remains one of the least understood [38]. Particularly with current rates of fragmentation and isolation, it is increasingly important to understand species' dispersal characteristics and their role in maintaining the larger metapopulation [25].

As with other polygynous mammalian species [39], male lions nearly always disperse from their natal area, often traveling two to three times farther than females [18], [40], [41]. Females generally stay with their natal pride or establish neighboring home ranges ([18], 'stepping stone' dispersal – [42]). Based on these generally accepted dispersal characteristics, we combine empirical data on the life-history traits and current geographic status of lion populations in a fragmented landscape with a spatially realistic modeling approach [29], [43], [44] to examine the lion metapopulation of Kenya and Tanzania.

We use an incidence function model (IFM) to explore the probability of occurrence of particular lion populations (i.e. patches) within a broader lion metapopulation, where both distance between patches and area of patches vary [43]. We use the IFM to consider the effect of sex-specific dispersal characteristics on metapopulation connectivity, the impact of human densities, and the threat of isolation on the remaining lion populations [45] across Kenya and Tanzania.

Materials and Methods

Modeling Approach

Reliable models are insightful for conservation management as they can help managers evaluate the current state and consider a system's future [44]. The simple and applicable incidence function model (IFM; [43], [46]) has high conservation value for evaluation of populations on a broad-scale [43]. The IFM was created to use empirical data to examine the effects of patch area and isolation on patch occupancy and is one of the most commonly used metapopulation models. An IFM can be built with snapshot presence/absence data of a species at a particular site, the simplest form of data that can be collected during field studies.

Incidence function models assume that suitable habitat occurs in discrete patches surrounded by unsuitable matrix, and that occupancy of each patch is determined by local colonization and extinction events [29], [45]. Extinction is negatively associated with patch area and colonization is negatively associated with patch isolation, so patch occupancy should increase with area and decrease with isolation [47]. Patch extinction and colonization are also assumed to depend on factors such as patch area (a proxy for local population size), spatial arrangement of patches, patch edge characteristics, dispersal ability of the species, and regional environmental stochasticity. In IFM models, the incidence is given as a function of connectivity and patch size [43]; in this study, factors such as lion occupancy and male and female dispersal distances, were calculated from empirical data on lion populations as well as verified metadata from various sources. Given the relatively high number of overall patches and the fraction of occupied patches during the short 'snapshot' period, we assumed the metapopulation was at equilibrium and thus executed the IFM [43].

To fit the IFM, we used a special case of generalized linear models with binomial error and logistic link function on the response of incidence (i.e. rate of occurrence) data for each habitat patch [48]. The necessary data inputs were incidence data (J_i; 1 for presence, 0 for absence), area of each patch (A_i), and coordinates of the center of each patch. We calculated all pairwise distances between patches (d_{ij}), a dispersal parameter (α), estimated from actual dispersal data equal to 1/average dispersal as well as 1/maximum dispersal, and a connectivity value (S_i). Connectivity (S_i) is a function of occupancies p_i, patch sizes A_i, patch distances d_{ij} and the species specific dispersion length parameter α. We used the negative exponential functional form of S_i as suggested by Hanski [43].

$$S_i = \sum_{i \neq j} e^{(-\alpha d_{ij})} p_i A_i$$

Due to impacts of human density on lion populations [13], [14], we included human density as a covariate in the incidence function models. Given the intense research on lion populations across Kenya and Tanzania as well as the high detectability of a breeding lion population when present (e.g. obvious tracks, roaring, livestock depredation, etc.), we believe the occurrence of false negatives (Type II error) to be negligible [15], [49], [50]. As discussed in Riggio et al. [2], the use of expert opinions and regional surveys for data of lion populations, particularly across East Africa, is likely to result in an inflation of lion range, not an underestimation.

Data for the Model

We used the most recent and authoritative sources to identify and map known suitable habitat patches for lion populations from both countries, Mésochina et al. [22] for Tanzania and the Conservation and Management Strategy for Lions, Kenya (Kenya Wildlife Service [21]). In the Mésochina et al. [22] report, lion populations were identified by reported frequency of observation; weekly and monthly sightings were considered permanent populations, and we omitted areas for which there was no information available. In the Kenya report, we mapped all populations labeled as 'known permanent'. Henceforth, we use the term 'patch' as synonymous with a distinct patch that was known to be suitable to support a lion population. In total, there were 25 patches with areas ranging from 86 to 127,515 km^2 (Fig. 1).

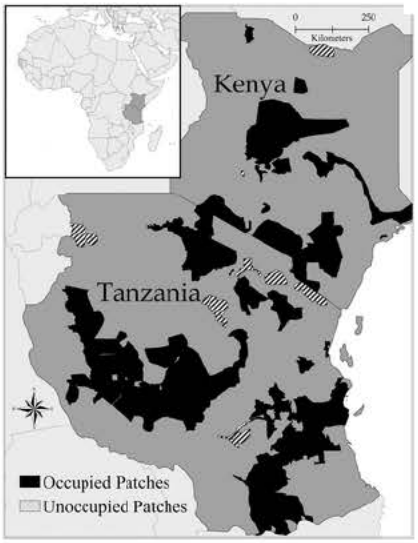


Figure 1. Map of study area in Africa.
Darkened areas indicate patches of permanent lion populations (n=25) across Kenya and Tanzania; black areas were considered occupied and striped areas were deemed unoccupied at time of survey.
http://dx.doi.org/10.1371/journal.pone.0088081.g001

Once all patches were identified, we sent maps to regional experts (conservationists, biologists, etc.) who were familiar with current lion population status in their areas. Experts identified areas that, to the best of their knowledge, contained a breeding lion population in December 2011-January 2012; they did not include areas where only male lions or dispersers were seen infrequently. This method gave a current presence-absence scenario (i.e. the 'snapshot') for patch occupancy.

We mapped and measured (km^2) patches using ArcMap 10.1 [51], and used the centroid of each patch to calculate the pairwise Euclidean distances between patches (d_{ij}). We subtracted the radii of the pair of patches for each pairwise distance, so the distances could be interpreted as the shortest straight-line distance between the edges of the paired patches. We gathered actual dispersal distances from the literature, unpublished reports, and the Lion Guardians program in the Amboseli ecosystem [17,40,41,Desert Lion [52], [53]. We used the maximum and average reported dispersal distances of 343 and 117 km for males and 128 and 50 km for females respectively as the dispersal parameter (α). We calculated human density for each patch from the 2009 census of Kenya (Kenya Bureau of Statistics [54]) at the sub-location level and the 2002 census for Tanzania (National Bureau of Statistics Tanzania [55]) at the ward level. We averaged the human density for each patch area.

Statistical Methods

We followed the methods outlined in Hanski [43] and Oksanen [48] and performed the IFM in program R, version 2.14.0 [56]. We included the rescue effect in the model and added the mean human density for each of the patches as a covariate in the model. Therefore, our full model added one new term to Eq (9) in Oksanen [48]:

$$\log\left(\frac{J_i}{1-J_i}\right) = -\log(ey) + 2\log(S_i) + x\log(A_i) + \log(H_i)$$

$$\text{logit}(J_i) = \beta_0 + 2\log S + \beta_1 * \log A + \beta_2 * \log H$$

where J_i is the incidence in patch i, S_i is a measure of connectivity, A_i is each patch's area, and H_i is the mean human density of each patch. When fitting the full model, the intercept, β_0 was log(ey), β_1 was an estimate of the stochasticity parameter $\hat{x}$, and β_2 was the parameter estimate for human density entering the model as a linear factor.

Additional model parameters were: A_0, the minimum suitable area, also referred to as critical patch area, and $\hat{x}$, a stochasticity parameter. The critical patch area is the minimum patch size observed for occupancy [43]; it is the smallest area found to contain a lion population. When $\hat{x}$ is large (>1), there is a range of patch sizes beyond which extinction becomes very unlikely, whereas if $\hat{x}$ is small (<1), there is no such critical patch size and even large populations in large patches have a substantial risk of extinction. Lastly, we included the parameters e, the intrinsic extinction rate, and y', the colonizing ability [43].

We used $\hat{x}$ and A_0, to find $\hat{e}$:

$$\hat{e} = A_0^x$$

Then we were able to use β_0 and $\hat{e}$ to solve for y' following Oksanen (2004):

$$-\log(ey) = \beta_0$$

$$ey = \exp(-\beta_0)$$

$$\hat{y} = \frac{\exp(-\beta_0)}{A_0^x}$$

We used Akaike's Information Criterion (AIC) to choose between nested models [57]. We ran male and female models independently, using average dispersal distance and maximum dispersal distance for each sex separately. The full models included human density additive to the patch area and the reduced models did not include human density. We used the connectivity term, $2\ln(S_i)$, as an offset in all eight models [48].

Results

There were 25 total patches with an average area of 13,898 (SD 28,639) km^2, and 60% of the patches were occupied (Fig.1). Mean human density value per patch was 162 (SD 475) per km^2. The average distance among all patches was 546 km, varying from 63 to 1,461 kilometers (Fig. 2).

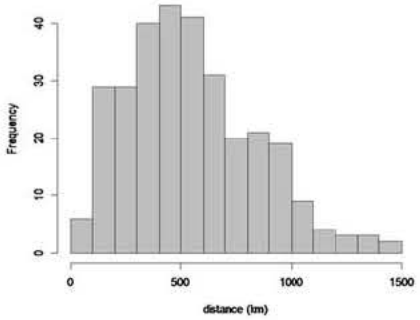


Figure 2. Pairwise distances between 25 Kenya and Tanzania lion population patches.
Distance was calculated in kilometers, using data obtained during 2008–2010.
http://dx.doi.org/10.1371/journal.pone.0088081.g002

The male and female lion models without the human density were only marginally stronger than the models with human density included (Table 1). We found significant differences in connectivity values between the male and female models using both maximum dispersal distance (t=21.16, p<0.001, df=24) and average dispersal distances (t=8.71, p<0.001, df=24) as well as between the male models (avg male to max male t=20.38, p<0.001, df=24) and female models (avg female to max female t=9.08, p<0.001, df=24). As was expected from the model inputs, the greater ability of males to move through the matrix (male max a =0.0029, avg a=0.0086 versus female max a=0.0078, avg a=0.02), gave the male models reliably higher connectivity (Table 1). Three patches (3, 8, and 9; Fig. S1) had the lowest connectivity values across all models (Table S1). Particularly for the two largest patches (patches 3 and 8 with areas >40,000 km^2; Fig. S1), the difference between the connectivity values of the two sexes was apparent (male max: mean (SD)=14.78 (1.32), male avg=0.72 (0.45); female max: mean (SD)=1.02 (0.56), female avg=0.01 (0.01); n=2).

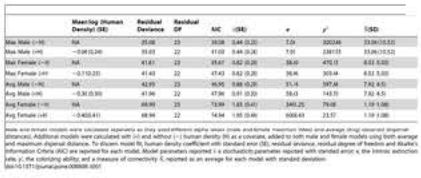


Table 1. Model outputs of eight African lion incidence function models.
http://dx.doi.org/10.1371/journal.pone.0088081.t001

We used the estimated model parameters (Table 1) to determine probability of occupancy of the individual patches (Fig. 3). With regards to area size and its effect on patch occupancy, moderate-sized patches (2,000< area <40,000 km^2) all had a relatively high probability of incidence (patch incidence J_i: mean (SD)=0.74 (0.26), n=15), while the smaller patches (area ≤2,000 km^2) had lower probabilities of lion occurrence (J_i: mean (SD)=0.40 (0.24), n=8). Surprisingly, the largest patches (area ≥40,000 km^2) also had much lower occurrence probabilities (J_i: mean (SD)=0.36 (0.21), n=2). Across all scenarios, female models had a lower mean

probability of patch incidence (max null models: mean (SD)=male 0.60 (0.18), female 0.57 (0.30); max human density models: male 0.55 (0.18), female 0.48 (0.30); avg null models: male 0.56 (0.31), female 0.43 (0.40); avg human density models: male 0.39 (0.31), female 0.25 (0.41)).

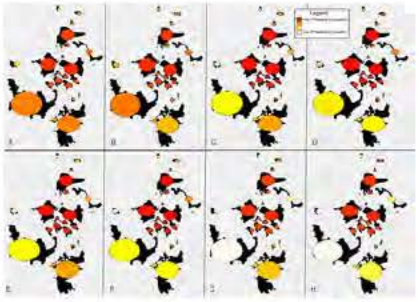


Figure 3. Probability of lion occurrence in identified lion population patches.
Occurrence was calculated on 25 habitat patches in Kenya and Tanzania based on the incidence function model for A) male dispersal using maximum observed distance, without human density, B) male dispersal using maximum observed distance with human density, C) female dispersal using maximum observed distance without human density, D) female dispersal using maximum observed distance with human density model, E) male dispersal using average of observed distances, without human density, F) male dispersal using average of observed distances with human density, G) female dispersal using average of observed distances without human density, H) female dispersal using average of observed distances with human density model. In plotting the results, we used color to show the predicted incidence with warmer colors (redder) showing higher probability of incidence and yellow to white showing lower probability of incidence.
http://dx.doi.org/10.1371/journal.pone.0088081.g003

Adding the human density parameter did not influence either male or female models; the influence of human density in the reduced models was not significant (p=0.81 and 0.32 for male models and 0.67 and 0.33 for the female models, using maximum and average dispersal distances). However, the human density parameter did decrease colonization for both sexes (colonization parameter, C; male max models t=−2.82, p=0.007, male avg models t=−4.49, p=<0.0001; female max models t=−2.91, p=0.005, female avg models t=−3.32, p=0.0017, at alpha level 0.05).

Furthermore, the patches with the highest associated human density (>2,000 people/km^2, n=2), had a decreased probability of occurrence in the models with human density added (mean=0.60 to 0.55 in male max models; 0.57 to 0.39 in male avg models and 0.57 to 0.48 in female max models; 0.43 to 0.25 in female avg models, Fig. 3).

Discussion

The present-day fragmentation of the East African lion population into patches fits the metapopulation framework. Population patches are well delimited and cover only a fraction of the total area, allowing us to apply a metapopulation approach to the network of remaining lion populations across Kenya and Tanzania. In particular, we considered the impact of sex-specific dispersal characteristics on regional lion populations. With only one snapshot of population occupancy, strong differences were apparent between male and female dispersal abilities on connectivity and probabilities of occurrence.

Male lions' ability to 'rescue' declining populations over 300 km away was strong, particularly since dispersal ability is pliant [58], [59]. If occupied patches, i.e. lion populations, are maintained and migration is allowed, then the males' strong rescue ability allowed for higher probabilities of patch occupancy and stronger values of connectivity [60]. Lion survival while in the matrix and a constant flow of male dispersers from stable populations are important. If male lions are not able to disperse from stable populations, as may be the case where adult male survival is low, i.e., sport hunting areas [5], [61], [62], [63], this could result in a lower rescue effect for the broader metapopulation, causing an increased risk of extinction for local populations [28].

Fragmentation and isolation are among the key challenges to metapopulation maintenance [25], [64], [65]. Our results suggest that even the largest patches were negatively affected by isolation as shown by the lower occurrence probabilities and the low connectivity values observed for the two largest patches (3 and 8, Fig. S1). These areas are known to hold the majority of the remaining lions found in East Africa [2], [22]. However, because the IFM approach does not consider population numbers, the results are based solely on considerations of patch area and proximity to other patches.

Based on the model outputs, the higher probabilities of occurrence for the patches of northern Tanzania and southern Kenya (Fig. 3 and Table S1), concur with other studies [27] that a centrally located network of moderate-sized populations has greater probabilities of occurrence than either the few large isolated populations or the smaller well-connected patches. When examining a network of lion populations, considerations of patch isolation and fragmentation are vitally important, in conjunction with local-level considerations of individual population size and viability.

To avoid local extinction due to genetic isolation, it is necessary for a minimum of one or more dispersers in each generation to survive the matrix and recolonize other patches, allowing populations to persist in stochastic environments [27], [30], [31], [66], [67], [68], [69]. The models showed males to have poor 'colonizing ability' (y') in comparison to females; this 'colonizing ability' is independent of the ability to move across the matrix (S_i) [43]. Our y' estimates suggest that even though male lions can move across the matrix better than female lions (increased ability to disperse), when compared to females, they have a harder time

establishing themselves in a patch. This makes sense biologically since males are more nomadic and move territories frequently whereas females disperse less often and shorter distances than males. Females choose to generally stay within their natal range or establish neighboring home ranges; once they reach a suitable patch, they tend to stay there [18], [40], [70].

Once patch extinction has occurred, recolonization would be dependent upon female lions, less capable dispersers, being able to reach the empty patch. Since female lion dispersal ability is limited, when populations go extinct, recolonization cannot occur if distances between patches exceed female dispersal ability or if females are not able to survive crossing the matrix. This has profound implications for the overall metapopulation of lions; the female models showed an intrinsic extinction rate from five-fold to a hundred-fold higher than the male models (Table 1).

Dispersal occurs in and is dependent upon the matrix, in this case largely non-protected, human-dominated landscapes [32]. Little is known about lion dispersal and survival in human-dominated areas. We suggest conservation efforts for lions in East Africa focus on increasing lion survival while crossing the matrix to ensure connectivity on a broad-scale. Additionally, conservation efforts could aim to improve accuracy of regional lion presence/absence data and the knowledge of occurrence and status of breeding lion populations through the establishment of a lion sightings database, as is done with other species (e.g. avian sightings databases [71], [72]). Observational data on lions across East Africa would increase our understanding of the distribution of lions and provide a foundation for more effective lion conservation.

As top predators, lions are especially vulnerable and even minor human-induced changes (either negative or positive) can have large impacts [73], [74], [75]. Wildlife or stakeholder carrying capacity (i.e. the amount of wildife local residents are willing to 'live with' - [76], [77]) is a concept that aims to increase tolerance of local communities, as a step toward increasing the number or density of lions that communities are able to tolerate or accept. Traditional-based participatory monitoring programs have been shown to increase local tolerance of lions [78], thus allowing for greater connectivity.

Improving human tolerance to allow movement of even a few individuals through non-protected or partially protected areas could play a vital role in conservation of carnivores, both to maintain populations and to allow greater exchange between them [78], [79]. Even though protected areas are necessary for long-term persistence [73], alone they are not enough as most of the lands essential for supporting carnivore dispersal and thus population connectivity, are outside protected areas, in lands that are affected by humans [1], [80].

In addition to suitable habitat and available prey, human tolerance for carnivores can create corridors between larger stable unfenced populations. Packer et al. [81] found fenced lion populations to occur at higher densities, but fences inhibit all exchange between populations, leading to further ecosystem fragmentation, loss of dispersal and migration routes, genetic isolation as well as reduced conservation value of wildlife in matrix areas [82]. If lions are seen as a benefit by the human communities living in the matrix, they will tolerate sharing the landscape with a challenging species allowing greater population viability, increased economic opportunities for the communities and better conservation.

Even though human density was not a significant factor for either model, we suspect that further study (i.e. subsequent surveys over longer time periods) would reveal longer-term impacts of human density on extinction and/or colonization rates. However, greater community tolerance and adaptive management policies may be more important factors than human population densities [35], [79], [83]. We also found the stochasticity parameter ($\hat{x}$) to be less than one for all models, implying that in this metapopulation, no lion population is immune from going extinct [84], further suggesting the need and urgency for conservation action on a broad geographic scale.

Incidence function models allowed a simple initial evaluation of lion populations and their connectivity across Kenya and Tanzania. Using only data on areas, locations and patch occupancies, we were able to analyze the effects of patch area, isolation and dispersal abilities on lion populations on a metapopulation scale. More explicit examination of extinction and colonization rates of the patches as well as further exploration of factors affecting dispersal and survival in the matrix areas would provide additional insights for making effective policy decisions about large-scale lion populations across Africa. Extirpation of lions throughout Africa is an immediate concern and the metapopulation approach and the incorporation of life-history traits are essential tools for understanding the broader networks of populations and movements between them.

Supporting Information

Figure S1.

Map of study area in Africa. Darkened areas indicate patches of permanent lion populations (n=25) across Kenya and Tanzania; black areas were considered occupied and striped areas were deemed unoccupied at time of survey. In this map, patches were numbered 1 to 25, corresponding with Patch ID of Table S1.
doi:10.1371/journal.pone.0088081.s001
(TIF)

Table S1.

Model outputs from eight incidence function models, varying the dispersal distance used by either male or female, maximum observed (Max) or average of observed (Avg) as well as the incorporation of human density (Hum) as a covariate in the models. Models without human density covariate are labeled as Null. Patches were given unique identification numbers 1 through 25. Each patch had an associated area (km^2) and human density (number people per km^2) variable. Outputs were: S_i as an estimate of connectivity associated with both male and female, maximum and average dispersal distance models; J_i as an estimate of patch occurrence, E estimates of patch extinction, and C estimate of patch colonization. All are given for the eight models and twenty-five patches.
doi:10.1371/journal.pone.0088081.s002
(DOCX)

Acknowledgments

This study would not have been possible without the knowledge and involvement of J. Cary, A. Norton, C. Packer, P. Henschel, H. Brinks, P. Schuette, A. Estes, S. Bhalla, A. Cotterill, and J. King. The manuscript was greatly improved by the valuable input of C. Ribic. The research was conducted under Kenya Research Permit No. MOEST 13/C689.

Author Contributions

Conceived and designed the experiments: SD JS. Performed the experiments: SD JS. Analyzed the data: SD JS. Contributed reagents/materials/analysis tools: SD JS LH LF. Wrote the paper: SD JS LH RSL LF.

References

1. Nowell K, Jackson P (1996) Wild cats: status survey and conservation action plan; IUCN, editor. Gland, Switzerland: IUCN/SSC Cat Specialist Group. 382 p.
2. Riggio J, Jacobson A, Dollar L, Bauer H, Becker M, et al.. (2012) The size of savannah Africa: a lion's (Panthera leo) view. Biodiversity and Conservation: 1–19.
3. Bauer H, Nowell K, Packer C (2008) IUCN Red List of Threatened Species. IUCN 2012 Version 2012.1.
4. Lindsey PA, Balme GA, Booth VR, Midlane N (2012) The significance of African lions for the financial viability of trophy hunting and the maintenance of wild land. PLoS ONE 7: e29332.
View Article • PubMed/NCBI • Google Scholar
5. Packer C, Kosmala M, Cooley HS, Brink H, Pintea L, et al. (2009) Sport hunting, predator control and conservation of large carnivores. PLoS ONE 4: e5941.
View Article • PubMed/NCBI • Google Scholar
6. Hazzah L, Borgerhoff Mulder M, Frank L (2009) Lions and warriors: social factors underlying declining African lion populations and the effect of incentive-based management in Kenya. Biological Conservation 142: 2428–2437.
View Article • PubMed/NCBI • Google Scholar
7. Ikanda D, Packer C (2008) Ritual versus retaliatory killing of African lions in the Ngorongoro Conservation Area, Tanzania. Endangered Species Research 6: 67–74.
View Article • PubMed/NCBI • Google Scholar
8. Ogutu JO, Owen-Smith N, Piepho HP, Said MY (2011) Continuing wildlife population declines and range contraction in the Mara region of Kenya during 1977–2009. Journal of Zoology 285: 99–109.
View Article • PubMed/NCBI • Google Scholar
9. Bauer H (2008) Synthesis of threats, distribution and status of the lion from the two lion conservation strategies. In: B. Croes RB, H. de longh and H Bauer, editor. Management and conservation of large carnivores in west and central Africa. Leiden: Institute of Environmental Sciences, Leiden University. 13–28.
10. Packer C, Brink H, Kissui B, Maliti H, Kushnir H, et al. (2010) Effects of trophy hunting on lion and leopard populations in Tanzania. Conservation Biology 25: 142–153.
View Article • PubMed/NCBI • Google Scholar
11. Bauer H, Van Der Merwe S (2004) Inventory of free-ranging lions (Panthera leo) in Africa. Oryx 38: 26–31.
View Article • PubMed/NCBI • Google Scholar
12. Riggio J (2011) The African lion (Panthera leo leo): a continent-wide species distribution study and population analysis [*Master's thesis*]: Duke University. 101 p.
13. Loveridge A, Canney S (2009) African lion distribution modeling project. Horsham, UK: WildCRU. 58 p.
14. Woodroffe R (2000) Predators and people: using human densities to interpret declines of large carnivores. Animal Conservation 3: 165–173.
View Article • PubMed/NCBI • Google Scholar
15. Hanski IA, Simberloff D (1997) The metapopulation approach, its history, conceptual domain, and application to conservation. In: Hanski IA, Gilpin ME, editors. Metapopulation Biology: Ecology, Genetics and Evolution. London: Academic Press Limited. 5–26.
16. McCollough D, editor (1996) Metapopulations and wildlife conservation: Island Press.
17. Dolrenry S (2013) African lion (Panthera leo) behavior, monitoring, and survival in human-dominated landscapes [*Dissertation*]. Madison: University of Wisconsin.

18. Schaller G (1972) The Serengeti lion: a study of predator-prey relations. Chicago: The University of Chicago Press.

19. Packer C, Pusey A, Rowley H, Gilbert D, Martenson J, et al. (1991) Case study of a population bottleneck: lions of the Ngorongoro Crater. Conservation Biology 5: 219–230.
View Article • PubMed/NCBI • Google Scholar

20. Chardonnet P (2002) Conservation of the African lion: contribution to a status survey. Paris, France: International Foundation for the Conservation of Wildlife.

21. Force KsNLCT (2008) Conservation and management strategy for lions and spotted hyaenas in Kenya 2009–2014. Nairobi, Kenya: Kenya's National Large Carnivore Task Force.

22. Mésochina P, Mbangwa O, Chardonnet P, Mosha R, Mtui B, et al.. (2010) Conservation status of the lion in Tanzania. Paris: MNRT-WD, MLDF, TAWIRI, TAHOA & TPHA.

23. IUCN (2006) Regional conservation strategy for the lion (*Panthera leo*) in eastern and southern Africa. Gland, Switzerland: IUCN.

24. Driscoll DA (2007) How to find a metapopulation. Canadian Journal of Zoology 85: 1031–1048.
View Article • PubMed/NCBI • Google Scholar

25. Wiens JA (1996) Wildlife in patchy environments: metapopulations, mosaics, and management. In: McCollough D, editor. Metapopulations and Wildlife Conservation. Washington, DC: Island Press. 53–84.

26. Hanski I, Gilpin M, editors (1997) Metapopulation biology: ecology, genetics, and evolution. San Diego, California: Academic Press. 512 p.

27. Stacey PB, Johnson VA, Taper ML (1997) Migration within metapopulations. In: Hanski IA, Gilpin ME, editors. Metapopulation biology: ecology, genetics, and evolution. San Diego: Academic Press. 215–246.

28. Brown JH, Kodric-Brown A (1977) Turnover rates in insular biogeography: effect of immigration on extinction. Ecology 58: 445–449.
View Article • PubMed/NCBI • Google Scholar

29. Hanski I (1999) Metapopulation ecology. New York: Oxford University Press. 313 p.

30. Vandermeer J, Carvajal R (2001) Metapopulation dynamics and the quality of the matrix. The American Naturalist 158: 211–220.
View Article • PubMed/NCBI • Google Scholar

31. Jules ES, Shahani P (2003) A broader ecological context to habitat fragmentation: why matrix habitat is more important than we thought. Journal of Vegetation Science 14: 459–464.
View Article • PubMed/NCBI • Google Scholar

32. Ricketts TH (2001) The matrix matters: effective isolation in fragmented landscapes. The American Naturalist 158: 87–99.
View Article • PubMed/NCBI • Google Scholar

33. Hanski I, Zhang D-Y (1993) Migration, metapopulation dynamics and fugitive co-existence. Journal of Theoretical Biology 163: 491–504.
View Article • PubMed/NCBI • Google Scholar

34. Treves A, Naughton-Treves L (1999) Risk and opportunity for humans coexisting with large carnivores. Journal of Human Evolution 36: 275–282.
View Article • PubMed/NCBI • Google Scholar

35. Treves A, Karanth KU (2003) Human-carnivore conflict and perspectives on carnivore management worldwide. Conservation Biology 17: 1491–1499.
View Article • PubMed/NCBI • Google Scholar

36. Hellgren EC, Onorato DP, Skiles JR (2005) Dynamics of a black bear population within a desert metapopulation. Biological Conservation 122: 131–140.
View Article • PubMed/NCBI • Google Scholar

37. Verner J (1992) Data needs for avian conservation biology: have we avoided critical research? Condor: 301–303.

38. Bowler DE, Benton TG (2005) Causes and consequences of animal dispersal strategies: relating individual behaviour to spatial dynamics. Biological Reviews 80: 205–225.
View Article • PubMed/NCBI • Google Scholar

39. Greenwood PJ (1980) Mating systems, philopatry and dispersal in birds and mammals. Animal Behaviour 28: 1140–1162.
View Article • PubMed/NCBI • Google Scholar

40. Pusey AE, Packer C (1987) The evolution of sex-biased dispersal in lions. Behaviour 101: 275–310.
View Article • PubMed/NCBI • Google Scholar

41. Funston PJ (2011) Population Characteristics of Lions (Panthera leo) in the Kgalagadi Transfrontier Park. South African Journal of Wildlife Research 41: 1–10.
View Article • PubMed/NCBI • Google Scholar

42. Kimura M (1953) Annual Report National Institute of Genetics; “Stepping Stone” model of population. Japan. 62–63 p.

43. Hanski I (1994) A practical model of metapopulation dynamics. Journal of Animal Ecology 63: 151–162.
View Article • PubMed/NCBI • Google Scholar

44. Gilpin M (1996) Metapopulations and wildlife conservation: approaches to modeling spatial structure. In: McCollough D, editor. Metapopulations and Wildlife Conservation. Washington, DC: Island Press. 11–27.

45. Moilanen A, Hanski I (1998) Metapopulation dynamics: effects of habitat quality and landscape structure. Ecology 79: 2503–2515.
View Article • PubMed/NCBI • Google Scholar

46. Hanski I, Kuussaari M, Nieminen M (1994) Metapopulation structure and migration in the butterfly (Melitaea cinxia). Ecology 75: 747–762.
View Article • PubMed/NCBI • Google Scholar

47. Hanski I (1994) Patch-occupancy dynamics in fragmented landscapes. Trends in Ecology and Evolution 9: 131–135.
View Article • PubMed/NCBI • Google Scholar

48. Oksanen J (2004) Incidence function model in R.

49. Mackenzie D, Nichols J, Lachman G, Droege S, Royle J, et al. (2002) Estimating site occupancy rates when detection probabilities are less than one. Ecology 83: 2248–2255.
View Article • PubMed/NCBI • Google Scholar

50. Moilanen A, Nieminen M (2002) Simple connectivity measures in spatial ecology. Ecology 83: 1131–1145.
View Article • PubMed/NCBI • Google Scholar

51. ESRI (2011) ArcGIS Desktop. In: Institute ESR, editor. Release 10 ed. Redlands, CA.

52. Conservation DL (2007) Dispersal and expansion. Desert Lion Conservation.

53. ALWG (2003, 2004) Lion Conservation Research. Workshops 3 & 4: From Conflict to Socioecology. In: Loveridge A, Lynam T, Macdonald DM, editors. Oxford: Widlife Conservation Research Unit. 1–95.

54. KNBS (2009) Population, Households and Density. In: Statistics KNBo, editor. Nairobi, Kenya: Kenya Open Data.

55. Statistics NBo (2002) Dar Es Salaam: National Bureau of Statistics of Tanzania.

56. Team RC (2011) R: a language and environment for statistical computing. 2.14.2 ed. Vienna, Austria: R Development Core Team.

57. Burnham KP, Anderson DR (2002) Model selection and inference: a practical information-theoretic approach. New York: Springer.

58. Björklund M (2003) The risk of inbreeding due to habitat loss in the lion (*Panthera leo*). Conservation Genetics 4: 515–523.
View Article • PubMed/NCBI • Google Scholar

59. Van Dyck H, Baguette M (2005) Dispersal behaviour in fragmented landscapes: routine or special movements? Basic and Applied Ecology 6: 535–545.
View Article • PubMed/NCBI • Google Scholar

60. Reed JM, Levine SH (2005) A model for behavioral regulation of metapopulation dynamics. Ecological Modelling 183: 411–423.
View Article • PubMed/NCBI • Google Scholar

61. Loveridge AJ, Searle AW, Murindagomo F, Macdonald DW (2007) The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation 134: 548–558.
View Article • PubMed/NCBI • Google Scholar

62. Becker MS, Watson FGR, Droge E, Leigh K, Carlson RS, et al.. (2012) Estimating past and future male loss in three Zambian lion populations. The Journal of Wildlife Management.

63. Yamazaki K (1996) Social variation of lions in a male-depopulated area in Zambia. The Journal of Wildlife Management 60: 490–497.
View Article • PubMed/NCBI • Google Scholar

64. Prugh LR, Hodges KE, Sinclair ARE, Brashares JS (2008) Effect of habitat area and isolation on fragmented animal populations. Proceedings of the National Academy of Sciences 105: 20770–20775.
View Article • PubMed/NCBI • Google Scholar

65. Hanski I (1997) Predictive and practical metapopulation models: the incidence function approach. Spatial ecology: the role of space in population dynamics and interspecific interactions Monographs in Population Biology 30: 21–25.
View Article • PubMed/NCBI • Google Scholar

66. Mills LS, Allendorf FW (1996) The one-migrant-per-generation rule in conservation and management. Conservation Biology 10: 1509–1518.
View Article • PubMed/NCBI • Google Scholar

67. Beier P, Barrett RH (1993) The cougar in the Santa Ana mountain range, California.

68. Fahrig L, Merriam G (1985) Habitat patch connectivity and population survival. Ecology: 1762–1768.

69. Hanski I, Gilpin M (1991) Metapopulation dynamics: brief history and conceptual domain. Biological journal of the Linnean Society 42: 3–16.
View Article • PubMed/NCBI • Google Scholar

70. Hanby J, Bygott J (1987) Emigration of subadult lions. Animal Behaviour 35: 161–169.
View Article • PubMed/NCBI • Google Scholar

71. Sullivan BL, Wood CL, Iliff MJ, Bonney RE, Fink D, et al. (2009) eBird: a citizen-based bird observation network in the biological sciences. Biological Conservation 142: 2282–2292.
View Article • PubMed/NCBI • Google Scholar

72. Wood C, Sullivan B, Iliff M, Fink D, Kelling S (2011) eBird: engaging birders in science and conservation. PLoS biology 9: e1001220.
View Article • PubMed/NCBI • Google Scholar

73. Woodroffe R, Ginsberg JR (1998) Edge effects and the extinction of populations inside protected areas. Science 280: 2126–2128.
View Article • PubMed/NCBI • Google Scholar

74. Ray J, Redford KH, Steneck RS, Berger J, editors (2005) Large carnivores and the conservation of biodiversity. Washington, D.C.: Island Press.

75. Ray J, Hunter L, Zigouris J (2005) Setting conservation and research priorities for larger African carnivores. New York: Wildlife Conservation Society.

76. Carpenter LH, Decker DJ, Lipscomb JF (2000) Stakeholder acceptance capacity in wildlife management. Human Dimensions of Wildlife 5: 5–19.
View Article • PubMed/NCBI • Google Scholar

77. Decker DJ, Purdy KG (1988) Toward a concept of wildlife acceptance capacity in wildlife management. Wildlife Society Bulletin 16: 53–57.
View Article • PubMed/NCBI • Google Scholar

78. Hazzah L, Dolrenry S, Naughton L, Edwards C, Kearney F, et al. (*in press*) Participation and payments: efficacy of two lion conservation programs in Maasailand, Kenya.

79. Linnell JDC, Swenson JE, Anderson R (2001) Predators and people: conservation of large carnivores is possible at high human densities if management policy is favourable. Animal Conservation 4: 345–349.
View Article • PubMed/NCBI • Google Scholar

80. Crooks KR, Burdett CL, Theobald DM, Rondinini C, Boitani L (2011) Global patterns of fragmentation and connectivity of mammalian carnivore habitat. Philosophical Transactions of the Royal Society B: Biological Sciences 366: 2642–2651.
View Article • PubMed/NCBI • Google Scholar

81. Packer C, Loveridge A, Canney S, Caro T, Garnett S, et al.. (2013) Conserving large carnivores: dollars and fences. Ecology letters.

82. Creel S, Becker MS, Durant SM, M'Soka J, Matandiko W, et al.. (2013) Conserving large populations of lions – the argument for fences has holes. Ecology letters: n/a–n/a.

83. Allendorf TD, Allendorf K (2012) What every conservation biologist should know about human population. Conservation Biology 26: 953–955.
View Article • PubMed/NCBI • Google Scholar

84. Hanski I (1992) Inferences from ecological incidence functions. American Naturalist: 657–662.

Review of *Panthera leo* from the United Republic of Tanzania and from Zambia

(Version edited for public release)

Review of *Panthera leo* from the United Republic of Tanzania and from Zambia

Prepared for

The European Commission, Directorate General Environment, Directorate E - Global & Regional Challenges, LIFE ENV.E.2. – Global Sustainability, Trade & Multilateral Agreements, Brussels, Belgium

Prepared August 2015

Copyright

European Commission 2015

Citation

UNEP-WCMC. 2015. Review of *Panthera leo* from the United Republic of Tanzania and from Zambia. UNEP-WCMC, Cambridge.

UNEP WCMC

The UNEP World Conservation Monitoring Centre (UNEP-WCMC) is the specialist biodiversity assessment of the United Nations Environment Programme, the world's foremost intergovernmental environmental organization. The Centre has been in operation for over 30 years, combining scientific research with policy advice and the development of decision tools.

We are able to provide objective, scientifically rigorous products and services to help decision-makers recognize the value of biodiversity and apply this knowledge to all that they do. To do this, we collate and verify data on biodiversity and ecosystem services that we analyze and interpret in comprehensive assessments, making the results available in appropriate forms for national and international level decision-makers and businesses. To ensure that our work is both sustainable and equitable we seek to build the capacity of partners where needed, so that they can provide the same services at national and regional scales.

The contents of this report do not necessarily reflect the views or policies of UNEP, contributory organisations or editors. The designations employed and the presentations do not imply the expressions of any opinion whatsoever on the part of UNEP, the European Commission or contributory organisations, editors or publishers concerning the legal status of any country, territory, city area or its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of a commercial entity or product in this publication does not imply endorsement by UNEP.

UNEP World Conservation Monitoring Centre (UNEP-WCMC)
219 Huntingdon Road,
Cambridge CB3 0DL, UK
Tel: +44 1223 277314
www.unep-wcmc.org

UNEP promotes environmentally sound practices globally and in its own activities. Printing on paper from environmentally sustainable forests and recycled fibre is encouraged.

Contents

Introduction and summary 1
Panthera leo II/B (*Panthera leo persica* I/A) 2
Taxonomic note 2
Trade patterns 2
Conservation status 7
United Republic of Tanzania 10
Distribution 10
Population size and status 11
Threats 13
Management 14
Zambia 17
Distribution 17
Population size and status 17
Threats 18
Management 19
References 21
Annex 1 24

Introduction and summary 1

This document provides a review of *Panthera leo* from the United Republic of Tanzania and from Zambia, following the publication of the 2015 IUCN Red List assessment for this species.

While the 2015 IUCN Red List assessment of *Panthera leo* maintains the global status of the species as 'Vulnerable', the 2015 assessment highlighted declines in a number of lion populations. The IUCN highlighted declines in subpopulations in two countries where the importation of trophies from the species is being reviewed by the European Union: the United Republic of Tanzania where the species is currently subject to a positive SRG opinion and Zambia which is subject to a 'No Opinion iii)' (Table 1).

Table 1: Overview of current SRG opinions as of 21/08/2015 for *Panthera leo*, and subpopulation numbers and changes reported by the IUCN in the 2015 assessment of the species.

SRG opinions			IUCN 2015 Red List information on 47 monitored sample subpopulations, by country			
Party	**Opinion**	**Last confirmed**	**1993 estimate**	**2014 estimate**	**% change 1993-2014**	**Notes**
Benin	-ve	03/09/2014	25	108	**+332%**	(see also Burkina Faso)
Botswana	No op. i)	28/05/2014	2235	1663	**-26%**	(3 populations considered, 1 declined)
Burkina Faso	-ve	09/04/2015	76	63	**-17%**	(1 population considered, overlapping with Benin and Niger)
Cameroon	-ve	09/04/2015	322	220	**-32%**	(2 populations considered, 2 declined)
Central African Republic	No op. iii)	07/06/2012	-	-	-	
Ethiopia	Susp. (b)	28/05/2015	-	-	-	
Mozambique	No op. iii)	27/03/2015	339	1235	**+264%**	(1 population considered)
Namibia	+ve	07/06/2012	514	725	**+41%**	(3 populations considered, 1 declined)
South Africa	+ve	03/09/2014	1946	2074	**+7%**	(10 populations considered, 1 declined)
South Sudan	No op. iii)	07/06/2012	-	-	-	
Sudan [prior to secession of S. Sudan]	No op. iii)	07/06/2012	-	-	-	
United Republic of Tanzania	+ve	24/10/2014	1787	608	**-66%**	(5 populations considered, 4 declined)
Zambia	No op. iii)	11/09/2012	139	100	**-28%**	(1 population considered)
Zimbabwe	+ve	08/12/2014	52	703	**+1252%**	(5 populations considered, 0 declined)

The CITES Authorities of the United Republic of Tanzania (hereafter referred to as Tanzania) and Zambia have been contacted to seek further clarification on the conservation status and management of the species in these countries. The Management Authority of Tanzania replied and provided more detailed information on the species' status in the country. However, at the time of submission of the present report, no reply had been received from Zambia.

Expert input has been sought from nine lion experts. Replies were received from six of these experts and relevant information has been included in this report.

MAMMALIA: FELIDAE

Panthera leo II/B (*Panthera leo persica* I/A)

COMMON NAMES:	Lion (EN), Lion d'Afrique (FR), León (ES)
RANGE STATES:	Afghanistan (extinct), Algeria (extinct), Angola, Benin, Botswana, Burkina Faso, Burundi (extinct), Cameroon, Central African Republic, Chad, Congo (extinct), Côte d'Ivoire (possibly extinct), Democratic Republic of the Congo, Djibouti (extinct), Egypt (extinct), Eritrea (extinct), Ethiopia, Gabon (extinct), Gambia (extinct), Ghana (possibly extinct), Guinea (possibly extinct), Guinea Bissau (possibly extinct), India, Iran (Islamic Republic of) (extinct), Iraq (extinct), Israel (extinct), Jordan (extinct), Kenya, Kuwait (extinct), Lebanon (extinct), Lesotho (extinct), Libya (extinct), Malawi, Mali (possibly extinct), Mauritania (extinct), Morocco (extinct), Mozambique, Namibia, Niger, Nigeria, Pakistan (extinct), Rwanda (possibly extinct), Saudi Arabia (extinct), Senegal, Sierra Leone (extinct), Somalia, South Africa, South Sudan, Sudan, Swaziland, Syrian Arab Republic (extinct), Togo (possibly extinct), Tunisia (extinct), Turkey (extinct), Uganda, United Republic of Tanzania, Western Sahara (extinct), Zambia, Zimbabwe
UNDER REVIEW:	United Republic of Tanzania, Zambia
EU DECISIONS:	Current positive opinion for wild specimens from Tanzania formed on 24/10/2014. Current no opinion iii) for wild specimens from Zambia formed on 11/09/2012.
IUCN:	Vulnerable

Taxonomic note

The current taxonomy of the African and Asian subspecies of *Panthera leo* was considered invalid (Barnett *et al.*, 2014). Based on Barnett *et al.* (2014), a different split into two subspecies, *P. l. leo* of Asia and West, Central and North Africa, and *P l. melanochaita* from South and East Africa was provisionally proposed by the IUCN SSC Cat Specialist Group in 2015 (Bauer *et al.*, 2015).

Trade patterns

Panthera leo persica was listed in CITES Appendix II on 01/07/1975 and *P. leo* in CITES Appendix III on 26/02/1976 by Ghana. On 04/02/1977, *P. leo* was listed in CITES Appendix II (included in Felidae spp.) and *P. leo persica* in CITES Appendix I. *P. leo* was listed in Annex B (included in Felidae spp.) and *P. leo persica* in Annex A of the EU Wildlife Trade Regulations on 01/06/1997.

The United Republic of Tanzania (hereafter referred to as Tanzania): Tanzania has not published any export quotas for *P. leo*. Direct trade in *P. leo* from Tanzania to the EU-28 between 2004 and 2013 consisted primarily of hunting trophies (Table 1). With the exception of two trophies reportedly seized/confiscated by Australia in 2010, all trade was wild-sourced. Apart from

specimens and hair, which were traded for scientific purposes, all trade was recorded as either purpose 'H', 'T', 'P' or reported without a purpose specified. In total there were 237 wild-sourced trophies, six skins and six skulls, reported imported by the EU-28 between 2004 and 2013. To estimate the number of individuals in trade for hunting trophies a permit analysis was undertaken to identify cases where multiple items were exported on the same permit, and therefore might represent the same individual. On the basis of this permit analysis, this is estimated to equate to 244 individuals.

The principal EU importers of trophies were Spain, Germany and France, while the principal EU importer of scientific specimens was the United Kingdom. Overall, the trend in EU imports of trophies is declining. The majority of direct trade to the rest of world was in wild-sourced trophies and trophy items.

With the exception of 2007, all CITES annual reports were submitted by Tanzania for the years 2004-2013.

Indirect trade in *P. leo* from Tanzania to the EU-28 principally consisted of low levels of wild-sourced trophies and trophy items (Table 2). Trade in specimens for scientific purposes was also reported in 2010-2011.

Small quantities of trade (direct and indirect) in lion parts and derivatives (including bones) other than those reflected in Tables 1 and 2 have been excluded from this analysis.

Table 1: Direct exports of *Panthera leo* from Tanzania to the EU-28 (EU) and the rest of the world (RoW), 2004-2013. Tanzania did not submit an annual report for 2007.

Importer	Term (unit)	Source	Purpose	Reported by	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
EU	feet	W	H	Importer										
				Exporter						2				
	skins	W	H	Importer	3									
				Exporter						34	14	3	1	1
			P	Importer	1									
				Exporter										
			T	Importer		1								
				Exporter										
			-	Importer	1									
				Exporter										
	skulls	W	H	Importer	2	1								
				Exporter						34	14	3	1	1
			P	Importer	1	1								
				Exporter										
			-	Importer	1									
				Exporter										
	specimens (kg)	W	S	Importer			0.9							
				Exporter										
	specimens (l)	W	S	Importer		0.4	0.225							
				Exporter										
	specimens	W	S	Importer		77	201							
				Exporter	31	515								
	trophies	I	-	Importer							2			
				Exporter										
		W	H	Importer	30	39	42	27	21	18	17	9	10	1
				Exporter	37	87	65		14	8	10	1	1	
			P	Importer		1		1	1	10	2		1	
				Exporter										

Importer	Term (unit)	Source	Purpose	Reported by	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
			T	Importer	2	1	1		3					
				Exporter										
RoW	live	C	Z	Importer						1				
				Exporter										
	skins	W	H	Importer		2	10			2	7	11	6	
				Exporter						39	32	3	6	5
			P	Importer	1		1							
				Exporter										
			T	Importer	1									
				Exporter										
	skulls	W	H	Importer		3	9			4	8	11	6	
				Exporter						39	32	2	6	8
			P	Importer	1									
				Exporter										
			T	Importer	1									
				Exporter										
	specimens	I	S	Importer								113		
				Exporter										
		W	S	Importer	12			90	29					
				Exporter										
	trophies	I	H	Importer					1			2		
				Exporter										
		O	H	Importer								1		
				Exporter										
		W	H	Importer	93	116	129	79	104	112	98	42	51	10
				Exporter	50	111	115		42	10	11	4	9	3
			P	Importer			1							
				Exporter								1		
			T	Importer			1	1						
				Exporter										
		-	H	Importer										
				Exporter	1									

Source: CITES Trade Database, UNEP-WCMC, Cambridge, UK, downloaded on 10/08/2015. See Annex 1 for a full list of CITES Source and Purpose codes.

Table 2: Indirect exports of *Panthera leo* originating in Tanzania to the EU-28, 2004-2013.

Importer	Term (unit)	Source	Purpose	Reported by	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
EU	bodies	W	H	Importer										
				Exporter						1				
			P	Importer										1
				Exporter										
	skins	W	H	Importer										
				Exporter							1	1		
	skulls	C	H	Importer										
				Exporter								1		
		W	H	Importer										
				Exporter			2				2	1	3	
	specimens	W	S	Importer							122			
				Exporter							122	6		
	trophies	C	H	Importer										
				Exporter								2		
		U	P	Importer										
				Exporter									1	
		W	H	Importer	2	2	1			1		2		
				Exporter	4	4	2	2	1	1	2	4	3	2

Importer	Term (unit)	Source	Purpose	Reported by	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
EU (cont.)	trophies (cont.)	W	P	Importer	1							1		
				Exporter	1	1								2
			T	Importer						1				
				Exporter								1		

Source: CITES Trade Database, UNEP-WCMC, Cambridge, UK, downloaded on 10/08/2015. See Annex 1 for a full list of CITES Source and Purpose codes.

Zambia: Zambia has not published any export quotas for *P. leo*.

Direct trade in *P. leo* from Zambia to the EU-28 between 2004 and 2013 consisted primarily of wild-sourced trophies and trophy items (Table 3). Apart from specimens, which were traded for scientific purposes, all trade was recorded as either purpose 'H', 'T', 'P' or reported without a purpose specified. In total there were 57 wild-sourced trophies, one skin, five skulls and two feet, reported imported by the EU-28 between 2004 and 2013. To estimate the number of individuals in trade for hunting trophies a permit analysis was undertaken to identify cases where multiple items were exported on the same permit, and therefore might represent the same individual. On the basis of this permit analysis, this is estimated to equate to 62 individuals. The principal importer of trophies was Spain, while the principal importer of scientific specimens was Sweden (according to exporters) and the United Kingdom (according to importers). The majority of direct trade to the rest of world was in wild-sourced trophies and trophy items.

Zambia has not yet submitted an annual report for 2013.

Indirect trade in *P. leo* from Zambia to the EU-28 principally consisted of low levels of wild-sourced trophies and trophy items. Trade in specimens for scientific purposes was also reported. No indirect trade was reported in 2004-2005 and 2007.

Small quantities of trade (direct and indirect) in lion parts and derivatives other than the ones referred to in Table 3 and 4 have been excluded from the analysis.

Table 3: Direct exports of *Panthera leo* from Zambia to the EU-28 (EU) and the rest of the world (RoW), 2004-2013. Zambia has not yet submitted an annual report for 2013. Quantities have been rounded to the nearest tenth of a litre, where applicable.

Importer	Term (unit)	Source	Purpose	Reported by	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
EU	feet	W	H	Importer							2			
				Exporter										
	skins	W	H	Importer							1			
				Exporter										
	skulls	W	H	Importer						4	1			
				Exporter								4		
	specimens (l)	W	S	Importer								0.01		
				Exporter										
	specimens	W	S	Importer			9							
				Exporter			9					2	108	
	trophies	W	H	Importer	4	1	7	6	10	6	2	10	3	2
				Exporter		7	16	9	15	11	12	12	17	
			P	Importer							1	2	1	
				Exporter										
			T	Importer						1				
				Exporter										
		-	-	Importer								1		
				Exporter	3									
RoW	live	C	E	Importer					3					

Importer	Term (unit)	Source	Purpose	Reported by	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
				Exporter										
RoW (cont.)	skins	W	H	Importer			4			3	2	3	3	
				Exporter						1				
			P	Importer					1					
				Exporter							1			
	skulls	W	H	Importer			4			1	3	3	3	
				Exporter		1						8	4	
			P	Importer						1			2	
				Exporter			1							
			T	Importer									2	
				Exporter										
	specimens (kg)	-	S	Importer										0.6
				Exporter										
	specimens (l)		S	Importer									0.19	
				Exporter										
	specimens	I	S	Importer										74
				Exporter										
		W	S	Importer							88	118		211
				Exporter							95	124	378	
		-	S	Importer							7	2		
				Exporter										
	trophies	C	H	Importer		2								
				Exporter										
		I	H	Importer				1	1					
				Exporter										
		R	H	Importer										
				Exporter		1								
		W	H	Importer	39	59	37	40	42	38	23	20	39	21
				Exporter		53	49	47	35	29	77	25	56	
			P	Importer										
				Exporter			1					2		
			T	Importer										
				Exporter			1						2	
		-	-	Importer										
				Exporter	34									

Source: CITES Trade Database, UNEP-WCMC, Cambridge, UK, downloaded on 10/08/2015. See Annex 1 for a full list of CITES Source and Purpose codes.

Table 4: Indirect exports of wild-sourced *Panthera leo* originating in Zambia to the EU-28, 2004-2013.

Importer	Term (unit)	Purpose	Reported by	2006	2008	2009	2010	2011	2012	2013
EU	skulls	H	Importer							
			Exporter	1						
		T	Importer							
			Exporter	2						
	specimens	S	Importer							
			Exporter				1		4	12
	trophies	H	Importer		1			1		
			Exporter	1	1	1				
		P	Importer							
			Exporter						1	

Source: CITES Trade Database, UNEP-WCMC, Cambridge, UK, downloaded on 10/08/2015. See Annex 1 for a full list of CITES Source and Purpose codes.

Conservation status

7

Panthera leo was reported to occur in most Sub-Saharan African countries (Wilson and Reeder, 2005; Bauer *et al.*, 2015), with a single isolated subpopulation remaining in Gir Forest National Park and Wildlife Sanctuary in India (Bauer *et al.*, 2015). Riggio *et al.* (2013) estimated the extant range of *P. leo* at 3.4 million km², reportedly representing 17 per cent of its historic range (Bauer *et al.*, 2015). However, based on recent records and inferred declines, Bauer *et al.* (2015) estimated the extent of occurrence of *P. leo* at 1.65 million km², representing 8 per cent of its historical range.

The species was reported to occur in all African habitats, with the exception of deep desert and deep rainforest, making it an "important element in many African ecosystems" (IUCN SSC Cat Specialist Group, 2006c).

The species lives in matriarchal prides, with males (single or coalitions) generally holding tenure over 2-3 years (Wilson and Mittermeier, 2009). Females usually lose their cubs to infanticide after takeovers, as males try to ensure paternity of offspring (Wilson and Mittermeier, 2009). Although males reach sexual maturity at 26 months, they usually only get the opportunity to breed at five years of age and while holding tenure of a pride (Wilson and Mittermeier, 2009).

"Educated guesstimates" of African *P. leo* numbers by the IUCN SSC Cat Specialist Group in the early 1990s ranged from 30 000 to 100 000 animals (Nowell and Jackson, 1996). In 2002, Chardonnet (2002) estimated 39 000 animals, with about half of the species' range in unprotected areas. Also in 2002, Bauer and Van Der Merwe (2004) estimated 23 000 *P. leo,* primarily occurring in protected areas. In 2006, the population was estimated at between 29 995 and 36 495 animals (IUCN SSC Cat Specialist Group, 2006c, 2006a); however, later counts in Western Africa found fewer animals than previously estimated, therefore requiring reduction of the 2006 estimates (LionAid, 2011). Riggio *et al.* (2013) estimated 32 000 animals, occurring in 67 areas, of which only 15 were reported to hold at least 500 animals; the majority of subpopulations were considered to be small and isolated. Ten *P. leo* "strongholds" (four in East Africa and six in Southern Africa), containing more than 24 000 lions in total (of which roughly 19 000 lions were in protected areas) were reported to exist (Riggio *et al.*, 2013). Bauer *et al.* (2015) noted that the population estimate of 32 000 by Riggio *et al.* (2013) included numbers from earlier sources where no new data was available. Applying regional trends to these sources, Bauer *et al.* (2015) recalculated the number of animals per region, with the exception of West Africa, which was instead based on a recent survey by Henschel *et al.* (2014). In total, Bauer *et al.* (2015) estimated fewer than 20 000 animals in Africa, providing the most recent estimate for this species.

While genetic modelling was reported to have shown that large populations (50-100 *P. leo* prides) and male dispersal were required to conserve genetic diversity and avoid inbreeding (Bjorklund, 2003), such conditions were considered to be met by few wild populations (Bauer, 2008; in Bauer *et al.,* 2008).

P. leo was categorised as Vulnerable in the IUCN Red List, based on a reduction of approximately 42 per cent over the past 21 years (three generations, 1993-2014) (Bauer *et al.*, 2015). This decline was calculated using time trend analysis of census data[1] for 47 "relatively well-studied" subpopulations estimated to total 7500 animals in 2014, which was considered to comprise a substantial proportion of the total population and enough to infer the observed decline for the species as a whole (Bauer *et al.*, 2015). Bauer *et al.* (2015) noted that the vast majority of the

[1] Census estimates were reported to have been obtained by total count, individual identifications, total or sample inventory using calling stations, radio telemetry, photo databases, spoor counts and density estimates based on direct observations corrected for patrol effort (Bauer *et al.*, 2015).

population was inferred to have declined at a rate that meets the criteria for categorisation as Endangered. Subpopulations in four southern Africa countries (Botswana, Namibia, South Africa and Zimbabwe) were observed to have increased by 11 per cent, while an observed decline of 60 per cent in sample subpopulations outside these countries was inferred for the remainder of the species range in Africa (Bauer *et al.*, 2015). Bauer *et al.* (2015) reported that the species had been recently extirpated in 12 African countries, with lions suspected have been recently extirpated in an additional four.

Likewise, Riggio *et al.* (2013) noted that there was evidence of widespread declines and local extinctions across Africa.

The main threats to the species were reported to be indiscriminate killing (primarily retaliatory or pre-emptive in defence of life and livestock) and prey base depletion (Bauer *et al.*, 2015). However, Bauer *et al.* (2015) noted that there is little information available on the number of lions killed as problem animals by local people. A number of populations were noted to have declined and become isolated due to habitat loss and conversion (Bauer *et al.*, 2015). Disease was also reported to have been a threat to populations (Munson *et al.*, 2008; Trinkel *et al.*, 2011 in Bauer *et al.*, 2015).

Poorly managed trophy hunting was considered a possible contributing factor to population declines (e.g. Packer *et al.*, 2006; Hunter *et al.*, 2013; Lindsey *et al.*, 2013; Bauer *et al.*, 2015). This includes impacts on reproduction among hunted populations, with increased turnover rates of pride males and reduced cub survival, if prime males were targeted (Whitman *et al.*, 2004) and changes in socio-spatial behaviour (e.g. Davidson *et al.*, 2011). The main problems associated with current management practices of lion hunting in some countries were identified as: non-scientific bases for setting quotas; excessively high quotas and off-take levels in some countries; fixed-quotas, which encourage over-harvest; lack of age restrictions; and hunting of females (in Namibia and Zimbabwe) (Hunter *et al.*, 2013).

However, well-managed trophy hunting was thought to represent a trivial threat to the species, if breeding biology and social behaviour were considered adequately, with strict restriction of hunting to males of a "safe minimum age" of ≥6 years (Whitman *et al.*, 2004, 2007). Similarly, Loveridge *et al.* (2009) considered *P. leo* populations to be "incredibly resilient", provided that the social structure remained relatively intact and immigration from other populations was possible. Furthermore, well-managed trophy hunting was considered an important management tool for *P. leo* conservation, (e.g. Packer *et al.*, 2006) that can provide revenues to government conservation authorities (IUCN SSC Cat Specialist Group, 2006a). Lions were considered amongst the most valuable trophy species, and the price of lion hunts was reported to be increasing faster than most other trophy species (Hunter *et al.*, 2013).

Palazy *et al.* (2011) considered scientifically established hunting quotas, regulated at an international level, combined with improved protection methods to be urgently required. Likewise, Hunter *et al.* (2013) considered that urgent and comprehensive reforms of lion management was required, and recommended the implementation and enforcement of age restrictions (6 years or older); improved, independent trophy monitoring and adaptive management of quotas; restriction of harvest to males; and a minimum length of lion hunts of at least 21 days (to allow time for selection and to maximise revenues). A sustainable offtake level of one male lion per 2000 km² was recommended by Packer *et al.* (2011).

LionAid (2011) considered trophy hunting to be highly unsustainable when depending on unknown source populations, and recommended a ban of all *P. leo* trophy hunting, until independent assessments of all populations within hunting concessions have been made and such populations have stabilised. Lindsey *et al.* (2012), however, noted that a hunting ban may have negative impacts on the conservation of the species and its habitat, compared to ecologically

unfavourable alternatives, and Frank *et al.* (2006) noted that "benefits of wildlife must outweigh the costs" to ensure conservation of the species. Likewise, Hunter *et al.* (2013) cautioned that, while trade restrictions may confer immediate benefits for overexploited populations, there are substantial associated risks, including removing or reducing the economic justification to retain large blocks of land for wildlife; undermining the potential for developing wildlife-based land uses; removing or reducing the funds for anti-poaching; and reducing the tolerance for lions. Lindsey *et al.* (2012) recommended that an intervention should focus on a reduction of hunting to sustainable levels, combined with improved management. Temporary hunting moratoria though were found to be potentially useful interventions to restore populations in hunting areas (Davidson *et al.*, 2011).

The species was reported to be present in a number of large and well-managed protected areas and was noted to generate significant cash revenue through wildlife tourism for park management and local communities, providing a strong incentive for conservation (Bauer *et al.*, 2015).

The species had been identified as a possible candidate for the CITES Review of Significant Trade in 2004, based on trade levels in trophies, mainly originating from Botswana, Namibia, South Africa, Tanzania, Zambia and Zimbabwe (AC20 Inf. 12), but it was not selected for review (AC20 Summary Record).

Also in 2004, a proposal by Kenya to transfer the species from Appendix II to Appendix I (COP13 Prop. 6) was withdrawn, with the Conference of the Parties recommending a series of workshops in support of the development of regional conservation strategies instead. The IUCN SSC Cat Specialist Group consequently published the *Conservation Strategy for the Lion in West and Central Africa* (IUCN SSC Cat Specialist Group, 2006a) and the *Regional Conservation Strategy for the Lion in Eastern and Southern Africa*, both of which were intended for implementation in the ten years following development (IUCN SSC Cat Specialist Group, 2006c).

The *Eastern and Southern African Regional Conservation Strategy* emphasised the importance of trophy hunting as a management tool capable of providing benefits to local people and revenues to government conservation authorities, if best practices ensuring sustainability are implemented (IUCN SSC Cat Specialist Group, 2006c).

The Strategy identified areas where management could be improved, and developed a series of objectives within the Strategy:

- Improved lion population management through national action plans for the species including sustainable trophy hunting, recognising its importance as a revenue generator and management tool. Recognition that traditional lion hunting required management too;

- Mitigation of human-lion conflict through preventive measures and damage compensation;

- Equitable sharing of costs and benefits derived from lion conservation;

- National legal frameworks for the promotion of wildlife-integrated land use;

- Better reflection of the regional and national intent in global policies in support of the sustainable use of lions; and

- Best practices in monitoring and trophy hunting management, improved regulation of legal trade while curbing illegal trade through increased efficiency of enforcement;

The Strategy also recommended the consequent development of national action plans for the species (IUCN SSC Cat Specialist Group, 2006c).

In February 2012, the Second African Lion Working Group meeting was held in Etosha, Namibia. In March 2012, Lion Aid organised a meeting on the conservation needs and status of *P. leo*, which directed all range States that had not yet developed National Lion Action Plans for lion conservation and management, in a structured and coordinated way, to urgently do so by April 2013.

At the 25th meeting of the CITES Animals Committee (July 2011), the Committee acknowledged that Kenya and Namibia had offered to lead the review of *P. leo* as a high priority with range State consultation, as a contribution to the Periodic Review of Felidae called for in Decision 13.93 (Rev. COP15) (AC25 summary record). A Periodic Review of *P. leo* by Kenya and Namibia was presented at AC27 (AC27 Sum. 2 (Rev.2)), recommending that *P. leo* did not meet the biological criteria for Appendix I and was appropriately listed in Appendix II (AC27 Doc. 24.3.3; AC27 Inf. 15). At its 27th meeting, the Animals Committee noted the then upcoming 2015 IUCN Red List assessment of *P. leo* and requested Namibia and Kenya to incorporate this information into their review and prepare a revised review for consideration at AC28 in August 2015 (AC27 WG8 Doc. 1). The Animals Committee also noted recent information regarding changes to the nomenclature of *P. leo* and requested its nomenclature expert to review this information (AC27 WG8 Doc. 1).

The addition of *P. leo* in Appendix II under CMS was proposed by Kenya at the 11th Meeting of the Conference of the Parties (COP) in 2014. (UNEP/CMS/ScC18/Doc.7.2.2). Resolution 11.32 invites range States to work towards developing an Appendix II listing proposal to be presented at the 12th COP to CMS.

P. leo has been proposed for official listing as Threatened on the U.S. Endangered Species Act (U.S. Fish & Wildlife Service, 2015) and is currently under consideration. The proposed listing includes a rule under Section 4(d) of the Act requiring import permits for all lion products (U.S. Fish and Wildlife Service, 2014).

United Republic of Tanzania

Tanzania was reported to host the largest population of *P. leo* in Africa (Mésochina *et al.*, 2010; Riggio *et al.*, 2013). Mésochina *et al.* (2010), estimated the total range to be approximately 749 700 km², comprising roughly 85 per cent of the total terrestrial land area of Tanzania. The majority (69 per cent) of this area was considered a 'permanent presence' lion range (Mésochina *et al.*, 2010). However, updated information on population size and trends was reported to be lacking for most populations (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015). One expert considered that lion population size and status has not been systematically assessed in the vast majority of conservation areas in Tanzania (Anon 1, 2015a). The same expert considered the known lion range in Tanzania to cover 377 000 km² (Anon 1, 2015a).

Distribution

The four main subpopulations of lions in Tanzania were reported as:

1) the Maasailand Ecosystem, mostly in Mara, Arusha, Kilimanjaro and Manyara Regions (north-eastern Tanzania);

2) Kagera and Kigoma Regions (north-western Tanzania);

3) Rukwa, Tabora and Mbeya Regions (central and western Tanzania); and

4) the Selous Ecosystem, mostly in Lindi, Morogoro and Ruvuma Regions (southern Tanzania) (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015).

Packer (2009) noted that unlike in other range countries, significant numbers of *P. leo* were found outside protected areas in Tanzania. According to Mésochina *et al.* (2010), the majority (around 55 per cent) of the species' range was in non-gazetted areas; however, the authors noted that in most sites outside protected areas, the species had been observed rarely, and that approximately 81 per cent of the total population was found within protected areas, including National Parks (21.5-24 per cent) and hunting areas (i.e. Game Reserves, Game Conservation Areas, and Open Areas) (57 per cent) (Mésochina *et al.*, 2010). Mésochina *et al.* (2010) recorded occurrence in 17 out of the 19 protected areas with no trophy hunting, and found lions to be present in all protected areas where hunting was practiced. Packer (2009) noted that out of the five areas with significant populations of *P. leo* (considered by Packer (2009) as Serengeti, Maasai Steppe, Selous, Moyowosi-Kigosi-Ugalla and Rukwa-Rungwa-Ruaha) in Tanzania, only Serengeti was primarily a National Park, whereas the rest were conserved primarily for hunting purposes. Mésochina *et al.* (2010) recorded occurrence in 72 out of 97 studied Districts, and noted that the species was absent in some areas in north-eastern Tanzania, the southern shores of lake Victoria, and the vicinity of lake Malawi. According to TAWIRI (2009), the species was also absent in the Usambara and Pare mountains.

Population size and status

Ikanda (2008) stated that mainly due to the high cost and inefficiency of aerial surveys, the total population size of *P. leo* in Tanzania had not been accurately determined. Mésochina *et al.* (2010) reported that the status of populations outside protected areas was particularly poorly known, and Riggio *et al.* (2013) noted that population numbers from Tanzania include many uncertainties.

The Ministry of Natural Resources and Tourism (*in litt.* to UNEP-WCMC, 2015) reported that its Wildlife Division, in collaboration with TAWIRI (Tanzania Wildlife Research Institute), had launched a national large carnivores survey in 2014 to monitor the status and population trends of *P. leo* in the tourist hunting areas of Tanzania. Surveys were undertaken in the eastern border of the Tarangire Ecosystem and the Selous Game Reserve during 2014 and 2015. Whilst preliminary results suggest that densities in Selous Game Reserve are comparable to those observed by Brink *et al.* (2013), and lion densities may have increased in some areas, the survey results are currently being analysed and the overall results are not yet available (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015).

One expert claimed that there was a lack of transparency around trophy hunting in Tanzania, and questioned whether TAWIRI had the resources and independence required to monitor lion populations (Anon 2, 2015). Another expert questioned the impartiality of the entities responsible for carrying out survey work underway in Tanzania (Anon 1, 2015a).

Ikanda (2008) estimated the size of eight known populations in National Parks and Game Reserves at 13 000 individuals, and after combining this to data collected from other suitable habitats by Chardonnet (2002), concluded the minimum population size to be 18 215 individuals. Ikanda and Packer (2006, cited in Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015) estimated the population to be 17 564. A considerably lower estimate of 7073 individuals in 2001/2002, was given by Bauer and Van Der Merwe (2004), although they noted that some important range areas were omitted. The IUCN SSC Cat Specialist Group, (2006b) reported a population estimate of less than 15 400 individuals, including some cross-border populations. Some Tanzanian populations of *P. leo* were considered to be connected with populations found in Kenya, Rwanda, Malawi, Mozambique and possibly Zambia (Mésochina *et al.*, 2010). Mésochina *et al.* (2010) estimated the population size to be 16 800 individuals, recalculated to be 15 818 by Riggio *et al.* (2013)

to exclude areas where lions were considered a temporary presence. The Tanzanian Wildlife Division accepted the estimate of 16 800 by Mésochina *et al.* (2010) as the latest nationwide lion estimate (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015). One expert raised concerns about the reliability of the methods used in prior estimates of lion population sizes in Tanzania (e.g, by Mésochina *et al.* (2010)) and reported that only 8 per cent of known lion range had been subject to systematic survey work utilising appropriate field methodology (Anon 1, 2015a).

Average densities calculated in different regions were reported to vary between 0.01 on the southern plains of the Serengeti to 0.38 individuals per km² in Manyara National Park and the grass plains of the Serengeti (TAWIRI, 2009).

The size of the four main subpopulations, according to the assessment by Mésochina *et al.* (2010), were reported at around: 3700 in the Maasailand Ecosystem; 520 in Kagera and Kigoma Regions; 2300 in Rukwa, Tabora and Mbeya Regions; and 7200 on the Selous Ecosystem (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015). The total figure for these four subpopulations is around 13,700 individuals.

The Selous Game Reserve (SGR) in Tanzania was believed to contain the largest lion population in Africa (Bauer and Van Der Merwe, 2004 in Brink *et al.*, 2012). However, few population surveys were reported to have been undertaken (Brink *et al.*, 2012). Between 2006 and 2009, Brink *et al.* (2012) combined individual recognition surveys with call-up surveys in a study area to estimate the overall number of *P. leo* throughout the SGR at around 4300 individuals (within an estimated range of 1700-6900 individuals) at densities of 0.06 adult lions per km² [2].

The Tarangire lion area was reported to hold an estimated 700 lions, of which only around 200 occurred in protected areas (IUCN categories I-VI); the remainder were reported to occur in non-designated hunting areas (Riggio *et al.*, 2013).

Katavi National Park was surveyed by Kiffner *et al.* (2009) in 2005 to assess lion density and identify the key factors influencing lion abundance. The population was estimated to be at 31-45 per cent of the parks carrying capacity, with considerably fewer sub-adult males observed than expected (Kiffner *et al.*, 2009). *P. leo* were also found to be less abundant near the park boundaries and were not detected outside (Kiffner *et al.*, 2009).

Ikanda (2008) noted that although the past abundance of *P. leo* in Tanzania was poorly known, "historical tribal tales and legends suggest fewer lions survive today than did in the past 50 years". In a study based on questionnaire surveys, Mésochina *et al.* (2010) reported that the majority of informants considered the recent population trend to be decreasing outside the protected areas but increasing or stable within the protected areas. Similarly, Chardonnet (2002) considered the populations in protected areas generally stable, however the populations outside protected areas were considered to be decreasing mainly due to livestock competition.

The IUCN SSC Cat Specialist Group, (2006b) reported varying increasing and decreasing trends for different populations in Tanzania. Packer *et al.* (2011) reported a decreasing population or hunting trend in 9 out of 12 areas where photo-tourism or hunting occurred. More recently, Bauer *et al.* (2015) reported declines in four out of five monitored subpopulations (Ngorongoro Crater, Katavi, Matambwe (Selous GR) and Tarangire) from 1993-2014 (Table 5). One subpopulation in the Serengeti was observed to have increased (35 per cent); however, overall the population in these five monitored subpopulations was inferred to have declined by 66 per cent. Bauer *et al.* (2015) noted that these study subpopulations do not necessarily represent total site populations.

[2] The authors noted that the density estimates should be viewed with caution and could decrease if a greater maximum call-up distance than 1.5 km was used (Nelson *et al.*, 2013).

Table 5: Inferred lion population trend based on census data from 1993-2014 in five monitored lion subpopulations in Tanzania (*Bauer et al., 2015*)

Sample Subpopulation	Estimated Lions (1993)	Estimated Lions (2014)	Percentage change
Ngorongoro Crater	61	55	-10
Katavi	1118	0	-100
Matambwe (Selous GR)	124	98	-21
Serengeti	232	314	+35
Tarangire	252	141	-44
Overall	**1787**	**608**	**-66**

The Ministry of Natural Resources and Tourism (*in litt.* to UNEP-WCMC, 2015) noted that the majority of lion surveys in Tanzania have taken place in National Parks, and only sporadically outside of these areas [noting the exception of Mésochina *et al.* (2010)].

The Ministry of Natural Resources and Tourism (*in litt.* to UNEP-WCMC, 2015) questioned the finding of zero lions for the sample subpopulation in Katavi, stating that lions are seen regularly in the Katavi Ecosystem (Mésochina *et al.*, 2010) and that 41 adult males (>5 years) have been harvested from Katavi since 2010.

The Ministry of Natural Resources and Tourism (*in litt.* to UNEP-WCMC, 2015) stated that the estimate of inferred decline for Tanzania by Bauer *et al.* (2015) should be considered with caution stating that due to the small study areas in National Parks and a small sample size, the assessment could not be considered representative of lion status and trends in the whole country.

Threats

The main threats to *P. leo* in Tanzania were considered to include habitat loss and illegal killing (TAWIRI, 2009; Mésochina *et al.*, 2010). Almost 200 lions were reported killed each year in response to livestock attacks, with an estimated minimum of 500 livestock lost each year. Less than 10 lions were reported to have been killed through official "problem animal control" (PAC) for this reason per year (AC27 Doc. 24.3.3). Poisoning of lions and habitat loss were reported to be growing threats (AC27 Doc. 24.3.3). Increasing human population was reported to have caused habitat loss, particularly outside protected areas (Ikanda, 2008).

Trophy hunting was reported to have contributed to population declines outside of (and within some) protected areas in Tanzania (Lindsey *et al.*, 2013) and was considered by Packer *et al.* (2011) to pose the greatest threat to the populations in trophy hunting areas. Lindsey *et al.* (2012) noted that recent studies indicated a notable negative impact of trophy hunting on populations of *P. leo* in Tanzania. Packer *et al.* (2011) recorded significant declines in four out of the seven hunting areas studied, with particularly steep declines in hunting areas with highest harvest levels, concluding that the hunting quotas, at that time, of approximately 500 individuals were unsustainable (see management section for details on quotas in Tanzania). LionAid (2011) considered the quotas allocated at the time, to be excessive, with the species overhunted in concessions and concluded that trophy harvest levels were unsustainable. Kiffner *et al.* (2009) found evidence to suggest that the intensity of hunting outside park boundaries had an impact on the abundance of *P. leo* within protected areas. Hunting of lions was considered to be responsible for the skewed sex ratio and low abundance in edge areas and outside of the Katavi National Park (Kiffner *et al.*, 2009) and was reported to have resulted in changes in the sex ratio of the Selous population (Brink *et al.*, 2012).

Decreasing wild prey base and increasing human population were seen as a main factor in human-lion conflicts (Mésochina *et al.*, 2010; Nyahongo and Røskaft, 2011). Mésochina *et al.* (2010) recorded conflicts in the majority (82 per cent) of studied Districts, with livestock depredation most commonly recorded in central and northern Tanzania and human casualties in southern and central parts of the country. According to Kushnir *et al.* (2010), lions attacked over 1000 people in Tanzania during 1990-2007. Ikanda (2008) noted that the impact of retaliatory killing was difficult to measure, as it typically took place in remote areas and was rarely reported to wildlife authorities.

Human-lion conflict was reported to pose a threat to the largest population in the Selous Game Reserve (Brink *et al.*, 2012). Since 2006, numbers of pastoralists in areas adjacent to Selous were reported to be increasing, which was considered likely to impact on the Selous lion population (Dr Brink *in litt.* to UNEP-WCMC, 2015).

P. leo was also reported to be illegally hunted as part of rituals (Kissui, 2008; Ikanda, 2008). In a study conducted in the Tarangire ecosystem, Lichtenfeld (2009) found that the Maasai killed approximately 6.4-8.8 per cent of the *P. leo* population annually. In a later study in the region, Maasai villagers gave livestock depredation as the main reason given for hunting lions (95 per cent of informants); interviewees mentioned that lions perceived as preparing to attack were often killed (Goldman *et al.*, 2013). In addition to retaliatory killing and cultural killing, *P. leo* was also reported to be poached for commercial purposes, traditional uses or due to accidental catching in bushmeat snares (Mésochina *et al.*, 2010). Illegal trade was considered rare (Ikanda, 2008; Packer *et al.*, 2011; AC27 Doc. 24.3.3); however, the Ministry of Natural Resources and Tourism (*in litt.* to UNEP-WCMC, 2015) noted an increase in the number of trophy items impounded by wildlife authorities around the country, which indicated illegal killing of lions. In addition, they noted a potential growing trade in lion bones to Asia from Tanzanian lions.

Management

Key management measures discussed in this section in place in Tanzania include compulsory age-based restrictions, quotas and national laws. Other management measures are also discussed.

Compulsory age-based restrictions below six years of age of hunted lions (Table 6) (stipulated in sections 24(5)(a) and 24(6) of the Tourist Hunting Regulations of 2010) (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015), controlled by annual inspection of trophies by the Tanzania Wildlife Division, were reported to have been implemented in Tanzania (AC27 Doc. 24.3.3; Lindsey *et al.*, 2013). Under the new rule, professional hunters are liable to fines or imprisonment for hunting lions under six years old (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015). A monitoring and control programme run by the Wildlife Division was reported to have been established (AC27 Doc. 24.3.3). According to the Ministry of Natural Resources and Tourism (*in litt.* to UNEP-WCMC, 2015), trophy hunting is monitored through a specific database which records all hunting permits, and is used to follow up on lion trophy activities (e.g. hunting success, hunting effort), however it is unclear how the impacts on populations are monitored. An overview of management measures in place in Tanzania compiled by Lindsey *et al.*, 2013 is provided in Table 6. A comparison of these measures with management measures in place in Zambia is provided in Annex 1, Table 3.

The report received from the Management Authority of Tanzania provides an overview of current management measures in place. While much of the information provided in Lindsey *et al.*, 2013 is still applicable (e.g. minimum age restrictions, sex of lions hunted, etc.), there were some areas that differed: the hunting season was reported to last from 1st July to 31st Decemeber; a specific database to monitor lion trophy hunting was reported; and a new aged-based lion quota setting system based on

the age of the lions harvested during the previous hunting season was reported (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015).

Table 6: Trophy hunting rules and processes in Tanzania

The rules and processes relating to the allocation of hunting blocks and management of lion hunting in Tanzania (sourced from (Lindsey *et al.*, 2013) from surveys with senior officials).

Concession allocation process	Closed tender, fixed fee (depending on status of wildlife in blocks)
Lease period	5 years
Community benefits from hunting in areas occupied by people	In Wildlife Management Areas (WMAs), communities accrue 60–65% of total hunting income; in Game Controlled and Open areas benefits limited to mandatory contr butions from operators to community projects
Basis for establishing lion quotas	Based on various source of info: operators provide recommendations; officers working for the Wildlife Division provide opinion regarding whether the previous quota was too big or too small; info from surveys or reports where available.
Mandatory quota payments required from operators ('Fixed quota')	40% of total quota regardless of off-take
Monitoring	Official observer, hunt return form
Season	1 Jul–31 Mar
Time	Sunrise – Sunset (no artificial light)
Minimum stipulated length of lion hunts (in days)	21
Sex of lions hunted	Male
Minimum age/size	6 years
General	Must be shot >200 m away from a vehicle, >2 km from a national park boundary and >500 m from a water source

Mésochina *et al.* (2010) noted that trophy fees were paid based on the fixed hunting quota, even if the animals were not hunted, which may act as an incentive for hunting younger individuals. It was noted that the centralised system of collecting hunting profits gave insufficient incentive for communities to conserve wildlife (Lindsey *et al.*, 2012). Furthermore, the lack of a compensation scheme or insurance system for human-lion conflicts was seen as problematic for lion conservation in Tanzania (Mésochina *et al.*, 2010). In 2012, changes were reportedly made to the regulatory framework for community-based conservation in the form of the Wildlife Management Area regulations, which grant local communities that have established Wildlife Management Areas greater involvement in granting trophy hunting concessions, and provide greater clarity regarding sharing revenues from hunting (Nelson *et al.*, 2013). Lindsey *et al.* (2012, 2013) considered the five-year leases of hunting concessions to potentially discourage incentives to invest in wildlife protection, and Mésochina *et al.* (2010) considered the introduction of a longer lease period as a key issue in improving the management of *P. leo* hunting in Tanzania. Furthermore, the majority of government income from hunting blocks was reported to come from trophy and licence fees, which may encourage higher quotas (Nelson *et al.*, 2013). LionAid (2011) claimed that corruption was a contributing factor in the assignment of hunting areas and in the lack of assessment of hunting pressure at the time.

The Ministry of Natural Resources and Tourism (*in litt.* to UNEP-WCMC, 2015) reported that a new aged-based quota system, which sets and allocates quotas to each hunting area according to the age of the lions harvested in the previous hunting season, has been adopted. Although hunting quotas in Tanzania were reported to be high compared to other range States, quotas were reported to have been reduced, from 520 in 2008-2009 to 315 in 2011-2012 (Lindsey *et al.*, 2013). Based on data provided by the Ministry of Natural Resources and Tourism (*in litt.* to UNEP-WCMC, 2015), quotas in 2013-2014 were between 250-300 individuals.

A general reduction in offtake since 2008 was reported, from 165 in 2008 to 42 in 2014 (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015), although it was noted that this could be at least partly due to continued population declines (Lindsey *et al.*, 2013; Nelson *et al.*, 2013). Furthermore, regional harvest rates in 2013-2014 in the main ecosystems of the lion range were reported to be below the recommended sustainable harvest rate as recommended by Packer *et al.* (2011), with the exception of the Serengeti (0.52 per 1000 km²) in 2013 (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015).

Prior to the decrease in quotas and due to the decrease in *P. leo* populations within the country, Packer *et al.* (2011) and Lindsey *et al.* (2012) suggested a reduction in the hunting quotas to a maximum of 0.5 individuals per 1000 km² (with a slightly higher quota of one individual per 1000 km² within the Selous Game Reserve). Alternatively, Lindsey *et al.* (2012) suggested that a short-term moratorium followed by reduced hunting quotas could also be of benefit to lion populations. Due to the high income of lion trophy hunting, Lindsey *et al.* (2012) considered Tanzania to be economically highly vulnerable to a ban or reduced hunting quota of *P. leo* hunting. Furthermore, as the majority of *P. leo* habitat was found within Hunting Areas (Packer, 2009), which were mainly sustained for the purposes of trophy hunting (Ikanda, 2008), Mésochina *et al.* (2010) cautioned that a ban could lead to significant habitat loss without the incentives to conserve the land for hunting. It was also noted that it could reduce the overall competitiveness of wildlife-based land uses (Lindsey *et al.* 2012).

Tanzania's categories of protected areas include 15 National Parks (covering 4.5 per cent of land area), 34 Game Reserves (13 per cent), the Ngorongoro Conservation Area (1 per cent), 46 Game Controlled Areas (5.5 per cent), 38 Wildlife Management Areas (4 per cent), and 570 Forest Reserves (15 per cent) (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015). Trophy hunting was reported to be conducted in hunting blocks designated as Game Reserves (GRs), Game Controlled Areas (GCAs), Open Areas (OAs), Forest Reserves (FR) and Wildlife Management Areas (WMAs) (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015). Trophy hunting of *P. leo* was reported to occur across a high proportion of its range (34-49 per cent) in Tanzania (Table 4 in Annex).

The sale of lion hunting permits from 2000-2015, was reported to have generated around 2 500 000 USD a year for the Wildlife Division (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015), providing a financial incentive for the retention and development of wildlife areas. The prices for *P. leo* hunting packages in Tanzania were higher compared to the other range countries, and the majority of hunting blocks were considered economically viable (Lindsey *et al.*, 2012).

The Tanzania Wildlife Conservation Act of 2009 (United Republic of Tanzania, 2009) listed *P. leo* under the First, Third (Big Game) and Fourth (Dangerous Animal) Schedules, specifying the need of a permit for hunting or capture. All informal harvesting was reported to be treated as poaching, with fines and penalties involved (Mésochina *et al.*, 2010). The Wildlife Act (1974, 2009) allows for the game scouts to kill 'problem animals' with approval from the district game department and traditional groups to obtain hunting rights (Goldman *et al.*, 2013). In addition to the Wildlife Conservation Act of 2009, trophy hunting in Tanzania was reported to be governed by The Wildlife Conservation (Tourist Hunting) Regulations of 2010 (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015). An amendment to the Tourist Hunting Regulations of 2010 in 2013 stipulated age restriction rules on hunting lions (in sections 24(5)(a) and 24(6) that "*no person shall hunt lion of an age below six years*"), which were adopted by the Wildlife Division (Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015).

Zambia

17

Distribution

The majority of *P. leo* were reported to occur in protected areas in three ecosystems: the Kafue, the Luangwa Valley and the Lower Zambezi (Midlane *et al.*, 2014). The extent of occurrence of *P. leo* in Zambia was reported at 113 600 km², of which 46 per cent (52 750 km²) was reported to be located within national parks, while 44 per cent (50 350 km²) is located within areas with lower protection status, such as GMAs (Anon 1, 2015b).

Population size and status

In 2002, the population was estimated at 1500, based on a survey conducted for the inventory by Bauer and Van Der Merwe (C. Stuart and T. Stuart, *pers. comm*. in Bauer and Van Der Merwe, 2004), to 3199 animals (Chardonnet, 2002); recalculated by Bauer *et al.* (2005). The IUCN SSC Cat Specialist Group (2006a) reported estimates ranging from 800 to 1980 animals and a stable or unknown population trend for the individual populations, including populations substantially overlapping with neighbouring countries. However, lion numbers were noted to be uncertain, with the population in Liuwa, for example, reported to contain only three lions (LionAid, 2011), rather than the <50 estimated previously (IUCN SSC Cat Specialist Group, 2006b). Furthermore, Riggio *et al.* (2013) noted that the IUCN's statement that populations of *P. leo* in Kafue National Park are stable "may be optimistic" due to the threat poaching poses to the animals' long-term persistence. Becker *et al.* (2013b) noted that little published information on *P. leo* populations in Zambia exists and that estimates of populations in Zambia are likely in need of revision. Monitoring and surveys of lion populations was reported to have been restricted to three study sites located within the main lion areas (Anon 1, 2015b). Hunting operators considered lions to be declining in a significant proportion of hunting areas in Zambia (Lindsey *et al.*, 2013). In 2015, the IUCN reported declines in a monitored subpopulation in the Luangwa of -28 per cent from 139 in 1993 to 100 in 2014 (Bauer *et al.*, 2015).

Populations in South Luangwa National Park, Kafue National Park, and Lower Zambezi National Park, which all border hunting areas, were surveyed between 2001 and 2009 to determine population density, age distribution, and sex ratio (Becker *et al.*, 2013b). The population in the South Luangwa study area (2775 km²) was estimated at 156 individuals in 13 prides and seven coalitions, at densities of 0.020 adults per km² and 0.035 individuals per km²; in the Kafue study area (4720 km²) at 107 individuals in 13 prides and four coalitions at densities of 0.015 adults per km² and 0.018 lions per km²; and in the Lower Zambezi study area (650 km²) and portions of the adjacent Game Management Area (GMA) data was collected for a population of 11-34 individuals in six prides and 13 coalitions at densities of 0.031 adults per km² and 0.037 individuals per km² (Table 7) (Becker *et al.*, 2013b).

Rosenblatt *et al.* (2014) monitored the South Luangwa lion population from 2008 to 2012 and estimated the local population size at a minimum of 94 lions in 2012, a decline from a maximum of 125 in 2009 (excluding cubs below one year of age) (Table 7).

From 2010-2013, Midlane *et al.* (2015) surveyed *P. leo* in the northern sector of Kafue National Park using both call-up surveys and track-count surveys to estimate the species' abundance at 200 individuals over one year of age, with a density of 1.83 per 100 km², at the lower end of density ranges for southern and east African protected areas (Table 7).

Table 7: Estimated size of lion populations in Kafue, South Luangwa and Lower Zambezi

Site	Estimated lion population size	Area assessed (km^2)	% of PA	Year assessed	Source
Kafue	264 (204-325)	11,000	16	2011	(Midlane *et al.*, 2015)
South Luangwa	94 (92-106)	2,775	5	2012	(Rosenblatt *et al.*, 2014)
Lower Zambezi	11-34	650	7	2009	(Becker *et al.*, 2013b)

Threats

The species was reported to be threatened by disease, illegal killing, limited prey availability, livestock encroachment, habitat conversion, resource extraction from protected areas, removal of problem animals and trophy hunting, with levels of threat varying across populations (IUCN SSC Cat Specialist Group, 2006b). According to the responses provided in the latest CITES Periodic Review consultation process, the main threats to *P. leo* in Zambia include snaring, human encroachment and destruction of habitat, especially in areas surrounding national parks and isolated populations (AC27 Doc. 24.3.3). Incidences of human-lion conflict mainly involved the loss of livestock and, on average, seven animals per year were reported to be controlled through official operations (AC27 Doc. 24.3.3). Illegal trade of lion parts and derivatives was reported to occur, but was considered most likely insignificant (AC27 Doc. 24.3.3).

Snaring dynamics and the impact of by-catch on lions in the Luangwa valley was evaluated using data from anti-poaching patrols from 2005-2010 (Becker *et al.*, 2013a). Approximately 11.5 per cent of the adult and sub-adult population and 20 per cent of the adult (>4 years) males were reported to have been snared, with 82 per cent reported to have been immobilised and treated, and subsequently recovered (Becker *et al.*, 2013a). Becker *et al.* (2013a) recommended precautionary management emphasising increased law enforcement as essential to protect wildlife and wildlife-based economies.

Based on findings of a 2010-2013 survey, Midlane (2013) concluded that the abundance of *P. leo* in Kafue National Park was primarily restricted by the suppressed prey population, and further, that prior to a ban on hunting in 2013, hunting quotas were excessive.

Excessive trophy hunting was also reported to have had negative impacts on the population density in South Luangwa National Park, and to have altered sex-ratios and ranging behaviour (Yamazaki, 1996 in Lindsey *et al.*, 2012). LionAid (2011) noted that the population size was uncertain, with high pressure from trophy hunting and concluded that the sustainability of harvest at the time was "highly questionable". Furthermore, monitoring of the South Luangwa lion population from 2008 to 2012 by Rosenblatt *et al.* (2014) indicated a declining population, low recruitment, low sub-adult and adult male survival, depletion of adult males, and a senescing adult female population. The primary cause of mortality was considered to be trophy hunting, with 46 males harvested (Rosenblatt *et al.*, 2014).

Population surveys in South Luangwa National Park, Kafue National Park, and Lower Zambezi National Park observed male-depletion compared to other systems, and male mortality was reported to be mainly due to trophy hunting and wire snares (Becker *et al.*, 2013b). Hunting in the adjacent GMAs was reported to occur every year during the study, with the exception of 2001-02, and 2009 when no lion quota was issued for a GMA adjacent to the Lower Zambezi. Hunters were reported to use bait along the park borders (Becker *et al.*, 2013b). Becker *et al.* (2013b) thought that instituting age limits on male harvest with quota reductions towards compliance with the

recommendation of 0.5 adult males per 1000 km² by Packer *et al.* (2011) would reduce male depletion, and slightly increase population size. Likewise, reducing male mortality from wire snare poaching could have similar results, and combined with changes in hunting regulations, could improve the population size and condition in Zambia (Becker *et al.*, 2013b).

Management

Zambia was reported to have banned lion hunting from 2001 to 2002 and halved their quotas in 2009 in response to concerns over the species' conservation status (AC27 Doc. 24.3.3). On 10th January 2013, a moratorium on safari hunting in the nineteen hunting blocks was imposed (Republic of Zambia, 2015b, 2015a). The reasons for the ban on cat hunting were given by the Government as:

(a) weak regulatory mechanism;

(b) declining lion population in some areas due to indiscriminate and over harvesting;

(c) depletion of habitats for lions; and

(d) unreliable statistics upon which to base the quotas.

Midlane (2013) and Rosenblatt *et al.* (2014) recommended maintaining the ban until at least 2016 to allow populations in Kafue and the South Luangwa to recover and should hunting resume, quotas should be substantially reduced, with strict age restrictions and effective management mandated. Midlane (2013) recommended that a quota of 5.25 lions per annum for the hunting concessions surrounding Kafue may be appropriate, with strict age-based regulations within an adaptive management framework, to ensure sustainability of harvest. Monitoring of other key populations in Zambia was thought to be required to determine the effects of the ban and provide guidance for future management (Rosenblatt *et al.*, 2014).

The ban was lifted on 10th May 2015 and, during a Parliamentary debate on this issue, it was reported that lion hunting will resume in the 2016/2017 hunting season with quotas that allow two lions to be hunted in prime hunting areas and one in secondary areas and game ranches (Republic of Zambia, 2015b, 2015a). Quotas were reported to be based on population estimates of lions, which were reported by Zambia as 1500-2500 animals (Republic of Zambia, 2015a); the basis of this population estimate was unclear. There was opposition to the lifting of the ban voiced according to the parliamentary proceedings and the accuracy of the Government reported population figures was queried at the heading (Republic of Zambia, 2015a).

Clarification was sought from the Zambian CITES Authorities in relation to the hunting ban, however, no response was received.

Prior to the ban, hunting of *P. leo* in Zambia was reported to be regulated through a quota system managed by the Zambia Wildlife Authority (ZAWA) (AC27 Doc. 24.3), who were reported to undertake regular monitoring of all sport hunting activities (AC27 Doc. 24.3). Hunting zones were reported to cover 167 000 km², of which lions were reported to be hunted across 89 035 km² (Lindsey *et al.*, 2013) (Table 4 in Annex). Hunting zones were noted to be impacted by economic, sociological and ecological degradation, and were not considered to provide a suitable basis for a sustainable wildlife tourism industry (UICN/PACO, 2009). ZAWA was reported to rely on safari hunting in Game Management Areas (GMAs) to generate 45-67 per cent of their funding (Manning, 2011; Sichilongo *et al.*, 2013 in Lindsey *et al.*, 2014) and increased quotas and division of hunting blocks as a result were reported in 2003, increasing revenues (Simasiku *et al.*, 2008). The lack of funds was reported to have also resulted in a lack of monitoring of both wildlife populations and trophies (Lindsey *et al.*, 2014). Trophy quotas were reported to be established arbitrarily (Lindsey *et al.*, 2014) and quotas for lions were considered particularly excessive (Lindsey *et al.*, 2014). One expert

considered that revenues from trophy hunting help create economic incentives for the GMAs, but that trophy hunting in Zambia is urgently in need of reform (Anon 1, 2015b).

Fixed quotas of 60 per cent, regardless of offtake, were reported, which were considered to encourage over-harvest (Lindsey *et al.*, 2013) and mean off-takes per unit area were reported to be higher than the 0.5 per 1000 km² recommended by Packer *et al.* (2011) (Lindsey *et al.*, 2013). Prior to 2013, utilisation and trophy quality were reported to be on the decline, which was considered to suggest that quotas were not sustainable (Simasiku *et al.*, 2008). Hunting operators considered lions to be declining in a significant proportion of hunting areas in Zambia (Lindsey *et al.*, 2013). However, quotas were reported to have been reduced significantly in recent years (Lindsey *et al.*, 2013); quotas were reported at ca. 100 in 2007 reduced to 74 in 2012, of which the actual offtake was reported to be 47 (Lindsey *et al.*, 2013). Zambia was also reported to have developed aging guidelines to help ensure that only mature male lions aged six years or older were hunted (AC27 Doc. 24.3.3; Lindsey *et al.*, 2013), however, a minimum age limit of lions for hunting in Zambia was not reported in a review of the country's rules and processes (Lindsey *et al.*, 2013).

National Parks are increasingly isolated, posing a threat to *P. leo* as a wide-ranging, low density, threatened species (Watson *et al.*, 2015). Protected areas in Zambia were considered to be under-performing in ecological, economic and social terms (Lindsey *et al.*, 2014). The reasons given for this by Lindsey *et al.* (2014) included:

> *a) "rapidly expanding human populations, poverty and open-access systems in Game Management Areas (GMAs) resulting in widespread bushmeat poaching and habitat encroachment;*
>
> *b) underfunding of the Zambia Wildlife Authority (ZAWA) resulting in inadequate law enforcement;*
>
> *c) reliance of ZAWA on extracting revenues from GMAs to cover operational costs which has prevented proper devolution of user-rights over wildlife to communities;*
>
> *d) on-going marginalization of communities from legal benefits from wildlife;*
>
> *e) under-development of the photo-tourism industry with the effect that earnings are limited to a fraction of the PA network;*
>
> *f) unfavourable terms and corruption which discourage good practice and adequate investment by hunting operators in GMAs;*
>
> *g) blurred responsibilities regarding anti-poaching in GMAs resulting in under-investment by all stakeholders."*

The impact of these was reported to include a "major reduction" in wildlife densities in most protected areas (Lindsey *et al.*, 2014). The authors noted that wildlife is more successful in areas with investment from the private and/or NGO sector and where there is no human settlement (Lindsey *et al.*, 2014).

In March 2015, a ministerial statement from the Minister of Tourism and Arts during a parliamentary debate, announced the transformation of the Zambia Wildlife Authority (ZAWA) into a Government department, under the Ministry of Tourism and Arts (Republic of Zambia, 2015c).

In 2009, ZAWA published a Conservation Strategy and Action Plan for *P. leo* in Zambia, which identified objectives under seven thematic areas: research and management; mitigation of human-lion conflicts; local community benefits from lion utilisation; land use planning and zoning, management of the conservation politics at national and international levels and trade in the African lion (Chansa *et al.*, 2009). However, LionAid (2013) reported that this had not been enacted.

P. leo is protected under the Zambia Wildlife Act, 1998, which prohibits the hunting, killing, capture or possessions of individuals without a license (AC27 Doc. 24.3.3).

References 21

Anon 1 *in litt.* to UNEP-WCMC, 14th August 2015a.

Anon 1 *in litt.* to UNEP-WCMC, 18th August 2015b.

Anon 2 *in litt.* to UNEP-WCMC, 13th August 2015.

Barnett, R., Yamaguchi, N., Shapiro, B., Ho, S., Barnes, I., Sabin, R., Werdelin, R., Cuisin, J. and Lars, G. 2014. Revealing the maternal demographic history of *Panthera leo* using ancient DNA and a spatially explicit genealogical analysis. *BMC evolutionary biology*, 14(70): 1471–2148.

Bauer, H., Chardonnet, P. and Nowell, K. 2005. *Status and distribution of the lion (Panthera leo) in east and southern Africa. Background paper for the East and Southern African Lion Conservation Workshop January 2006, Johannesburg, South Africa*. Cambridge, UK.

Bauer, H. and Van Der Merwe, S. 2004. Inventory of free-ranging lions Panthera leo in Africa. 26–31 pp. Available at: WOS:000220283600007.

Bauer, H., Packer, C., Funston, P., Henschel, P. and Nowell, K. 2015. *Panthera leo*. Available at: http://www.iucnredlist.org. [Accessed: 24/07/2015].

Becker, M., McRobb, R., Watson, F., Droge, E., Kanyembo, B., Murdoch, J. and Kakumbi, C. 2013a. Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. *Biological Conservation*, 158: 26–36.

Becker, M., Watson, F., Droge, E., Leigh, K., Carlson, R. and Carlson, A. 2013b. Estimating past and future male loss in three Zambian lion populations. *The Journal of Wildlife Management*, 77(1): 128–142.

Bjorklund, M. 2003. The risk of inbreeding due to habitat loss in the lion (Panthera leo). *Conservation Genetics*, 4(4): 515–523.

Brink, H., Smith, R.J. and Skinner, K. 2012. Methods for lion monitoring: a comparison from the Selous Game Reserve, Tanzania. *African Journal of Ecology*, 51: 366–375.

Chansa, W.C., Simukonda, C.C., Mukanga, P.S. and Zyambo, F.C. 2009. *Zambia's conservation strategy and Action Plan for the African Lion*. Chilanga. 25 pp.

Chardonnet, P. 2002. *Conservation of the African lion: Contribution to a status survey*. International Foundation for the Conservation of Wildlife, France & Conservation Force, USA.

Davidson, Z., Valeix, M., Loveridge, A.J., Madzikanda, H. and Macdonald, D.W. 2011. Socio-spatial behaviour of an African lion population following perturbation by sport hunting. *Biological Conservation*, 144(1): 114–121.

Frank, L., Hemson, G., Kushnir, H. and Packer, C. 2006. *Lions, Conflict and Conservation in Eastern and Southern Africa. Background paper for the estern and southern African lion conservation workshop, Johannesburg, SOuth Africa, 11-13 January 2006*.

Goldman, M.J., de Pinho, J.R. and Perry, J. 2013. Beyond ritual and economics: Maasai lion hunting and conservation politics. *Oryx*, 47(4): 490–500.

Henschel, P., Coad, L., Burton, C., Chataigner, B., Dunn, A., MacDonald, D., Saidu, Y. and Hunter, L.T.B. 2014. The lion in West Africa is critically endangered. *PloS one*, 9(1): e83500.

Hunter, L., Lindsey, P., Balme, G., Becker, M., Begg, C., Brink, H., Chardonnet, P., Dickman, A., Edwards, C., Frank, L. *et al.* 2013. *Urgent and comprehensive reform of trophy hunting of lions is a better option than an endangered listing; a science-based consensus*. New York.

Ikanda, D. 2008. Non detriment report under CITES regarding the export of African Lions Panthera leo from United Republic of Tanzania. *NDF Workshop Case Studies, WG5-Case study*, 1(2005): 1–15.

IUCN SSC Cat Specialist Group 2006a. *Conservation strategy for the lion in eastern and southern Africa*. IUCN Regional Office for Southern Africa.

IUCN SSC Cat Specialist Group 2006b. *Conservation strategy for the lion in West and Central Africa*. Yaounde, Cameroon.

IUCN SSC Cat Specialist Group 2006c. *Regional conservation strategy for the lion Panthera leo in Eastern and Southern Africa*.

Kiffner, C., Meyer, B., Mühlenberg, M. and Waltert, M. 2009. Plenty of prey, few predators: what limits lions Panthera leo in Katavi National Park, western Tanzania? *Oryx*, 43(01): 52.

Kissui, B.M. 2008. Livestock predation by lions, leopards, spotted hyenas, and their vulnerability to retaliatory killing in the Maasai steppe, Tanzania. *Animal Conservation*, 11(5): 422–432.
Kushnir, H., Leitner, H., Ikanda, D. and Packer, C. 2010. Human and ecological risk factors for unprovoked lion attacks on humans in southeastern Tanzania. 315–331 pp.
Lichtenfeld, L. 2009. *The risk of living with lions: Human-lion conflict in the Tarangire ecosystem*. Tanzania Wildlife Research Institute, Arusha, Tanzania. 77–79 pp.
Lindsey, P. a, Nyirenda, V.R., Barnes, J.I., Becker, M.S., McRobb, R., Tambling, C.J., Taylor, W.A., Watson, F.G. and T'Sas-Rolfes, M. 2014. Underperformance of african protected area networks and the case for new conservation models: insights from zambia. *PloS one*, 9(5): e94109.
Lindsey, P.A., Balme, G.A., Booth, V.R. and Midlane, N. 2012. The significance of African lions for the financial viability of trophy hunting and the maintenance of wild land. *PloS one*, 7(1): e29332.
Lindsey, P.A., Balme, G.A., Funston, P., Henschel, P., Hunter, L., Madzikanda, H., Midlane, N. and Nyirenda, V. 2013. The trophy hunting of African lions: scale, current management practices and factors undermining sustainability. *PloS one*, 8(9): e73808.
LionAid 2011. *Summary Report: Trophy hunting and lion population status in eastern, western and central, and southern Africa*.
LionAid 2013. *Trip report: LionAid in Zambia and Kenya*. Available at: http://www.lionaid.org. [Accessed: 6/08/2015].
Loveridge, A.J., Packer, C. and Dutton, A. 2009. Science and the recreational hunting of lions. In: Dickson, B., Hutton, J. and Adams, W.M. (Eds.). *Recreational Hunting, Conservation and Rural Livelihoods: Science and Practice*. Wiley-Blackwell, Oxford, UK. 108–124.
Manning, I.P.A. 2011. *Wildlife conservation in Zambia and the Landsafe Customary Commons*. University of Pretoria. 355 pp.
Mésochina, P., Mbangwa, O., Chardonnet, P., Mosha, R., Mtui, B., Drouet, N., Crosmary, W. and Kissui, B. 2010. *Conservation status of the lion (Panthera leo) in Tanzania*. Gland, Switzerland.
Midlane, N. 2013. *The conservation status and dynamics of a protected African lion* Panthera leo *population in Kafue National Park, Zambia*. University of Cape Town. 173 pp.
Midlane, N., O'Riain, M.J., Balme, G.A. and Hunter, L.T.B. 2015. To track or to call: comparing methods for estimating population abundance of African lions Panthera leo in Kafue National Park. *Biodiversity Conservation*, 24: 1311–1327.
Midlane, N., O'Riain, M.J., Balme, G.A., Robinson, H.S. and Hunter, L.T.B. 2014. On tracks: A spoor-based occupancy survey of lion *Panthera leo* distribution in Kafue National Park, Zambia. *Biological Conservation*, 172: 101–108.
Ministry of Natural Resources and Tourism *in litt.* to UNEP-WCMC, 2015
Munson, L., Terio, K.A., Kock, R., Mlengeya, T., Roelke, M.E., Dubovi, E., Summers, B., Sinclair, A.R.E. and Packer, C. 2008. Climate extremes and co-infections determine mortality during epidemics in African lions. *PLoS ONE*, 3: e2545.
Nelson, F., Lindsey, P. and Balme, G. 2013. Trophy hunting and lion conservation: a question of governance? *Oryx*, 47(4): 501–509.
Nowell, K. and Jackson, P. 1996. *Wild cats: status survey and conservation action plan*. Available at: http://books.google.com/books?hl=en&lr=&id=OxfxlpfXNtcC&oi=fnd&pg=PR7&dq=Wild+Cats+status+survey+and+conservation+action+plan&ots=MAtLIrb_kM&sig=JI_-cMBNLfDNGYRonWCOsWZSIb4. [Accessed: 01/02/2013].
Nyahongo, J.W. and Røskaft, E. 2011. Perception of people towards lions and other wildlife killing humans, around Selous Game Reserve, Tanzania. 110–115 pp.
Packer, C. 2009. *'Best practices' for trophy hunting of African lions*. Tanzania Wildlife Research Institute, Arusha, Tanzania. 69–77 pp.
Packer, C., Brink, H., Kissui, B.M., Maliti, H., Kushnir, H. and Caro, T. 2011. Effects of Trophy Hunting on Lion and Leopard Populations in Tanzania. *Conservation Biology*, 25(1): 142–153.
Packer, C., Whitman, K., Loveridge, A.J., Jackson III, J. and Funston, P. 2006. *Impacts of Trophy Hunting on Lions in East and Southern Africa: Recent offtake and future recommendations*. Background paper for the eastern and southern African Lion conservation Workshop, Johannesburg, South Africa, 11-13 January 2006. 15 pp.

Palazy, L., Bonenfant, C., Gaillard, J.-M. and Courchamp, F. 2011. Cat dilemma: too protected to escape trophy hunting? *PloS one*, 6(7): e22424.
Republic of Zambia 2015a. *Lifting of the ban on cat hunting in Zambia [Ministerial statements, 9 July 2015]*. Available at: http://www.parliament.gov.zm/node/4324. [Accessed: 14/08/2015].
Republic of Zambia 2015b. *Statement by Hon. Jean Kapata, MP, Minister of Tourism and Arts on the lifting of the ban on cat hunting in Zambia*. Available at: http://www.parliament.gov.zm/sites/default/files/images/publication_docs/Ministerial Statement - Ministry of Tourism and Arts - Ban on Cat Hunting.pdf. [Accessed: 14/08/2015].
Republic of Zambia 2015c. *Transformation of ZAWA into a Department [Ministerial statements, 13 March 2015]*. Available at: http://www.parliament.gov.zm/node/466. [Accessed: 17/08/2015].
Riggio, J., Jacobson, A., Dollar, L., Bauer, H., Becker, M., Dickman, A., Funston, P., Groom, R., Henschel, P., de Iongh, H. *et al.* 2013. The size of savannah Africa: a lion's (Panthera leo) view. *Biodiversity and Conservation*, 22(1): 17–35.
Rosenblatt, E., Becker, M., Creel, S., Droge, E., Mweetwa, T., Schuette, P.A., Watson, F., Merkle, J. and Mwape, H. 2014. Detecting declines of apex carnivores and evaluating their causes: An example with Zambian lions. *Biological Conservation*, 180: 176–186.
Sichilongo, M., Mulozi, P., Mbewe, B., Machala, C. and Pavy, J. 2013. *Zambian wildlife sector policy: Impact analysis and recommendations for the future policy*. Lusaka, Zambia.
Simasiku, P., Simwanza, H.I., Tembo, G., Bandyopadhyay, S. and Pavy, J.-M. 2008. *The Impact of Wildlife Management Policies on Communities and Conservation in Game Management Areas in Zambia: Message to Policy Makers*. Natural Resources Consultative Forum (NRCF).
TAWIRI 2009. *The Tanzania lion and leopard conservation action plan. Pages 64-111 in Tanzania carnivore conservation action plan*. Tanzania Wildlife Research Institute, Arusha, Tanzania.
Trinkel, M., Cooper, D., Packer, C. and Slotow, R. 2011. Inbreeding depression increases susceptibility to bovine tuberculosis in lions. *Journal of Wildlife Diseases*, 47: 495–500.
Trinkel, M., Funston, P., Hofmeyr, M., Hofmeyr, D., Dell, S., Packer, C. and Slotow, R. 2010. Inbreeding and density-dependent population growth in a small, isolated lion population. *Animal Conservation*, 13(4): 374–382.
U.S. Fish & Wildlife Service 2015. *Endangered Species*. Available at: http://www.fws.gov/endangered/. [Accessed: 5/08/2015].
U.S. Fish and Wildlife Service 2014. Endangered and Threatened wildlife and plants; listing the African Lion subspecies as Threatened with a rule under Section 4(d) of the ESA. *Federal Register*, 79(209): 64472–64502.
UICN/PACO 2009. *La grande chasse en Afrique de l'Ouest: quelle contribution à la conservation? (Big Game Hunting in West Africa. What is its contribution to conservation?* IUCN, Gland, Switzerland and Cambridge, United Kingdom.
United Republic of Tanzania 2009. *Wildlife Conservation Act (No. 5 of 2009)*.
Watson, F., Becker, M., Milanzi, J. and Nyirenda, M. 2015. Human encroachment into protected area networks in Zambia: implications for large carnivore conservation. *Regional Environmental Change*, 15: 415–429.
Whitman, K., Starfield, A.M., Quadling, H.S. and Packer, C. 2004. Sustainable trophy hunting of African lions. *Nature*, 428(6979): 175–178.
Whitman, K.L., Starfield, A.M., Quadling, H. and Packer, C. 2007. Modeling the effects of trophy selection and environmental disturbance on a simulated population of African lions. *Conservation biology : the journal of the Society for Conservation Biology*, 21(3): 591–601.
Wilson, D.E. and Mittermeier, R.A. 2009. *Handbook of the Mammals of the World. Vol. I. Carnivores*. Wilson, D.E. and Mittermeier, R.A. (Eds.). Lynx Edicions, Barcelona.
Wilson, D.E. and Reeder, D.M. 2005. *Mammal species of the world - a taxonomic and geographic reference*. 3rd Ed. Smithsonian Institution Press, Baltimore, USA. 2142 pp.
Yamazaki, K. 1996. Social variation of lions in a male-depopulated area in Zambia. 490–497 pp. Available at: WOS:A1996UZ98500003.

Annex 1

Table 1: Purpose of trade

Code	Description
T	Commercial
Z	Zoo
G	Botanical garden
Q	Circus or travelling exhibition
S	Scientific
H	Hunting trophy
P	Personal
M	Medical (including biomedical research)
E	Educational
N	Reintroduction or introduction into the wild
B	Breeding in captivity or artificial propagation
L	Law enforcement / judicial / forensic

Table 2: Source of specimens

Code	Description
W	Specimens taken from the wild
R	Ranched specimens: specimens of animals reared in a controlled environment, taken as eggs or juveniles from the wild, where they would otherwise have had a very low probability of surviving to adulthood
D	Appendix-I animals bred in captivity for commercial purposes in operations included in the Secretariat's Register, in accordance with Resolution Conf. 12.10 (Rev. CoP15), and Appendix-I plants artificially propagated for commercial purposes, as well as parts and derivatives thereof, exported under the provisions of Article VII, paragraph 4, of the Convention
A	Plants that are artificially propagated in accordance with Resolution Conf. 11.11 (Rev. CoP15), as well as parts and derivatives thereof, exported under the provisions of Article VII, paragraph 5 (specimens of species included in Appendix I that have been propagated artificially for non-commercial purposes and specimens of species included in Appendices II and III)
C	Animals bred in captivity in accordance with Resolution Conf. 10.16 (Rev.), as well as parts and derivatives thereof, exported under the provisions of Article VII, paragraph 5
F	Animals born in captivity (F1 or subsequent generations) that do not fulfil the definition of 'bred in captivity' in Resolution Conf. 10.16 (Rev.), as well as parts and derivatives thereof
U	Source unknown (must be justified)
I	Confiscated or seized specimens (may be used with another code)
O	Pre-Convention specimens

Table 3: Trophy hunting rules and processes

The rules and processes relating to the allocation of hunting blocks and management of lion hunting in Tanzania and Zambia (sourced from (Lindsey *et al.*, 2013) from surveys with senior officials).

	Tanzania	Zambia
Concession allocation process	Closed tender, fixed fee (depending on status of wildlife in blocks)	Game Management Areas (GMAs): closed tender process. Game ranches: long term lease
Lease period	5 years	GMAs: 10–15 years (depending on status). Game ranches: long term lease
Community benefits from hunting in areas occupied by people	In WMAs, communities accrue 60–65% of total hunting income; in Game Controlled and Open areas benefits limited to mandatory contr butions from operators to community projects	In GMAs, communities accrue 50% of trophy fees and 20% of concession fees
Basis for establishing lion quotas	Based on various source of info: operators provide recommendations; officers working for the Wildlife Division provide opinion regarding whether the previous quota was too big or too small; info from surveys or reports where available	A set % of estimates of lion populations, but modulated by local communities and operators recommendations
Mandatory quota payments required from operators ('Fixed quota')	40% of total quota regardless of off-take	60% of total quota regardless of off-take (Prime hunting blocks – 5 'classic' & 7 'mini' safaris; Secondary hunting blocks –3 classic and 5 mini safaris)
Monitoring	Official observer, hunt return form	Official observer; completion of a hunt return form and submission of photos of the trophy required as a pre-requisite for obtaining export permits
Season	1 Jul–31 Mar	1 May-31 Dec
Time	Sunrise – Sunset (no artificial light)	Sunrise – Sunset (no artificial light)
Minimum stipulated length of lion hunts (in days)	21	No stipulation
Sex of lions hunted	Male	Male
Minimum age/size	6 years	None
General	Must be shot >200 m away from a vehicle, >2 km from a national park boundary and >500 m from a water source	Must be shot >200 m away from a vehicle

Table 4: Trophy hunting areas

The area in which lions occur, total area in which trophy hunting occurs and the area across which lions are hunted (sourced from (Lindsey *et al.*, 2013).

	Total lion range (km^2)	Total hunting area (km^2)	Area across which lions are hunted (km^2)	% of lion range where lions are hunted	% of hunting area with lion on quota
Tanzania	516,000	300,000	254,207	49%	85%
Zambia	200,237	167,000	89,035	44%	53%

Fwd: Paper in review cited in Beyond Cecil docucment

1 message

Vannorman, Tim <tim_vannorman@fws.gov> Tue, Jan 3, 2017 at 9:38 AM
To: FWHQ DMA-BOP <fwhq_dma_bop@fws.gov>

All,

Some information on lions throughout Africa that Kathy has uncovered.

Tim

---------- Forwarded message ----------
From: Moore, Kathleen <kathleen_moore@fws.gov>
Date: Tue, Jan 3, 2017 at 8:51 AM
Subject: Re: Paper in review cited in Beyond Cecil docucment
To: Peter Lindsey <plindsey@panthera.org>
Cc: Michelle Gadd <michelle_gadd@fws.gov>, Tim Vannorman <tim_vannorman@fws.gov>

Thanks very much. Our office looks forward to seeing the document when you get word.

Can you also forward the affiliations of co-authors? Since that won't change it would be good to become familiar with those that i don't recognize.

Best,
Kathleen

On Mon, Jan 2, 2017 at 7:07 AM, Peter Lindsey <plindsey@panthera.org> wrote:

> Hi Kathleen,
>
> Here is the abstract of the paper.. As soon as it is accepted, I will send you the full version with all of the figures.
>
> The performance of African protected areas for lions and their prey, determinants of success and key conservation threats
>
> Lindsey, P.A. [1, 2†], Petracca, L. [1,3†], Funston, P.J. [1], Bauer, H. [4], Dickman, A. [4], Everatt, K. [5], Flyman, M. [6], Henschel, P. [1], Hinks, A. [4], Kasiki, S. [7], Loveridge, A.[4], Macdonald, D.W.[4], Mandisodza, R. [8], Mgoola, W. [9] Miller, S[10, 11]., Nazerali, S.[12], Siege, L. [13], Uiseb, K. [14], Hunter, L. [1]
>
> Abstract
>
> -
>
> Using surveys of experts associated with 186 sites across 24 countries, we assessed the effectiveness of African protected areas (PAs) at conserving lions and their prey, identified factors that influence conservation effectiveness, and identified patterns in the severity of various threats. Less than one third of sampled PAs conserve lions at ≥50% of their estimated carrying capacity (K), and less than half conserve lion prey species at ≥50% of K. Given adequate management, PAs could theoretically support up to 4x the total extant population of wild African lions (~83,000), providing a measurable benchmark for future conservation efforts. The performance of PAs shows marked geographic variation, and in several countries there is a need for a significant elevation in conservation effort. Bushmeat poaching was identified as the most serious threat to both lions and to wildlife in general. The severity of threats to wildlife in PAs and the performance of prey

populations were best predicted by geographic-socioeconomic variables related to the size of PAs, whether people were settled within PAs, human/livestock densities in neighbouring areas and national economic indicators. However, conservation outcomes for lions were best explained by management variables. PAs tended to be more effective for conserving lions and/or their prey where management budgets were higher, where photographic tourism was the primary land use, and, for prey, where fencing was present. Lions and prey fared less well relative to their estimated potential carrying capacities in poorer countries, where people were settled within PAs and where PAs were used for neither photographic tourism nor trophy hunting.

Regards,

Peter

From: "Moore, Kathleen" <kathleen_moore@fws.gov>
Date: Wednesday, 28 December 2016 at 13:04
To: Peter Lindsey <plindsey@panthera.org>
Cc: Michelle Gadd <michelle_gadd@fws.gov>, Tim Vannorman <tim_vannorman@fws.gov>
Subject: Re: Paper in review cited in Beyond Cecil docucment

Thank you Dr. Lindsey. Do you anticipate an acceptance date now that you have taken into account the peer review?

If you do not anticipate any more substantial changes to the document, it would be great to see it. I hesitate to quote anything just yet though until I get word from you that it has been accepted.

Thanks much,
Kathleen

On Fri, Dec 23, 2016 at 3:15 AM, Peter Lindsey <plindsey@panthera.org> wrote:

> Hi Kathleen
>
> That paper is about to be re-submitted to the journal, the changes that were requested by the reviewers having been made.
>
> It will thus hopefully be published soon. I will send it to you when it comes out
>
> In the meantime, I would be happy to provide you the nutshell elements relating to hunting in the meantime, if you would like?
>
> Best regards
>
> Peter

From: Moore, Kathleen [mailto:kathleen_moore@fws.gov]
Sent: Thursday, December 22, 2016 9:49 PM
To: Peter Lindsey <plindsey@panthera.org>
Cc: Michelle Gadd <michelle_gadd@fws.gov>; Tim Vannorman <tim_vannorman@fws.gov>
Subject: Paper in review cited in Beyond Cecil docucment

Hi Dr. Lindsay,

Hope this message finds you well. I was not able to make your acquaintance last you were in the DC area but I am part of Mr. Van Norman's team here in the Division of Management Authority..

As you are well aware, the U.S. Fish and Wildlife Service is tasked with reviewing the potential import from U.S. hunters who visit various African countries to harvest lions for the purpose of obtaining a personal sport hunted trophy. In reviewing various documents I came across the document mentioned above that cites an in review paper by you. Has this paper been accepted to a journal as yet? If so, could we please obtain a copy?

Thanks very much.

Best regards,

Kathleen

--

Kathleen Moore

Senior Biologist

USFWS/Division of Management Authority

Branch of Permits, MS: IA

5275 Leesburg Pike

Falls Church, VA 22041-3803

1-800-358-2104 (Phone)

Che*ck* out the new CITES specie*s* database at www.speciesplus.net to find out more information about how specie*s* are listed and protected under the Convention.

--
Kathleen Moore
USFWS/Division of Management Authority
Branch of Permits, MS: IA

> 5275 Leesburg Pike
> Falls Church, VA 22041-3803
> 1-800-358-2104 (Phone)
>
> **Che*ck* out the new CITES specie*s* database at www.speciesplus.net to find out more information about how specie*s* are listed and protected under the Convention.**

--
Kathleen Moore
USFWS/Division of Management Authority
Branch of Permits, MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803
1-800-358-2104 (Phone)

Check out the new CITES species database at www.speciesplus.net to find out more information about how species are listed and protected under the Convention.

--
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!





Barry, Anna <anna_barry@fws.gov>

Fwd: Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting

1 message

Vannorman, Tim <tim_vannorman@fws.gov> Tue, Jan 3, 2017 at 1:46 PM
To: FWHQ DMA-BOP <fwhq_dma_bop@fws.gov>

Additional info on lion hunting.

Tim

---------- Forwarded message ----------
From: Gnam, Rosemarie <rosemarie_gnam@fws.gov>
Date: Tue, Dec 27, 2016 at 11:27 AM
Subject: Fwd: Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting
To: Craig Hoover <Craig_Hoover@fws.gov>, "Vannorman, Tim" <tim_vannorman@fws.gov>
Cc: "Arroyo, Bryan" <bryan_arroyo@fws.gov>, Gloria Bell <Gloria_Bell@fws.gov>

FYI
---------- Forwarded message ----------
From: Susan Lieberman <slieberman@wcs.org>
Date: Fri, Dec 23, 2016 at 12:00 PM
Subject: Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting
To: Rosemarie Gnam <Rosemarie_Gnam@fws.gov>

Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting

https://www.wildcru.org/wp-content/uploads/2016/12/Report_on_lion_conservation.pdf

This report (to UK DEFRA) was published the end of November. You probably already have it, but I am sending it if not. It is very comprehensive. Please feel free to forward, of course.

All the best,
Sue

Susan Lieberman, Ph.D.
Vice President, International Policy
Wildlife Conservation Society
2300 Southern Boulevard, Bronx, New York 10460 USA and
750 9th Street NW, Suite 525, Washington, DC 20001 USA
Cell/mobile phone: +1 (240) 779-5045
Skype: sslieberman; Twitter: @sslieberman

--
Rosemarie Gnam, Ph.D.
Chief
Division of Scientific Authority- International Affairs
U. S. Fish and Wildlife Service
MS: IA
5275 LEESBURG PIKE
FALLS CHURCH, VA 22041-3803

Phone: (703) 358-2497
Fax: (703) 358-2276

www.fws.gov/international

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!



--
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!





Barry, Anna <anna_barry@fws.gov>

Fwd: African Lion - 2015 Zimbabwe NDF (sent on behalf of John Jackson)

1 message

Vannorman, Tim <tim_vannorman@fws.gov> Mon, Jan 11, 2016 at 1:26 PM
To: Anna Barry <anna_barry@fws.gov>
Cc: Lisa Lierheimer <lisa_lierheimer@fws.gov>

Anna,

As discussed at last Thursday BOP meeting, the evaluation of lion trophy imports has been divided up between the biologists and senior biologists. You were selected to analyze Zimbabwe's lion trophy program.

While there is a draft letter saved on the R drive (R:/dma/bop/lions/zimbabwe), I am not sure we need to send it yet. Attached is Zimbabwe's non-detriment finding which may cover much of what we need to make our enhancement finding (either pro or con). Please review the non-detriment finding with an eye towards enhancement. We can then talk about whether we need additional information or not. Remember I have been working on Zimbabwe elephant program, so have a lot of additional background information that will help in your evaluation.

Thanks,

Tim

---------- Forwarded message ----------
From: Regina A. Lennox <regina.lennox@conservationforce.org>
Date: Mon, Jan 11, 2016 at 1:20 PM
Subject: Re: African Lion - 2015 Zimbabwe NDF (sent on behalf of John Jackson)
To: "Vannorman, Tim" <tim_vannorman@fws.gov>

Hi Tim,
Great. Do you have Zimbabwe's aging guidelines for 2014 and forward? I attach that too, just in case. It is available on ZimParks' website, but I am not sure it ever made it to you. It explains some of the decisions in the NDF.
Cheers,
Regina

On Mon, Jan 11, 2016 at 11:57 AM, Vannorman, Tim <tim_vannorman@fws.gov> wrote:

> Regina,
>
> Thank you for the e-mail. I was about to send a letter to Olivia with a series of questions regarding lions - your e-mail may make that letter unnecessary at this time.
>
> I will have one of my staff review the non-detriment finding to see if it answers all of our questions regarding whether the lion hunting program is enhancing the survival of the species (the requirement under the Endangered Species Act). If we have additional questions, we will contact Olivia directly.
>
> Sincerely,
>
> Tim
>
> On Mon, Jan 11, 2016 at 12:44 PM, Regina A. Lennox <regina.lennox@conservationforce.org> wrote:
>
> > Dear Tim,
> >
> > Attached please find Zimbabwe's 2015 Non-Detriment Finding for African Lion. It is being submitted to assist FWS in making its enhancement finding for import of lion hunting trophies from Zimbabwe. We hope to be able to provide other relevant documents as they become available.

> We intend to refer to these documents in permit applications in lieu of attaching them to each individual application unless you would prefer they be attached to each.
>
> We note that the current population estimates have increased since those in the attached document. Example: Bubye Valley Conservancy is reported to now have 510 lion.
>
> Most sincerely,
>
> John J. Jackson, III
>
> --
> Conservation Force
> 3240 S I-10 Service Road W, Suite 200
> Metairie, Louisiana 70001 USA
> 504-837-1233 (office)
> www.conservationforce.org

--
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

--
Regina A. Lennox
Conservation Force
3240 S I-10 Service Road W, Suite 200
Metairie, Louisiana 70001 USA
504-837-1233 (office)
919-452-8652 (cell)
regina.lennox@conservationforce.org

--
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

Lion trophy age restrictions Zimbabwe 2014.pdf
500K

Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting

A report prepared by Professor David W. Macdonald CBE, FRSE, DSc*

Director of WildCRU, Department of Zoology, University of Oxford

at the request of Rory Stewart OBE

Under Secretary of State for the Environment

28 November 2016



WILDCRU
Wildlife Conservation Research Unit

UNIVERSITY OF OXFORD

* david.macdonald@zoo.ox.ac.uk

Contributors

This report was prepared with the assistance of members of the Wildlife Conservation Research Unit, Department of Zoology, University of Oxford, of which the core team was Dr Amy Dickman, Dr Andrew Loveridge, Mr Kim Jacobsen, Dr Paul Johnson, Dr Christopher O'Kane and Dr Byron du Preez, supported by Dr Kristina Kesch and Ms Laura Perry.

It benefitted from critical review by:

Dr Guillaume Chapron
Dr Peter Lindsey
Professor Craig Packer

It also benefitted from helpful input from:

Dr Hans Bauer
Professor Claudio Sillero
Dr Christiaan Winterbach
Professor John Vucetich

Under the aegis of DEFRA the report was helpfully informed by evidence and opinions offered during consultations with the following organisations:

Born Free
LionAid
Safari Club International Foundation (SCIF)
The British Association for Shooting and Conservation (BASC)
The European Federation of Associations for Hunting and Conservation (FACE)
The International Union for Conservation of Nature (IUCN)
The Wildlife Conservation Society (WCS)
The World Wide Fund for Nature (WWF)

Contents

Contributors ii

Abbreviations Used in the Text viii

Preface ix

Executive Summary and Recommendations xiii

1 Reasons for examining the issue of trophy hunting with respect to lion conservation 1

1.1 Reasons for being concerned about lion conservation 1

1.1.1 What value do lions have? 1

1.1.2 To what extent have lions declined, in terms of numbers and geographic range? 1

1.1.3 What is the current threat status of lions? 2

1.1.4 What are the major current threats to lions? 2

1.1.5 Future considerations for lion conservation 3

1.1.6 Summary of reasons for being concerned about lion conservation . . 4

1.2 Background to lion trophy hunting 5

1.2.1 What is lion trophy hunting? 5

1.2.2 Legality of lion trophy hunting 6

1.2.3 Ethical acceptability of lion trophy hunting 10

1.2.4 Extent of lion trophy hunting and its markets 11

1.2.5 Reason for the UK Government examining this issue now 12

1.3 Summary of reasons for examining trophy hunting with regard to lion conservation 18

2 Threats and impacts associated with lion trophy hunting 19

2.1 The significance of trophy hunting as a threat to lions 19
2.1.1 Significance of trophy hunting as a threat to lions at a population scale 19
2.1.1.1 Negative population effects associated with the removal of females 20
2.1.1.2 Negative population effects associated with the removal of pride males 20
2.1.1.3 Threat to lion populations of trophy hunting relative to other threats 22
2.1.2 Significance of trophy hunting as a threat to lions at a national scale 23
2.1.2.1 Significance of trophy hunting as a threat to lions in Botswana 24
2.1.2.2 Significance of trophy hunting as a threat to lions in Mozambique 24
2.1.2.3 Significance of trophy hunting as a threat to lions in Namibia 25
2.1.2.4 Significance of trophy hunting as a threat to lions in Tanzania 27
2.1.2.5 Significance of trophy hunting as a threat to lions in Zambia 29
2.1.2.6 Significance of trophy hunting as a threat to lions in Zimbabwe 30
2.1.3 Factors mediating the threat posed by trophy hunting 31
2.1.4 Significance of trophy hunting as a threat to lions at a regional scale 32
2.1.5 Summary of the significance of trophy hunting as a threat to lions . 32
2.2 Impacts associated with lion trophy hunting 34
2.2.1 Ecological impacts 34
2.2.1.1 Habitat protection 34
2.2.1.2 Reduction of other threats to lions and other wildlife 35
2.2.2 Impacts of economic benefits generated from trophy hunting 36
2.2.2.1 Level of trophy hunting revenue generated 36
2.2.2.2 The economic contribution of lion hunting and its impact on land-use 37
2.2.2.3 Trophy hunting and economic incentives for lion conservation 41

2.3 Summary of the impacts associated with trophy hunting 44

3 Current and recommended lion trophy hunting practices 45

3.1 Lease length, allocation and fixed quotas 45

3.2 Restrictions on lions able to be hunted 46

4 Options to improve the conservation impact of trophy hunting 49

4.1 Possible impacts of maintaining the status quo 49

4.2 Possible impacts of a total import ban 49

4.3 Possible impacts of stricter controls on the import of lion trophies to the UK 51

4.3.1 Reasons for considering stricter controls 51

4.3.2 Possible options for stricter conditions 52

4.3.2.1 Best-practice: Lion populations are sustainably managed, as determined by professional-standard science-based monitoring 54

4.3.2.2 Age-based harvesting 54

4.3.2.3 Interim scenario 55

4.3.2.4 Dealing with areas which do not meet the desired conditions 55

4.3.3 Notes on scale and conditions of import 56

4.3.3.1 Recommended scale at which criteria are applied 56

4.3.3.2 Verification of hunting practices 57

5 An overview: Framing trophy hunting in the context of wider lion conservation 59

5.1 Summary of lion trophy hunting in the context of conservation 61

Appendix A Ethics and trophy hunting 64

A.1 The ethical background to trophy hunting 64

A.2 What is the moral status of animals? 64

A.3 If trophy hunting is permissible in principle, what affects this? 67

A.4 How does emotion affect judgements concerning trophy hunting? 69

A.5 What inconsistencies are there in value judgments concerning acceptable reason for killing animals? 70

A.6 Does the Cecil event highlight changing perspectives on the acceptability of trophy hunting? 72

A.7 Summary 73

Appendix B Extent of trade in lion trophies **74**

B.1 Botswana 74

B.2 Mozambique 75

B.3 Namibia 76

B.4 Tanzania 77

B.5 Zambia 78

B.6 Zimbabwe 79

Appendix C Case study of a successful hunting area: the Bubye Valley Conservancy **80**

C.1 Background to Bubye Valley Conservancy 80

C.2 Lions in Bubye Valley Conservancy 80

C.3 Revenue generated from lion hunting in Bubye Valley Conservancy 81

Appendix D Example of an Adaptive Age Based Quota System **82**

Literature Cited **85**

List of Figures

1 International lion trophy trade map 13

2 Threat Rankings for Lions in (a) West and Central Africa and (b) East and Southern Africa 33

List of Tables

1 Summary of the historic extent of trophy hunting practice across Africa . . 8

2 Summary of the total number of wild-sourced lion trophies 12

3 Comparison of hunting revenue per country per year 38

4 Reported international imports vs exports 2006-2015: *Botswana* 74

5 Reported international imports vs exports 2006-2015: *Mozambique* 75

6 Reported international imports vs exports 2006-2015: *Namibia* 76

7 Reported international imports vs exports 2006-2015: *Tanzania* 77

8 Reported international imports vs exports 2006-2015: *Zambia* 78

9 Reported international imports vs exports 2006-2015: *Zimbabwe* 79

10 Zimbabwe's adaptive quota points system 82

11 Worked examples of an adaptive quota points system 83

Abbreviations Used in the Text

ALWG	African Lion Working Group
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DEFRA	Department for Environment, Food and Rural Affairs
FSC	Forest Stewardship Council
ISO	International Organisation for Standardisation
IUCN	International Union for Conservation of Nature
PAC	Problem Animal Control
SCI	Safari Club International
SCIF	Safari Club International Foundation
TAWIRI	Tanzania Wildlife Research Institute
UNPD	United Nations Population Division
USFWS	US Fish and Wildlife Service
WWF	World Wide Fund for Nature
ZPWMA	Zimbabwe Parks and Wildlife Management Authority

Preface

This is a scientific report about one aspect of the conservation of wildlife and, specifically, of lions in Africa. That aspect is the trophy hunting of wild lions, and the remit is to evaluate evidence that trophy hunting has, or could, impact on the distribution and abundance of lions for better or worse in terms of their conservation. Other considerations beyond this, most obviously ethics (Macdonald et al. 2016b), are relevant to society's decisions on whether hunting lions for trophies is an acceptable activity. These other considerations are very important, and potentially decisive, but they are not the remit of this report. Indeed, those who have contributed to this report have done so strictly from a position of professional neutrality that is neither pro- nor anti-hunting, although they are united in being pro good evidence and anti bad management of lion populations.

The question of whether trophy hunting of lions harms or benefits lion conservation has become important and topical because lion numbers are declining fast and because the allegedly illegal hunting in Zimbabwe in 2015 of a lion nicknamed Cecil has focused unprecedented international attention on the issue (Macdonald et al. 2016a). It has also revealed that, at least in many of the countries into which lion trophies are currently imported, large sections of society regard hunting lions for sport as an ethically inappropriate activity for the twenty-first century (Macdonald et al. 2016a). Others take the opposite view, most notably often amongst people who actually have to live with lions in their range countries (Nzou 2015). Crucially relevant to the consequences of this disagreement is the proposition that rather than being a threat, hunting lions contributes significantly to their conservation, primarily through the maintenance of wild habitat, and that its cessation would worsen the species' already deteriorating status (Lindsey et al. 2012b; Di Minin et al. 2016). These ethical and pragmatic views may be irreconcilable, but before deciding what to do about it, individuals and nations need to know the facts, and indeed the gaps in

knowledge. Providing these facts, and identifying important gaps, is one function of this report, and it is particularly important insofar as policies applied impulsively could have perverse consequences if the intention to improve lion conservation resulted in worsening it. In that case, even those implacably opposed to lion hunting on ethical grounds might favour a *journey* rather than a *jump*. For example, if society judged trophy hunting lions unacceptable, but also concluded that it benefited lion conservation, then this dilemma might be approached via a journey to find ways of replacing the benefits of hunting before jumping to end them.

It was against this background that the then Minister for the Environment, Rory Stewart, invited this review of existing lion trophy hunting practice with the aim of:

1. providing recommendations for criteria for best practice in the industry to inform assessments of whether trophy hunting is well managed and sustainable;
2. providing recommendations for what the UK, working with the our partners in the EU and also internationally, could do to assist implementation of best practice; and
3. framing these recommendations within the wider context, and overall goal, of supporting lion conservation.

As will become clear, the topic is vast, its ramifications endless, and the knowledge gaps numerous. Plugging those gaps could take a substantial inter-disciplinary research programme, and compiling even what is known now might usefully take a team of scholars a year. In reality, only a few months have been available, and so amongst the things this report is not, is entirely comprehensive or complete. Nonetheless, it aspires to set the scene and offer recommendations that are evidence-based, precautionary and workable.

Having stated that this report is concerned with trophy hunting in terms only of its impact on lion, and other wildlife, conservation, it is worth being clear on the meaning of conservation as used in this report. It is a highly inter-disciplinary blend of natural and social sciences that together provide the evidence from which

to understand, and thereby to provide the basis for conserving, species and their diversity. That evidence is necessary, but not sufficient, to make decisions on policy, because like other political matters good decisions rest upon wise judgement beyond the facts. Conservation is often characterised as being focused on populations, but insofar as the behaviour of populations emerges from the behaviour of the individuals that comprise them, conservation is also concerned with the fates and well-being of individuals. Conservation is sometimes characterised as being disinterested in animal welfare, but that is an error: for example, welfare is one of the factors that would be considered in evaluating different conservation policies. Furthermore, there was a time when conservation was thought to prioritise wildlife over people, but this too is a simplification to the point of error. Modern wildlife conservation strives to find mutual advantage between the well-being of wildlife and the people who live, often with difficulty and in poverty, alongside it.

In this report, the 'lion estate' refers to the area of land occupied by wild lions (more technically, their geographical range) and relevant to the species' conservation in the wild. Due to ecological factors (principally linked to variation in rainfall, vegetation and prey abundance) lion abundance varies across their geographical range (East 1984). But over and above that natural intra-specific variation in population density (e.g. between <1 and 40 lions 100 km^{-2}; Packer et al. 2013a), their numbers are frequently below carrying capacity due to human factors. For example, lions are often poisoned in reprisal for stock-raiding, or killed by snares set by poachers for bushmeat, or they may be hunted unsustainably for trophies. This report is concerned with lion conservation in terms of impacts on the extent of the lion estate and the abundance of lions occupying it. Any human action that diminishes the extent of that estate is considered here as inimical to lion conservation; any action that maintains or increases the lion estate is a benefit to lion conservation. In terms of the abundance of lions, while in the face of their widespread decline increasing the numbers of lions is generally considered a benefit to conservation, maximising their numbers is not necessarily the goal of conservation. This is because, in the context of natural communities, a greater abundance of lions can lead, through competition, to smaller numbers of other wild carnivores (e.g. leopards, cheetahs, African wild dogs) or, through predation, to fewer of their prey. Notwithstanding these nuances, the

primary aim of this report is to evaluate how trophy hunting impacts lion conservation, where the goal is to maintain or increase the lion estate and the eventual abundance of lions thereon.

The original Ministerial request to prepare this report had the intention of informing the British government delegation to the 17th meeting of the Conference of the Parties to CITES (CoP17), at which a proposal by Niger and eight other countries to up-list lions to Appendix I was anticipated to have implications that could have added further restrictions to the trophy hunting of wild lions, and thus had consequences, some of them perhaps unintended, for lion conservation. As Bauer and Breittenmoser (2016) report, the proposal was not adopted and so trophy hunting of wild lions was not directly affected. However, the mood of the meeting, and perhaps also of a wider global community, was that if trophy hunting had on this occasion avoided strictures it was nonetheless the moment for that industry to take decisive steps to ensure forcefully not only that it caused no detriment to lion conservation but actively enhanced it. Thus an additional and timely role emerges for this report: to address the question of how, for so long as it continues, trophy hunting can be managed to maximise its contribution to lion conservation.

David W. Macdonald

WildCRU, Oxford

28th November 2016

Executive Summary and Recommendations

Value and Status: Lions are charismatic, widely valued and have the potential to act as conservation 'ambassadors' for biodiversity. As a species, they are not doing well: lions have disappeared from 92% of their historic range and their numbers have declined drastically to approximately just 20,000 individuals.

Grasping the moment to create the movement: Given this rapid decline of one of the world's most iconic species, action to conserve lions is urgently needed. Considering this urgency, and from the perspective of conservation, it is unacceptable to tolerate factors worsening the lion's status where options exist for mitigating them. With the world's attention galvanised by the killing of 'Cecil' the lion, there is an opportunity to convert that *Cecil Moment* into the *Cecil Movement* for global conservation. From the perspective of conservation, there is a global responsibility to grasp that opportunity.

Threats to lions: The primary threats to lions (which vary regionally), are habitat loss and degradation, loss of prey base and conflict with people over livestock. These threats are likely to intensify with climate change and rapidly increasing human population, predicted to double in Africa by the year 2050. Trophy hunting of lions can be a threat to some populations.

Extent of lion trophy hunting: Trophy hunting of lions was legal in 18 African countries in 2014, is currently practised at a significant level in at least 12 countries, and is an extensive form of land use therein. 'Canned' hunting of captive animals is legal in some countries but these are not considered wild lions and so are considered only in passing in this report.

Ethical considerations: The ethics of trophy hunting are much debated. This report focuses on trophy hunting's consequences for lion conservation, while recognising that ethics, particularly relating to animal and human welfare, will influence policy decisions.

Numbers of lions hunted for trophies: Most trophy-hunted lions are bred in captivity. The number of wild lions trophy-hunted is hard to establish with precision due to inconsistencies in the data. Between 2006 and 2015, CITES recorded 4,474 'wild'-sourced lion trophies (which include parts of lions so may not reflect numbers of individuals) as imported world-wide, with only 2,429 reported as exported. Between 1991 and 2013, CITES records 80 wild lion trophies (not individual lions) exported to the UK; the UK importation records show 4 trophies.

Effects of trophy hunting on lion populations: Trophy hunting, particularly of females and pride males, can be a significant (and in some cases even primary) threat to lion populations at a local level, especially when additive to other effects. The damaging effects of unsustainable trophy hunting can extend beyond hunting areas into adjacent protected areas. However, there is little evidence that trophy hunting has substantial negative effects at a national or regional level. Where trophy hunting is well-regulated, transparent and devolves sufficient authority to the land managers, it has the potential to contribute to lion conservation, but in many countries, poor governance and weak regulation can lead to unsustainable trophy hunting.

Impact of trophy hunting on lion populations: There is little evidence that trophy hunting has substantial negative effects at a national or regional level. Where trophy hunting is well-regulated, transparent and devolves sufficient authority to the land managers, it has the potential to contribute to lion conservation, but in many countries, poor governance and weak regulation can lead to unsustainable trophy hunting.

Trophy hunting as a contributor to lion conservation: The most fundamental benefit of trophy hunting to lion conservation is that it provides a financial incentive to maintain lion habitat that might otherwise be converted to non-wildlife land uses. It has been estimated that trophy hunting areas cover 1.4 million km^2 – 22% more land than National Parks – in Africa. How much of that area could viably be converted to phototourism is unknown, but this certainly could not be accomplished everywhere.

Revenue generated from trophy hunting: The revenue generated by trophy hunting is debated, with estimates of >US$200 million in gross revenue annually across sub-Saharan Africa. Lion hunting probably accounts for 5-17% of that income, depending on the country. Overall, the trophy hunting industry is not heavily

dependent on lions for its financial viability, but if lion hunting was ruled out, trophy hunting could, according to the only peer-reviewed published estimate (Lindsey et al. 2012), become unviable across approximately 60,000 km^2.

Approaches to reducing the risk of over-harvesting: Two main proposals have been made for reducing the risk of unsustainable trophy hunting – the first is area-based, with removal level ideally capped at 0.5 lions 1,000 km^{-2} (unless there is evidence it can withstand a higher level), and the second is age-based, where it is recommended that only males of 7 years or above are taken. In areas where other threats are present then combining the age- and area-based methods would be the safest policy (if other risk factors are not increasing, this should have a <10% risk of population extirpation within 25 years).

Trophy hunting in perspective: Over and above the issue of trophy hunting, international attention should be focused on generating new financial mechanisms to secure lion populations across their range. In this context lions are a metaphor, and an ambassador, for wider biodiversity conservation. Given that there are probably 60 remaining wild lion populations, a priority, and a call to arms, is to secure the six remaining ones of those which have substantial lion numbers and to safeguard all 60 remaining wild lion populations.

Recommended criteria for importing trophies to the UK: The criteria for whether a lion trophy could be imported into the UK should be that the hunting (a) was unlikely to cause detriment to the lion population from which it was taken, and (b) contributes to lion conservation. Therefore, we recommend that the following essential criteria should be applied to the consideration of lion trophy imports to the UK:

i. That the UK should import trophies only from areas that are sufficiently large to offer conservation benefit to lions (we suggest 500 km^2 or more), and where the lion population is demonstrably well-managed.

ii. Good management requires either adequate monitoring, which allows scientific quota-setting and shows a stable or increasing population, or age-based harvesting. Age-based harvesting could include either the precautionary approach (0.5 male lions of ⩾7 years per 1,000 km^2, with rest periods, unless there are good data showing it can withstand a higher level), or adaptive age-based quotas.

iii. Areas that fail to qualify under the foregoing criteria could possibly receive a 'grace period' of up to 3 years under very strict criteria and annual review in order to allow

them to reach the required standards. During any such period, hunting should be heavily limited, e.g. to a maximum of 0.5 lions 1,000 km^{-2} aged $\geqslant$7 years. Failure to meet the required conditions after the grace period would result in a moratorium on UK imports from the area until they are in place.

iv. In areas where lion populations are declining unsustainably under any of the permitted harvesting systems, hunting should be stopped or, if there is a significant risk of losing that habitat from the wildlife estate, the area should be examined on a case-by-case basis and any lion hunting kept only at a very minimal level until the situation can be improved.

v. These criteria should ideally be applied at the level of the hunting area not the country, and exports should be managed by an independent committee of stakeholders in each country. That committee should audit hunting practices, set and monitor quotas, encourage certification of hunters, ensure adequate training of professional hunters, ensure transparency and compliance, and verify the age of hunted lions based on hunt reports, photos and tooth X-rays. The costs of operating these national committees would normally be met by stakeholders such as the hunting industry, relevant NGOs, international and local governments.

In addition, the likelihood of trophy hunting contributing to lion conservation would be increased if regulations were designed to maximise the revenue procured that was, at least partly, available to conservation. Therefore, this report recommends that the following desirable elements should be in place:

i. Short leases, and the short-termism and incentive for over-harvesting that they encourage, should not be issued to hunting blocks. A suitable minimum would be ten years, with option for extension by the current tenant (assuming conservation requirements have been met).

ii. Hunting blocks should be allocated according to an open auction system.

iii. Trophy hunting fees should only be applied following successful hunts, thereby reducing the incentive to kill inappropriate individuals.

Because trophy hunting involves killing a wild animal that, if not killed cleanly, has the potential to suffer, and because human safety is also at risk with the use of firearms, this report recommends reviewing the evidence and codes of practice that would ensure:

- that professional hunters are strictly accredited as evidenced by membership of internationally recognised associations that put standards first and foremost (including those

of marksmanship and animal welfare), and will conduct investigations into reports of misconduct and expel guilty members (national governments should support such expulsions by refusing disciplined PHs permission to hunt). Membership with such an association would be necessary to market hunts (e.g. at the large international conventions where an estimated >75% of the hunts are booked).

Finally, broader scale analysis of imports and exports of lion trophies is an essential element of monitoring the industry and its impact on conservation. The CITES database is a potentially incomparable resource for doing so. However, ambiguities over the muddling of entire lions and parts of lions, and some lack of clarity between exports and re-exports, currently confound the data, and lamentably diminish the value of the database. Therefore, this report also recommends that:

- CITES procedures are adjusted so that it is possible to assign various body parts to a single trophy lion (thereby avoiding the double-counting of, say, the pelt and skull of a single animal), and to track successive re-exports of that individual.

These recommendations, based on an impartial review of the scientific evidence, represent feasible steps for minimising risk of adverse effects of trophy hunting on lion populations, while ensuring that where trophy hunting occurs it contributes significantly to the benefit of lion conservation. This is important, but the UK government, and its partners and collaborators in this grand vision, will also need to invest heavily in tackling even greater issues beyond trophy hunting to secure the long-term future of this globally iconic species.

Wider implications for the governance of lion trophy hunting to ensure it is not detrimental to lion conservation and has the potential to enhance it: Although this report was commissioned by the then Under Secretary of State to inform decisions on the conditions that might apply to the import of lion trophies to the UK, the recommendations set out in that context in the foregoing section apply equally to the wider question of how the lion trophy hunting industry might be regulated to ensure that it is not detrimental to lion conservation and is best placed to enhance it.

1. Reasons for examining the issue of trophy hunting with respect to lion conservation

1.1 Reasons for being concerned about lion conservation

1.1.1 What value do lions have?

The African lion is one of the world's most iconic species, and has played a rich role in the symbolism and culture of the United Kingdom. At a wider scale, at least a large part of the global public assign great existence value to lions (Dickman et al. 2011), and there is vast international interest in lion welfare and conservation (Macdonald et al. 2016a). Lions and other big cats are viewed as particularly charismatic species amongst people likely to engage with conservation campaigns, making them powerful ambassadors for conservation (Macdonald et al. 2015a).

As apex predators, lions also have great ecological value, and the removal of top carnivores from ecosystems can have long-lasting negative ecological impacts (Ripple et al. 2014). In addition to their cultural and ecological significance, lions undoubtedly have very high economic value, and are one of the top draws for both photographic tourists and trophy hunters to the countries where they remain, generating large amounts of revenue (McNeely 2000; Lindsey et al. 2012b). Lions are a regular part of the trophy hunting industry in at least 10 African countries and more information on the specific economic revenue of lion trophy hunting is provided in Section 2.2.2.

1.1.2 To what extent have lions declined, in terms of numbers and geographic range?

The urgency and importance of lion conservation arises from the fact that lions have experienced a dramatic decline in both numbers and geographic range over recent decades. The latest IUCN estimates suggest a population of 23,000 – 39,000 African lions (probably closer to the lower estimate), representing a decline of at least 43% between 1993 and 2014 (approximately three lion generations) (Bauer et al. 2016). Most alarmingly, lions are now considered to have been extirpated from at least 92% of their historic range[1] (Bauer et al. 2016).

[1] *Lions occur in 24 African countries (Bauer et al. 2016). Since 1977, 20 of these countries have exported lion trophies (CITES: http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12])*

According to the 2016 Red List Assessment, in Africa, lions are now extinct in 15 countries (including Western Sahara, which is technically a disputed territory), are possibly extinct in another seven and now occur in only 24 countries (Bauer et al. 2016). Lion decline may be even more severe than currently estimated by the IUCN, due to the assessment being based on data from relatively well-known populations. This is a common practice, but well-monitored populations are also those which are likely to have relatively high levels of attention, investment and protection, so a possible bias is that they are likely to be less threatened than many other subpopulations (Durant et al. submitted).

1.1.3 What is the current threat status of lions?

The lion is classed as 'Vulnerable' by the IUCN (Bauer et al. 2016) based on its declining population size, so is thought to be facing a high risk of extinction in the wild. However, across the majority of its range, the lion meets the IUCN criteria for 'Endangered' status, with an inferred rate of decline of over 50% across three lion generations, but the positive trends from southern Africa reduce that average decline at a range-wide level (Bauer et al. 2015). Only two African countries (Namibia and Zimbabwe) had substantially increased lion populations between 1993 and 2014, and it is of note (given the purpose of this report) that both those countries are ones which trophy-hunt lions. Similarly, while lions in most parts of Mozambique are declining, in Niassa Game Reserve where hunting was tightly regulated, lion populations increased locally between 1993 and 2014. However, trophy hunting is clearly not a guarantee of increasing lion populations, as other key trophy hunting countries such as Tanzania showed declines (Bauer et al. 2016), with previous data from Packer et al. (2009) showing highest declines in countries with highest trophy hunting rates.

1.1.4 What are the major current threats to lions?

The 2016 IUCN Red Listing for the lion states that "*Among the causes of decline, the most important are indiscriminate killing in defence of human life and livestock, habitat loss, and prey base depletion. Prey base depletion is partly linked to habitat loss, but more importantly to poaching and bushmeat trade (Becker et al. 2013). An emerging threat is trade in bones and other body parts for traditional medicine, both within Africa and in Asia (IUCN 2006a, b; Riggio et al. 2013). Furthermore, although trophy hunting contributes positively to Lion conservation, improvements in management practices have been recommended (Hunter et al. 2013; Lindsey et al. 2013; Edwards et al. 2014), as when poorly regulated, it also contributes to population declines (Packer et al. 2009; Croes et al. 2011;*

Packer et al. 2011; Rosenblatt et al. 2014). While attention is currently focused on Lion hunting reforms to ensure sustainability, the leading causes of population decline are more difficult to address and are likely to continue" (Bauer et al. 2016).

The CITES/CMS meeting of all lion range states in May 2016 summarised that: "*...the main threats (listed in no particular order) for lions in Africa are: (1) Unfavourable policies, practices and political factors (in some countries); (2) Ineffective lion population management; (3) Habitat degradation and reduction of prey base; (4) Human-lion conflict, (5) Adverse socio-economic factors; (6) Institutional weakness; and (7) Increasing trade in lion bones.*" The two 2006 IUCN regional reports for lions noted that the major factors affecting lion viability were availability of wild prey, indiscriminate killing of lions, size and extent of the lion population, and loss, degradation and fragmentation of lion habitat, with increasing human populations and poverty acting as key underlying root causes of decline, as well as institutional weakness and poor management (IUCN 2006a, b). A 2016 report by Panthera, WildAid and WildCRU named human-lion conflict and bushmeat poaching as critical threats to lions, while human encroachment was a high threat and trophy hunting and lion poaching were deemed medium threats (Panthera et al. 2016). In short, experts agree that the primary threats to lions (which vary to some extent by region; see Section 2.1.4) are habitat loss and degradation, loss of prey base and conflict with people over livestock depredation.

1.1.5 Future considerations for lion conservation

There are significant global challenges facing lions and other biodiversity, particularly the impacts of human population growth and climate change. Human populations are set to swell over the 21st century, as is their demand for resources including land. Africa, with a current population size of ∼1.2 billion (UNPD 2015), has the fastest population growth rate in the world, with projections estimating a population tripling across 27 African states by 2100, leading to a continental estimate of ∼4 billion. Eight lion range states[2] (as well as Mali, where lions are possibly extinct, and Burundi, where they are extinct) are estimated to have a five-fold increase in human population by 2100 (UNPD 2015). At current rates of population growth, by the end of the century the population of Tanzania will be two-thirds that of the United States of America (USA) but in an area ten times smaller. Worse still, Nigeria, also with a surface area roughly one-tenth that of the USA, is projected

[2] *Angola, Democratic Republic of the Congo, Malawi, Niger, Somalia, Uganda, Tanzania and Zambia*

to have a population that will be double that of the USA (European Commission 2015). The impact of this human population growth on the lion estate depends on many variables, but even supposing favourable economic development and land-use transitions were to occur (which seems unlikely in many places), it is expected that pressure on lion habitat and prey will increase substantially. Livestock numbers are expected to grow concomitantly, leading to intensified human-lion conflict. Changes in human populations may also be associated with changes in patterns of tourism, which might affect both photographic and hunting revenues for lion range states.

Regarding climate change, under moderate emissions scenarios, global mean temperature is expected to reach 2° above pre-industrial levels by 2050. More likely, and given the reticence or incompetence with which governments have faced climate change, these temperature scenarios will be exceeded. A more likely prediction is 2.5–3° warming by 2050[3]. Climate changes are likely to have pervasive effects such as reduced and more erratic rainfall (Fields 2005; Toulmin 2009). Although lions have broad habitat tolerance within the savannah biome, the predicted drying trend is likely to affect lions through declines and changes in prey species communities. The implications of changing climate for lions are not limited to direct effects: it could also feasibly alter the potential human land-uses. There is uncertainty about how increasing aridity may affect land conversion and the implications for the lion estate. However, there is likely to be increasing pressure on water-rich regions from growing human populations, increasing demand for land and increasing pressure on currently protected areas.

1.1.6 Summary of reasons for being concerned about lion conservation

Lions have great value at national and international scales, including significant existence, ecological and economic value. Furthermore, lions hold both symbolic meaning and widespread affection in the UK, making their conservation important for the British populace. Rural populations in many African countries often take a different view of animals that can and do kill their stock and even members of their families, and to them, lion killing can be not only ethical but often desirable (Hazzah et al. 2009; Dickman 2015). Furthermore, governments in lion range countries, often affected by poverty and all the attendant pressures, will have different priorities from West-

[3] *IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.*

ern audiences. Over only a few decades, the lion estate has shrunk strikingly, as have numbers of lions occupying parts of it, so to those who value it, the conservation of this iconic species is now more urgent than ever. With perhaps not many more than 20,000 free-ranging lions remaining, and in the light of increasing pressure on lion populations, there is a pressing requirement for effective conservation, and anything that might imperil it necessitates careful scrutiny. There have been vociferous arguments that trophy hunting is one of the factors that imperils lions, while others state equally vigorously that restricting trophy hunting would be a larger danger factor for lion conservation. Therefore, it is urgent that this issue is examined impartially, in order to develop suggestions for policy that would minimise negative impacts for lion conservation.

1.2 Background to lion trophy hunting

1.2.1 What is lion trophy hunting?

According to the IUCN, "*Trophy hunting generally involves the payment of a fee by a foreign or local hunter for a hunting experience, usually guided, for one or more individuals of a particular species with specific desired characteristics (such as large size or antlers). The trophy is usually retained by the hunter and taken home*" (IUCN 2016). Trophy hunting is also known as 'safari hunting' and is often referred to as a type of 'sport' or 'recreational' hunting (and justifications are clearly distinct from those when hunting is primarily for pest control or subsistence; Loveridge et al. 2007b). Regarding lions, the trophy is normally the animal's skull and skin (and clavicle, hyoid bone and claws). The mane is the prominent feature of the skin, with longer, thicker and darker hairs signifying a better quality of trophy, although ultimately Safari Club International (SCI) define trophy quality by skull size (Safari Club International 2005). Trophies are usually mounted for display and associated kudos and nostalgia.

Although an important part of the pursuit, trophies themselves are not usually the sole motivation for hunting. Motivations may include engagement in outdoor pursuits, an enthusiasm for collection, social status and owning 'bigger' trophies (as evidenced by the emphasis on trophy size in SCI Awards and record book). Surveys of over 600 international trophy hunters who had hunted in South Africa between 1999 and 2003 revealed that spiritual or emotional motives (particularly the enjoyment of being in nature), were the most commonly mentioned reasons for hunting, followed by 'emotional' aspects such as enjoying the challenge of the hunt, although col-

lection of the trophy was an important theme for many people (Radder 2005).

In Africa, government or wildlife management agencies make hunting concessions available, usually on leasehold, and normally issue trophy hunting licences that are available to the hunting client through hunting outfitters, also known as safari operators[4], for a fee. The overall cost to the hunting client covers the direct costs of the hunt (e.g. trophy fees, per diem rates [which differ between species and are significantly larger for dangerous species], concession fees, accommodation, subsistence, staff and travel costs). It also usually covers a levy that goes to the Government, part of which may be used by the Government to provide funds for wildlife areas and local communities (see Section 2.2.2.3). The motivation of the lion range states for permitting trophy hunting is, as for other forms of tourism, to generate revenue and jobs; this has the consequence of financing a wildlife economy on land where in some cases alternative forms of land-use are less profitable or practical.

The hunting operations are usually run by outfitters (although sub-leasing and external marketing complicates the system and the task of regulating it); outfitters are responsible for all hunting requirements in-country, such as obtaining the correct licences, permits, liaising with landowners, and organising all other logistics. Outfitters also provide access to a professional hunter (which may be the outfitter themselves), whose responsibility it is to accompany the client and ensure that the hunt is conducted to the required standard. Professional hunters are variously accredited by national hunting bodies or wildlife management authorities. The exact mechanisms of lion trophy hunting vary by country, but once the lion has been killed, the outfitter or professional hunter is responsible for the field preparation and care of the trophy, and ensuring that all the relevant permits are in place for the client to export the trophy to its final destination.

1.2.2 Legality of lion trophy hunting

The global outcry over the trophy hunting[5] of Cecil the lion in July 2015 (Macdonald et al. 2016a) revealed widespread surprise amongst the public, particularly in more developed countries, that trophy hunting remains a legal practice

[4] *Hunting outfitters or safari operators have the legal rights to hunt on a defined piece of land (either private land, government concession, or community land) for which they may be issued a hunting quota for particular species. Professional hunters are contracted by the safari operators to guide paying tourist hunters in their pursuit of quarry; doubling up as instructors, first aiders, bodyguards etc.*

[5] *All legal charges relating to the hunting of Cecil were dropped in November 2016. A Zimbabwe court ruled that they were too vague for a proper defence to be mounted (http://www.bbc.co.uk/news/world-africa-37948866). Most trophy hunting is legally practiced.*

(and an expansive land use) in many African countries. Trophy hunting (of certain wildlife species, not just lions) is currently practiced at a significant level in approximately 12 African countries (historically at least 33 African countries permitted trophy hunting; CITES data: http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12]). A summary of which African countries historically hunted and currently hunt lions, according to CITES data, is shown in Table 1.

As of December 2015, trophy hunting was banned in six African lion range countries that are still thought to have lions – Angola, Botswana, Kenya, Malawi, Niger and Nigeria (U.S. Fish and Wildlife Service 2015). While some of these bans are long-standing (e.g. Kenya banned all trophy hunting in 1977), some are recent bans – for example Botswana enforced a ban on all trophy hunting in public areas from the start of 2014 (following a moratorium on lion hunting between 2001 and 2004, and successive restrictions thereafter). Trophy hunting is also banned in Congo, Gabon and Mauritania, where the lion is regionally extinct, in Ghana where they are possibly extinct, and in Rwanda where a small number of lions were reintroduced in 2015[6] (U.S. Fish and Wildlife Service 2015; Bauer et al. 2016).

The US Fish and Wildlife Service found that as of May 2014, 18 African countries in Africa legally permitted lion hunting: Benin, Burkina Faso, Central African Republic, Democratic Republic of the Congo, Ethiopia, Côte d'Ivoire, Mali, Mozambique, Namibia, Senegal, Somalia, South Africa, Sudan, Tanzania, Togo, Uganda, Zambia and Zimbabwe (U.S. Fish and Wildlife Service 2015). However, lions are thought to be extinct in three of those countries (Côte d'Ivoire, Mali and Togo), and in Ethiopia and Uganda, trophy hunting is restricted to problem or dangerous animals (U.S. Fish and Wildlife Service 2015), with some similar restrictions in places in Namibia. However, they also found that as of 2013, lion trophy hunting was only documented to occur in eight countries, namely Benin, Burkina Faso, Central African Republic, Mozambique, Namibia, Senegal, Somalia, South Africa, Tanzania and Zimbabwe – Zambia imposed a moratorium on the trophy hunting of big cats in 2013, but lifted it for the 2015/16 hunting season for leopards, and announced the lifting of the ban on lions for the following year (U.S. Fish and Wildlife Service 2015). Swaziland has no legal protection for lions (similar to Guinea Bissau, where lions are possibly extinct, and Burundi and Lesotho where they are regionally extinct) (U.S. Fish and Wildlife Service 2015; Bauer et al. 2016). There have

[6] *Rwanda is amongst the 7 countries we cite on a list of those from which lions have probably become recently extinct according to the IUCN Redlist. This situation may be retrieved by the 2015 reintroduction.*

also been some restrictions on lion hunting within countries – for example, Zimbabwe imposed a regional moratorium on lion hunting between 2004 and 2008 (Loveridge et al. 2010).

As with any other form of wildlife management, permitted trophy hunting activities are legislated by the relevant national government and wildlife authorities, and the specifics of that legislation (as well as how well it is enforced) vary considerably. In some countries (most notably South Africa) lions can be shot within very small enclosures, a practice known as 'canned', 'captive' or 'put-and-take' hunting. As long as the landowner complies with the relevant national and provincial legislation regarding minimum standards for fencing and enclosure sizes, it is legal to breed lions and hunt them within those small fenced areas (although trophies from these captive lions from South Africa can no longer be imported into the US as a result of the October 2016 evaluation by the USFWS). Most lion hunting in South Africa is from captive animals: Lindsey et al. (2012a) reported that South African hunting operators estimated that only 0.9% – 1.1% of lions hunted in 2009 and 2010 were wild. The CITES Scientific Authority for South Africa have given a slightly higher estimate, with wild lions accounting for 5% of total successful lion hunts, but the vast majority of hunting in South Africa is clearly from captive animals (Williams et al. 2015). There is widespread opposition to the practice of canned or captive hunting on ethical and animal welfare grounds (IUCN 2016) and it has been condemned by the IUCN, which states: "*Canned hunting...raises very different issues from trophy hunting of free-ranging animals, and is condemned by existing IUCN policy*" (IUCN Recommendation 3.093, 'Application of the IUCN Sustainable Use Policy to sustainable consumptive use of wildlife and recreational hunting in southern Africa', 2004; IUCN 2016).

Table 1: *Summary of the historic extent of trophy hunting practice across Africa, including information on the recent export of trophies from that country. The current lion conservation status for each country is summarised as per Bauer et al. (2015). The relative scales as a proportion of 1 for both general trophy hunting and lion hunting are provided for the decade 2006 and 2015. Data were extracted from the CITES database* (http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12]) *for the years 1975 to 2015 and for the purpose of* 'H – Hunting trophy'*. The data were then subset by* 'W' *(wild) source and term* 'trophies'*. As there may be a lag in exporting trophies and updating the records, the* 'Recently exported' *columns consider data from 2014 to 2015.*

Country	Historically hunt *Trophies*	Recent export *Trophies*	Relative scale *Trophies*	Lion status	Historically hunt *Lions*	Recent export *Lions*	Relative scale *Lions*
Algeria	no	no	-	Extinct	no	no	-
Angola	no	no	-	EXTANT	no	no	-
Benin	YES	YES	0.002	EXTANT	YES	YES	0.004
* Botswana	YES	YES	0.044	EXTANT	YES	no	0.025
Burkina Faso	YES	YES	0.007	EXTANT	YES	YES	0.050
Burundi	no	no	-	Extinct	no	no	-
Cameroon	YES	YES	0.028	EXTANT	YES	YES	0.026
Cape Verde	no	no	-	absent	no	no	-
Central African Republic	YES	YES	0.010	EXTANT	YES	no	0.007
Chad	YES	no	0.001	EXTANT	YES	no	0.001
Comoros	no	no	-	absent	no	no	-
Congo	YES	YES	0.000	Extinct	no	no	-
Congo	YES	no	0.000	EXTANT	YES	no	0.000
Cote D'ivoire	YES	no	0.000	*Unsure*	no	no	-
Djibouti	no	no	-	Extinct	no	no	-
Egypt	no	no	-	Extinct	no	no	-
Equatorial Guinea	no	no	-	absent	no	no	-
Eritrea	no	no	-	Extinct	no	no	-
Ethiopia	YES	YES	0.004	EXTANT	YES	YES	0.001
Gabon	YES	no	0.000	Extinct	YES	no	0.000
Gambia	no	no	-	Extinct	no	no	-
Ghana	YES	no	0.000	*Unsure*	no	no	-
Guinea	YES	no	0.000	*Unsure*	no	no	-
Guinea-bissau	no	no	-	*Unsure*	no	no	-
Kenya	no	no	-	EXTANT	no	no	-
Lesotho	YES	no	0.000	Extinct	no	no	-
Liberia	YES	no	0.000	absent	no	no	-
Libya	no	no	-	Extinct	no	no	-
Madagascar	YES	no	0.000	absent	no	no	-
Malawi	YES	no	0.000	EXTANT	no	no	-
Mali	YES	no	0.000	*Unsure*	no	no	-
Mauritania	no	no	-	Extinct	no	no	-
Mauritius	YES	YES	0.000	absent	no	no	-
Mayotte	no	no	-	absent	no	no	-
Morocco	YES	no	0.000	Extinct	no	no	-
Mozambique	YES	YES	0.035	EXTANT	YES	YES	0.040
Namibia	YES	YES	0.186	EXTANT	YES	YES	0.024
Niger	YES	YES	0.000	EXTANT	no	no	-
Nigeria	YES	no	0.000	EXTANT	no	no	-
Reunion	no	no	-	absent	no	no	-
Rwanda	no	no	-	*Unsure*	no	no	-
Sao Tome And Principe	no	no	-	absent	no	no	-
Senegal	YES	no	0.000	EXTANT	YES	no	0.000
Sierra Leone	no	no	-	Extinct	no	no	-
Somalia	no	no	-	EXTANT	no	no	-
South Africa	YES	YES	0.436	EXTANT	YES	YES	0.269
South Sudan	no	no	-	EXTANT	no	no	-
Sudan	YES	no	0.001	EXTANT	no	no	-
Swaziland	YES	no	0.000	EXTANT	no	no	-
Tanzania	YES	YES	0.118	EXTANT	YES	YES	0.424
Togo	YES	no	0.000	*Unsure*	YES	no	0.000
Tunisia	no	no	-	Extinct	no	no	-
Uganda	YES	YES	0.000	EXTANT	no	no	-
Western Sahara	no	no	-	Extinct	no	no	-
§ Zambia	YES	YES	0.060	EXTANT	YES	no	0.079
Zimbabwe	YES	YES	0.069	EXTANT	YES	YES	0.047

∗ *Botswana banned lion trophy hunting in 2008, and all trophy hunting in public arenas in 2014.*

§ *Zambia implemented a lion and leopard hunting moratorium in 2013, which was reversed in 2015 for leopards and 2016 for lions.*

Across Africa, there is also a bias towards hunting captive lions rather than wild ones[7]: CITES export records document more than twice as many captive lion trophies as wild ones, with a ratio of 2.35 to 1 (5,715 'captive' versus 2,429 'wild'), although the importers record a slightly different ratio, of 1.89 captive trophies for every wild one (4,474 'captive' versus 2,367 'wild').

In South Africa at least, captive lions are bred for the purpose of supplying the demand for lion trophies, with this industry regulated by the Department of Environmental Affairs (DEA) and the Department of Agriculture, Forestry and Fisheries (DAFF)[8]; however these lions are generally neither considered as wild or contributing to lion conservation[9].

The African Lion Working Group (ALWG) in 2016 stated that "*the sport hunting of lions that are captive bred and reared expressly for sport hunting, and/or sport hunting of lions that occur in fenced enclosures and are not self-sustaining, does not provide any demonstrated positive benefit to wild lion conservation efforts and, therefore, cannot be claimed to be conservation... The estimated 8,000 lions in South Africa currently being maintained and bred on game farms as part of this industry should not be included in any assessments of the current status of wild lions.*"

As this report is focused on wild lion conservation, canned or captive hunting does not fall within its remit, and will therefore not be considered further, except insofar as it might indirectly affect lion conservation.

1.2.3 Ethical acceptability of lion trophy hunting

There has been more than a century of concern over the ethics of hunting (e.g. fox hunting in the UK: Burns Inquiry 2002; Macdonald and Johnson 2015a), against which background the killing of Cecil the lion triggered widespread outrage over the perceived ethical unacceptability of trophy hunting (Macdonald et al. 2016a). The motivation for that outrage varied, but tended to centre around the unacceptability of killing an animal purely for sport, particularly when that animal is a threatened species.

However, views regarding trophy hunting (and indeed the killing of animals in general) vary markedly across

[7] *Similar systems of put-and-take hunting are familiar in the West, for example, in the UK the shooting of reared game birds or angling in stocked trout lakes*

[8] https://www.environment.gov.za/sites/default/files/docs/lionmanagementinSA_questions_answers2015

[9] http://www.repository.up.ac.za/dspace/bitstream/handle/2263/19272/Lindsey_Possible(2012).pdf

the world (Macdonald et al. 2016b). In many African communities, the killing of a lion is often something to be celebrated (Hazzah et al. 2009; Dickman 2015), and there is a commonly-held view that it was unethical for foreigners to care so much about the killing of one lion (or indeed lions in general), particularly when lions themselves kill people and endanger their livelihoods (Nzou 2015). It was also noted that much of the demand for banning trophy hunting in Africa came from the United States, which has one of the largest domestic trophy hunting markets in the world (Sharp and Wollscheid 2009). The ethical debates around trophy hunting are important and merit consideration (Macdonald et al. 2016b), but they are beyond the scope of this report, which is focused specifically on the role of trophy hunting with regard to conservation. Conservation action does not of course take place in an ethical vacuum – Vucetich and Nelson (2012) provide an accessible account of applied conservation ethics. An exploration of the specific issues raised by trophy hunting is provided in Appendix A. Some people find any form of lion hunting morally unjustifiable, regardless of the sustainability question, particularly if it is done in ways that involve animal suffering. This report focuses on conservation. But welfare and other ethical issues (which dominated the much of the public discourse following Cecil's death) are inextricably part of the process that shapes conservation policy.

1.2.4 Extent of lion trophy hunting and its markets

It is surprisingly hard to determine exactly how many lions are trophy hunted across Africa each year, because the CITES database (which records imports and exports of such trophies) records the number of trophies (i.e. individual parts moved) and not the number of animals killed. One trophy-hunted lion could result in multiple trophies, for example if the skin, skull and claws were counted separately. This is an issue which is clearly highlighted by CITES itself, which states that "*Because 'specimens' include parts and derivatives, the numbers of specimens do not reflect numbers of individual animals*" (CITES 2014). In addition, the records of exported trophies often do not match the number imported, partly because of delays in the system and partly because of inconsistencies in the ways different countries record their data. Despite this, many reports publish the number of trophies as if it was the number of lions hunted, which is misleading. Bearing in mind these caveats, the CITES database gives an overall idea of trends and comparative numbers, and a summary of the number of wild-sourced lion trophies

(using data from the CITES database, http://trade.cites.org/) is given in Table 2, with more information on the international extent of trade in lion trophies by country is given in Appendix B.

Table 2: *Summary of the total number of wild-sourced lion trophies (not necessarily the number of lions) recorded as exported or imported by CITES.*

Country	Reported exports *Lion trophies*	Reported imports *Lion trophies*	Total destinations *Lions*
Benin	25	18	6
Botswana	168	151	20
Burkina Faso	333	78	12
Cameroon	176	78	15
Central African Republic	48	49	12
Chad	10	6	2
Congo, Democratic Republic Of	0	1	1
Ethiopia	10	13	3
Gabon	2	0	1
Mozambique	268	197	19
Namibia	163	168	28
Senegal	3	0	2
South Africa	1801	3572	69
Tanzania, United Republic Of	2842	2305	49
Togo	1	0	1
Zambia	530	562	33
Zimbabwe	317	1117	34
Total	**6697**	**8315**	**-**

The UK was recorded as having 80 wild lion trophies exported to it (from 9 source countries) during the 22 years from 1991–2013, with the importation records showing 4 trophies[10]. Figure 1 provides an overview of the movements of lion trophy across the globe, and highlights the significance of the US and European markets for such trophies.

1.2.5 Reason for the UK Government examining this issue now

Wildlife conservation has been a concern in Britain for centuries, and remains a strong interest of the UK public (Sutherland 2008).

[10] *These numbers have to be interpreted bearing in mind the problems of inferring number of lions from number of trophies.*



Figure 1: *Overview of international movements in lion trophies, showing source (red) and destination (blue) countries for lion trophies linked by directional arrows. Arrow width indicates the scale of trade from one country to another. Tone of colour per country indicates the relative scale of either export or import relative to all other exporters or importers respectively. ISO2 country codes of exporter and importer countries are indicated on the map. Lion hunting data was obtained from CITES and considered for the decade between 1996 and 2015. The data was subset to include only* 'lion' 'trophies' *from a* 'wild' *source and that were* 'hunted'. (CITES data: http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12])

For the roots of modern conservation some might look to 1066 when King William I set aside forests, such as New Forest, Sherwood and Forest of Dean as royal hunting reserves (others trace the roots of conservation to concerns over UK forests in the 1660s). John Muir, a Scotsman, inspired the movement to preserve wilderness in the USA, including Yosemite National Park. In 1892, he founded the Sierra Club, one of the first organisations devoted to environmental conservation.

The roots of conservation in Europe and the USA are inextricably bound to hunting, initially by protecting wild animals for it and latterly more often protecting them from it. In 1903, British naturalists helped found another pioneering conservation society (the Society for the Preservation of the Wild Fauna of the Empire, which has evolved today into Fauna and Flora International) (Loveridge et al. 2007b). As a group they were known as 'The Penitent Butchers' because all were former sportsmen or trophy hunters who became concerned by the wide-scale decimation of wildlife through unregulated hunting particularly in Africa (Loveridge et al. 2007b). Their aim was to safeguard Africa's large mammals from over-hunting and habitat encroachment. The Society worked with Governments, land-owners and hunters to pass legislation which restricted hunting across large swathes of East and southern Africa, and which ultimately led to the creation of some of Africa's most iconic parks, such as the Serengeti National Park.

In short, hunting and conservation has long been a preoccupation within British society. There has long been a demand to examine and reform trophy hunting, but public awareness of the issue reached a peak in July 2015 over the killing of Cecil the lion (Macdonald et al. 2016a). Much of the reaction to Cecil's killing focused on pressing for bans on trophy hunting, or at least of the carriage and import of trophies to countries such as the USA and the UK. As of August 2016, 32 airlines, including British Airways, have instigated complete bans on carrying trophies. Seven more refuse to carry 'Big Five' trophies, and a further five have implemented specific embargoes, from a ban on CITES Appendix I species by Emirates to a much broader ban on dead/processed/research animals by Turkish Airlines. In total, 44 airlines now refuse to carry lion trophies[11], with pressure on other carriers to do the same[12].

As a measure of feeling (although it floundered), in January 2016 a group of members in the European Parliament

[11] http://www.hsi.org/news/news/2015/08/airlines-shipping-hunting-trophies
[12] http://www.ifaw.org/united-states/news/trophies-back-board-south-african-airways-cans-its-ban
[13] http://www.europarl.europa.eu/sides/getDoc

called for the signing of a declaration restricting trophy imports[13], while the UK Government is actively considering its position on the importation of lion trophies, including asking for this report to be produced to inform its thinking.

As of August 2016, several countries have already banned lion trophy imports, including the Netherlands, France, Australia and Costa Rica. Whilst the USA has refrained from an outright ban, lion trophies had been made illegal in Washington State and New Jersey[14], although in late August 2016, the New Jersey ban was deemed illegal by US authorities[15].

Moreover, in December 2015 the US Fish and Wildlife Service (USFWS) listed the lion in southern and eastern Africa, *Panthera leo melanochaita*, as threatened under the Endangered Species Act (the lion in west, central, northern Africa and India, *P. l. leo*, was listed as endangered). Although this threatened listing comes with an addendum permitting the import of sport-hunted trophies, the conditions under which a permit may be granted are rigorous, perhaps prohibitively so, requiring that exporting countries address concerns over "*evaluating population levels and trends; the biological needs of the species; quotas; management practices; legal protection; local community involvement; and use of hunting fees for conservation*" (Federal Wildlife Service, 2016[16]). This evaluation has now taken place for South Africa[17] (with the conclusion that only trophies from wild or wild-managed lions could be imported to the US); evaluations will follow for other relevant countries.

A proposal (CoP17 Prop 4) for consideration at the 2016 Conference of the Parties (CoP) to CITES was made by nine countries (Chad, Côte d'Ivoire, Gabon, Guinea, Mali, Mauritania, Niger, Nigeria and Togo) for all African populations of *Panthera leo* to be transferred from Appendix II to Appendix I. However, it should be noted that only three of those countries (Chad, Niger and Nigeria) are still thought by the IUCN to have any extant lions (Bauer et al. 2016), and the proposed listing was met with significant opposition by many of the key lion range countries, particularly the southern African lion hunting countries where lion populations are stable.

In fact, the first CITES/CMS (Convention on International Trade in Endangered Species of Wild Fauna and Flora / Convention on the Conservation of Migratory Species of Wild Animals) meeting of all lion range states, which

[14] http://www.nj.com/politics/index.ssf/2016/06/christie_signs_law_banning_trophy_animals_in_nj
[15] http://www.africahunting.com/threads/victory-for-new-jersey-hunters-in-the-anti-trophy-law.30930/
[16] https://www.fws.gov/endangered/what-we-do/pdf/Lion_FL_FAQs_Final.pdf
[17] http://www.huffingtonpost.com/entry/a-major-step-forward-for-lion-conservation-in-africa_us_5808f6ffe4b099c434319294

took place in 2016, highlighted the importance of trophy hunting under certain conditions, stating: "[*We*] *Highlight the benefits that trophy hunting, where it is based on scientifically established quotas, taking into account the social position, age and sex of an animal, have, in some countries, contributed to the conservation of lion populations and highlight the potentially hampering effects that import bans on trophies could have for currently stable lion populations*".

Regarding the 2016 proposal to list lions on CITES Appendix I, the CITES/CMS report states that "*Lion Range States have different views on the inclusion of all African populations of* Panthera leo *in Appendix I, with some arguing that the populations in West and Central Africa are fragmented and highly threatened; and others arguing that the species does not meet the listing criteria and is threatened by factors other than those CITES can address*".

The 2016 CITES CoP (CoP17) eventually decided not to list lions on Appendix I, but did state they would work towards lion conservation in a more active way, including helping to develop and support the implementation of joint lion conservation plans and strategies (CITES 2016). CoP17 did add an amendment which prohibited the export of bones, bone pieces, bone products, claws, skeletons, skulls and teeth from wild lions for commercial purposes, although it remained possible for these parts to be exported from captive-bred lions in South Africa (CITES 2016).

This decision, and the subsequent October 2016 evaluation by the USFWS which banned the import to USA of trophies from 'canned' lions, interact to raise two new questions of relevance to the conservation of wild lions. First, insofar as the majority of farmed lion trophies would hitherto have been imported to the USA, will this prohibition cause a proportion of the American hunters who might formerly have hunted farmed lions to turn to wild lions, thereby affecting the demand on the wild sector? Second, and considering the report by Williams et al. (2015) on the export from South Africa of farmed lion products aside from trophies, with the loss of their income from trophies destined for America, will the farmers flood the market with lion body parts with the possible result, through predatory pricing, of increasing the subsequent demand?

In terms of lion conservation, banning the importation of trophies to the UK would have little significant direct effect because the numbers of lions involved are so few (<4 lions yr^{-1} between 1991 and 2013 exported from Africa to Britain; CITES data; see Section 1.2.4). However, the cascading indirect effects of UK policy are difficult to predict and possibly wide-reaching. The UK may have impact beyond its borders through the influence of the evidence it is able to present (e.g. this report) and through ad-

vocating for greater alignment of North American and European positions.

Even if the UK doesn't change policy, the status quo will not be maintained, as international policy developments will bring about change. For example, it has been proposed that lions should be uplisted to CITES Appendix I, most recently in 2016 and previously by Kenya to the CoP in 2004 (although that was subsequently withdrawn) – such uplisting has not been passed but similar proposals could be submitted again in the future. It is very likely that any such listing would lead to increased regulation and/or limitation of trophy exports to all Parties, including the UK. Although strictly tangential to the issue of trophy hunting, the UK's influence on the classification of lions under CITES is likely to be influenced by lobbying motivated by opposition to hunting. Listing lions on CITES Appendix I would prevent commercial trade in wild specimens but hunting trophies are currently considered personal effects. It is not necessary to have specific Resolutions (cf black rhinos and leopards) to permit future trade.

Although the CITES uplisting has not passed to date, there has been a significant recent change in international policy regarding lions, when in 2015 the US listed them as Endangered in West and Central Africa and as Threatened in East and southern Africa on the annexes of the Endangered Species Act. As a consequence, imports of lion trophies into the large and lucrative American market are no longer allowed from West and Central Africa, and the industry in other regions is forced to demonstrate that trophy hunting is of net benefit to lion conservation. Many trophy hunting areas are now setting up monitoring systems to be able to demonstrate net positive effect in order to maintain access to the US market, and the US is currently considering whether those areas do provide enhancements for the species. The USFWS announced their first finding, for South Africa, in October 2016, stating that it would not permit the importation of trophies from captive-bred lions as they did not meet the criteria for conservation enhancement, but would permit the import of trophies from wild and wild-managed lions on a case-by-case basis[18]. Some possible consequences for wild lions of this prohibition on the import to the USA of farmed lion trophies are mentioned above.

In another policy development, many Parties to the Convention on Migratory Species are arguing that the lion should be listed under that Convention[19] – the implications would depend on which Appendix they were added to, but this

[18] http://www.huffingtonpost.com/entry/a-major-step-forward-for-lion-conservation-in-africa_us_5808f6ffe4b099c434319294

[19] https://cites.org/eng/news/sg/Lion_Range_State_Meeting_Joint_statement_by_CITES_CMS_300516

could facilitate management of transboundary lion populations. The UK plays an active role in these international developments, but that doesn't preclude further domestic policy development.

Given the intensity of global interest in this subject, and the wide range of views and stakeholders involved, the UK government has recognised the need for comprehensive and impartial advice on how possible trophy hunting might affect lion conservation, as well as how the UK Government can best support lion conservation in a wider context.

1.3 Summary of reasons for examining trophy hunting with regard to lion conservation

Lions are one of the world's most iconic species, and are under increasing threat. The degree to which trophy hunting plays either a negative or positive role in lion conservation is hotly debated and will be covered in more detail below, but it is clear that there is a long history of polarised views over trophy hunting. Recently – and particularly notably since the killing of Cecil the lion – a large section of the global public appears to have concluded that lion trophy hunting in particular, is unethical. However, this contrasts strikingly with the views of many people in the African countries where lions occur, and it is important to consider how any actions taken by the UK and its partners would affect those range countries with regard to wild lion conservation.

2. Threats and impacts associated with lion trophy hunting

2.1 The significance of trophy hunting as a threat to lions

2.1.1 Significance of trophy hunting as a threat to lions at a population scale

Trophy hunting can have marked impacts at a population scale, particularly when harvest rates are high (Loveridge et al. 2007a; Caro et al. 2009; Creel et al. 2016). Trophy hunting tends to be particularly negative when it is additive to other threats – and the magnitude of those other threats also depends strongly on how well the hunting area is managed. For example, lion populations are declining across the Benoue complex in Cameroon, thought to be due to a combination of high poaching pressure and excessively high lion trophy off-takes (Croes et al. 2011). However, there are strong underlying pressures in Cameroon – large mammal populations have declined steeply since the 1970s due to habitat destruction and poaching, and are particularly precarious due to the small size and fragmentation of protected areas, as well as poor management of those areas (Croes et al. 2011). Modelling by Creel et al. (2016) suggested that in the presence of additional (and stable) threats such as human encroachment, poaching and prey depletion, the addition of any hunting produced some degree of population decline and an increased probability of local extirpation, although conservative limits on hunting (see Section 3.2), resulted in situations with relatively stable dynamics and low probability of extirpation over a 25 year period.

In some populations, hunting alone explains lion declines – Packer et al. (2009) found that within Tanzania's Selous Game Reserve (the largest lion trophy hunting landscape in the world), the hunting blocks with the highest lion offtakes per 1,000 km^2 had the steepest declines in lion populations, unrelated to the impact of habitat loss. In western Zimbabwe lion populations rebounded by 50% when lion hunting was suspended, suggesting that previously high quotas were a cause of population decline (Loveridge et al. 2010; Loveridge et al. 2016). In Zambia, trophy hunting was the major factor behind declining lion populations (Rosenblatt et al. 2014). Poorly calculated and/or enforced quotas are thus perilous for lion populations (Caro et al. 2009; Packer 2015). The severity of impacts at a population level depends upon both the number and de-

mography of the animals removed, and this is covered in more detail below (see Section 3.2).

2.1.1.1 Negative population effects associated with the removal of females

Currently, only male lions are now hunted in most countries, but females were hunted in Zimbabwe until 2004 (Packer et al. 2006) and are still hunted in Namibia (Lindsey et al. 2013), as well as South Africa[20] (although many of those lionesses are in canned hunting operations). The number of females in a pride has a strong effect on per capita reproductive success, with the lowest cub production in prides with fewer females (Packer et al. 1988).

Larger prides have greater survival of all cub age-classes, benefitting from collective defence and possibly from synchronous breeding and communal nursing (Packer et al. 2001; Loveridge et al. 2010). Therefore, the removal of adult females is particularly damaging to populations of lions and other long-lived species.

2.1.1.2 Negative population effects associated with the removal of pride males

Loss of male lions from a pride facilitates pride takeover by other males, and infanticide of dependent cubs (Loveridge et al. 2007a; Loveridge et al. 2010). Rapid turnover of males also results in premature eviction and subsequent death of sub-adults (Elliot et al. 2014). The difference in male turnover between hunting/non-hunting periods was evident from cub survival rate, with only 66% of cubs surviving to 1 year of age during the trophy hunting period, which increased to 80% in the absence of hunting (Loveridge et al. 2010). Similarly, cubs in protected core areas experienced >40% greater survival than did cubs in edge prides, presumed as a result of reduced male turnover (Loveridge et al. 2010).

Moreover, the consequences for hunted populations are not limited to those individuals on hunting concessions: there can be knock-on effects even across core protected areas, as a result of the vacation of territories. In Hwange, removal of territorial males from the adjoining hunting zone resulted in a 'vacuum effect' where the availability of territory and lack of competition drew individuals from the safe area into hunting zones (Loveridge et al. 2010). Thus, removal of males within hunting areas adjacent to protected areas can have pervasive effects at a population scale when hunting offtake is high (Whitman et al. 2004; Loveridge et al. 2007a; Loveridge et al.

[20] https://www.discountafricanhunts.com/hunts/south-africa-spot-stalk-lioness-hunting-safari.html

2010). That excessive levels of trophy hunting can negatively impact lion populations is illustrated by Hwange National Park. Sport hunting of lions over the period 1999–2004 greatly reduced the number of males in the population, resulting in sex ratios heavily skewed towards females. However male densities and sex ratios recovered quickly once trophy hunting levels were reduced (Barthold et al. 2016a; 2016b; Loveridge et al. 2016a). Similarly, the number of male coalitions across the population was lower and the average coalition size smaller than in the absence of hunting (Loveridge et al. 2010). The number of adult females also increased when hunting was absent or light, probably as a response to increased adult and cub survival (Loveridge et al. 2016b). In the absence of hunting, there was an average reduction in male lion territory size of 421 km^2 in Hwange, which was probably due to a resultant increase in lion density from the lack of harvest offtake (Davidson et al. 2011).

Trophy hunting was the primary cause of death in Zambia's South Luangwa landscape between 2008 and 2012, with 46 males harvested (Rosenblatt et al. 2014). This was linked to a declining population, low recruitment, low survival of sub-adult and adult males, depletion of adult males and an ageing population of adult females (Rosenblatt et al. 2014). Similarly, Loveridge et al. 2016b show that trophy hunting areas form 'attractive sinks' for male lions, in that they represent areas with intact habitat and available prey and thus attractive to lions. The risk of mortality in these areas is however very high with few cues available to the lions to facilitate avoidance.

These strong negative impacts associated with the removal of pride males forms the biological basis for stipulating a minimum age limit where only older (and ideally post-reproductive) males can be hunted, as this should theoretically limit these 'cascading effects' of pride male removal. The principle behind restricting trophies to older males is that their tenure in the pride should have overseen the raising of at least one generation of cubs to adulthood. Following early models setting the minimum age at 5 years or older (Whitman et al. 2004), age limits set within countries have traditionally been set at $\geqslant$6 years. However, more recent modelling (Creel et al. 2016) has suggested that it would be prudent to raise this to $\geqslant$7 years (see Section 3.2 for more detail), while Packer et al. (2006) suggest that because the '6-year rule' was developed in Tanzania and male lions seem to mature later in southern Africa, it might be prudent to use a 7 year minimum in southern Africa. Nonetheless, it has been evident that in some populations, e.g. in Hwange National Park, almost all trophy males, even very old ones such as Cecil, were reproductively active in a pride when hunted. Old males evicted from prides in Hwange National Park rarely survive long enough to be hunted,

and even elderly males in prides seem to be reproductive, meaning that their deaths are followed by perturbation in the same way as those of younger pride males.

2.1.1.3 Threat to lion populations of trophy hunting relative to other threats

It is important to view trophy hunting within the context of all threats facing lion populations. Trophy hunting is usually only one of several threats facing lions, and the relative magnitude of those threats varies between sites. In South Luangwa, Zambia, trophy hunting was indeed the major threat at the population scale – although snaring was a significant concern, 87% of known snared lions were immobilised and successfully treated for their injuries, so this had little impact on lion dynamics (Rosenblatt et al. 2014). The snaring of prey is likely to contribute to the declining lion population as well, but the magnitude of this threat had not been quantified, and trophy hunting was the only obvious cause of the severe male depletion seen in the population (Rosenblatt et al. 2014).

In western Zimbabwe, trophy hunting was the primary source of recorded mortality for adult lions (mostly males), followed by snaring bycatch and retaliatory killing. Natural annual mortality rates were only 0.11 for males and 0.30 for females, compared with trophy hunting mortality rates of 0.65 and 0.30 for males and females respectively, which underlines the profound effect that anthropogenic factors can have on population dynamics (Loveridge et al. 2016b). In Tanzania's Selous Game Reserve, trophy hunting is thought to also pose one of the largest threats to lions (Creel and Creel 1997), but this is Africa's largest protected area, where other anthropogenic threats are likely to be relatively small.

In some other populations, trophy hunting is an additional (and often important) factor but not the major reason for any lion decline. In Tanzania's Ruaha landscape, another major trophy hunting landscape, there is an extremely high level of lion killing to protect livestock or to fulfil cultural roles (Dickman 2015), and it is likely that the impact of trophy hunting is dwarfed by these other threats. In that landscape, 37 lions were documented as killed through conflict with pastoralists in an area of less than 500 km^2 in one year – which equates to over 100 times the recommended maximum offtake if that was a hunting area (Dickman pers. comm.). That level of lion killing across just a few rural villages (which is likely to be an underestimate of the real level of killing), exceeds the number of lions imported as trophies into the US (the major importer) in 2013 from Botswana, Mozambique, Namibia, Zambia and Tanzania combined (U.S. Fish and Wildlife Service 2015). Similarly, in the Niassa National Reserve, 12 lions

were trophy hunted in 2014–15, while at least 42 lions were killed by local people. Across Africa, the number of lions killed illegally has been estimated as perhaps 5 times as many as those killed by trophy hunters, with the level of illegal killing being up to 10 times higher in some populations (Panthera et al. 2016).

We are not aware of any documented case of trophy hunting being the primary driver of lion population extirpation – Tanzania's Katavi National Park is one case where lions have apparently been extirpated, according to the latest IUCN listing (Bauer et al. 2016) and anthropogenic mortality is a likely driver of that decline, but that includes both unsustainable trophy hunting and traditional killing (Kiffner et al. 2009).

However, it should be noted that there is considerable debate about whether lions have truly been extirpated from Katavi – in communication with the EU CITES Scientific Authorities, Tanzanian authorities maintain that "*there are substantial numbers of lions remaining in Katavi ecosystem and a significant proportion of prime age males are still present, suggesting a balanced age pyramid and population structure (despite trophy hunting in the area)*" (Sigsworth pers. comm.).

2.1.2 Significance of trophy hunting as a threat to lions at a national scale

There are several guidelines for the percentage of a hunted lion population that can be sustainably harvested. Creel and Creel (1997) and Greene and Mangel (1998) suggest sustainable offtakes of 5% and 10% of adult males respectively. Caro et al. (2009) recommend harvests of 5% of total population, which if only males are hunted (as is the norm) would result in a higher proportion of males in the population being hunted than Creel and Creel (1997) or Greene and Mangel (1998) recommend. But few lion populations are adequately surveyed at the population level, so using a percentage harvest to determine sustainable offtakes is generally unworkable. If the above guidelines are accepted then at the current scale, trophy hunting offtake in most of the countries where it currently occurs is relatively conservative with no more that 2–4% of lions hunted annually (Loveridge et al. 2009)[21].

However, in the past, offtakes have often been considerably higher (e.g. in Zambia, offtakes occasionally reached 8–9% of the population per year, while in Zimbabwe historically offtakes reached 20–30% (Packer et al. 2006). Although, in a review for the Eastern and Southern

[21] *Given that there is a large degree of uncertainty surrounding lion population size and status across much of the species range these figures should be treated with some caution. The utility of defining sustainable offtakes as a percentage of a population is limited when population sizes is unknown.*

African regional lion plan, Packer and colleagues concluded that "*quota sizes have probably been too small in almost every country to contribute to any decline in lion numbers in the past 20–30 yrs...[with] one exceptional country, Zimbabwe, there is some evidence that trophy hunting can have a significant effect at a national scale, as over the past 25 years the steepest declines in lion harvests occurred in countries with the highest hunting intensities*" (Packer et al. 2009).

Next, we examine the potential significance of trophy hunting as a threat to lions in the six most significant countries for lion conservation (including Botswana as the ban is very recent, and excluding South Africa as the vast majority of its hunting involves captive lions).

2.1.2.1 Significance of trophy hunting as a threat to lions in Botswana

Our latest data suggest that Botswana holds approximately 2,800 free-ranging lions[22] in an estimated lion range of 237,000 km^2 (Dickman in prep.). The latest Red List assessments compiled data from three populations in Botswana (none of which were hunting areas), and found they had undergone an overall decline of 26% between 1993 and 2014, although this was heavily biased by the 46% decline in the Okavango, while Kwando/Chobe had an increase of 84% and Magkadikgadi had an increase of 121% (Bauer et al. 2016). Di Minin et al. (2016) estimated that 37.2% of the country was in terrestrial protected areas, while 23.0% was in hunting areas, although Botswana has banned all lion trophy hunting since 2008 and all trophy hunting in public areas since 2014. Botswana does not have a national action plan for the lion, but did adopt a 6-year minimum for trophy males in March 2005. Botswana has imposed various temporary bans on trophy hunting – after the ban of 2001–2004 there was an expectation of high quality trophy lions, which pushed the price per lion hunt from US$25,000–US$30,000 pre-ban, to US$85,000–US$115,000, and meant that the country was able to generate more income with half the quota (Winterbach pers. comm.). Before the most recent cessation of lion trophy hunting the country had an annual quota of 30 lions, of which 13–18 trophies were exported (Winterbach et al. in prep.). Due to this low offtake, lion trophy hunting in the recent past may have been sustainable in Botswana.

2.1.2.2 Significance of trophy hunting as a threat to lions in Mozambique

[22] *Defined, for this and all countries in this section, as lions which are either completely free-ranging, in areas of at least 500 km^2 if the population is partially fenced, or in areas of at least 1,000 km^2 if the population is partially fenced.*

Our latest data suggest that Mozambique holds approximately 1,500 free-ranging lions in an estimated lion range of 247,000 km^2 (Dickman in prep.). Di Minin et al. (2016) estimates that 17.6% of the country is in protected areas, while 10.5% is covered by hunting areas. Lions have declined substantially across Mozambique (with some areas, such as the Niassa National Reserve, apparently showing population increases; Bauer et al. 2016), and the key causes for the reduction in lion distribution and are thought to be declining prey numbers and conflict with livestock-rearing pastoralists (Fusari et al. 2010). The IUCN Red List obtained population trend data from only one population (Niassa National Reserve, where hunting occurs), which showed a 246% increase between 1993 and 2014 (Bauer et al. 2016). Although Niassa might not be representative of the whole country, as it has had relatively high conservation investment, it does hold perhaps two-thirds of Mozambique's lions (Dickman et al. in prep.), so this trend is significant for the country's overall population.

The lion trophy hunting quotas in Mozambique have been criticised as being too high, as well as being issued without any scientific basis (Fusari et al. 2010). The annual quota was 50 animals in 2007, 111 in 2008 and 60 in 2009 (Fusari et al. 2010), but the actual offtake appears to be significantly lower than that. Many wildlife areas have been depleted in Mozambique, due to factors including government culling of wildlife (including lions) during the 1960s and 1970s, and extensive poaching for meat during and after the civil war (Fusari et al. 2010). Due to this wildlife depletion, most hunting areas currently generate negative returns on investment, with hunting operators investing in unprofitable concessions on the assumption that wildlife populations will recover. Age-based export regulations have now been developed and enforced in Niassa National Reserve, with a 6-year minimum implemented in September 2006, limiting the negative impacts of trophy hunting (and leading the EU to conclude a positive opinion for lion trophies from Niassa only rather than the whole of Mozambique; Sigsworth pers. comm.). The small number of lions trophy hunted per year in Mozambique relative to its population size suggests that trophy hunting unlikely to have a significant negative impact at a national scale, with bushmeat pressure, growing human populations and pastoralist-lion conflict more significant threats.

2.1.2.3 Significance of trophy hunting as a threat to lions in Namibia

The 2008 draft Namibian national lion conservation strategy suggested that, based on data collected within the two previous years, Namibia had fewer than 1,000 lions, including between 615 and

799 free-ranging lions (as termed in the report) and an additional 100 to 125 animals on private land (MET 2008). Our latest data suggest that Namibia holds approximately 750 free-ranging lions in an estimated lion range of 170,000 km^2 (Dickman in prep.).

The draft national lion conservation strategy states that lions are subject to extreme human pressure, with nearly 900 lions destroyed over the past 20 years, mainly due to conflict with livestock keepers (MET 2008). Di Minin et al. (2016) estimated that 43.2% of Namibia was covered by protected areas, with 11.4% covered by game ranches. As well as state protected areas and private game ranches, by the end of 2014, Namibia had 82 communal conservancies (including 36 in Kunene region, mentioned below), which covered over 17% of the country and encompassed 184,000 people, around 8% of the national population and around one in four rural Namibians (NACSO 2011, 2015). Sustainable use of wildlife (including trophy hunting), with devolved power and benefits to local communities, are a cornerstone of the conservancies – about half the conservancies benefit solely from hunting, and the revenues from trophy hunting totalled US$1.6 million in 2013 (NACSO 2015). This community-based conservation model is thought to be one of the key factors behind Namibia's expanding population of free-roaming lions (NACSO 2011, 2015). The latest Red List assessment of Namibian lion populations, based on three areas (one of which had hunting) showed an overall increase of 41% between 1993 and 2014. However, this was strongly influenced by the huge increase in lions in Kunene (the area where trophy hunting occurred), which had an increase of 3,933%, going from an estimated 6 lions in 1993 to 242 lions in 2014 (Bauer et al. 2016).

At least as of 2008, Namibia had no annual national-level lion quota. Trophy hunting permits are allocated to kill problem lions (males only) on conservancy land. 38 lions were hunted this way between 1998 and 2008, with an average offtake of less than 4 a year. In addition, trophy hunting is permitted on free-roaming lion populations in hunting concessions, which may be conservancies or protected areas (excluding Etosha National Park) (MET 2008). Most lions shot as trophies in Namibia are from hunting concessions, mostly in the Kunene and Caprivi regions (MET 2008).

The draft national lion conservation strategy revealed that some illegal trophy hunting was occurring along the southern boundary of Etosha National Park, making the allocation of quotas and maintenance of trust with landowners very difficult (MET 2008). The draft national lion conservation strategy set out some key activities for improving trophy hunting in Namibia, specifically that efforts should be made to:

- Develop and implement an approved

quota setting methodology rigorously and consistently across all hunting areas

- Review and analyse annual quotas and offtakes to ensure these are adaptive and responsive to population changes, trophy quality and levels of PAC over time
- Allocate quotas at a scale reflective of lion ecological and biological functionality which invariably acts across different and/or smaller land units or uses
- Develop and implement standardised hunt return forms and trophy hunting databases and review annually thereafter
- Ensure centralised database and cost-effective system for data collection from hunting areas and subsequent collation, entry, analysis, reporting and feedback to key stakeholders in the wildlife industry (MET, NAPHA, NAU, NNFU, Conservancies, conservation NGOs and researchers etc. as appropriate)
- Provide training to MET, Conservancy and NAPHA personnel and other relevant field staff in the approved quota setting methodology
- Review trophy fees to maximise benefit and generate additional revenue

Overall, trophy hunting does not seem to pose a threat to lions in Namibia, and is in fact (particularly in the conservancy areas) thought to be one of the reasons why Namibia's lion population has increased over recent years (NACSO 2011, 2015). However, Namibia is an unusual case in having relatively good governance and very low human population density, so it is unlikely that the successes seen here could easily be replicated across many other African countries. More generally, governance and infra-structural capacity, of which corruption is a factor, are relevant to the delivery of felid conservation as documented by (Dickman et al. 2015), and governance has been highlighted as a key issue with regard to the sustainability or otherwise of trophy hunting operations (Packer 2015).

2.1.2.4 Significance of trophy hunting as a threat to lions in Tanzania

Our latest data suggest that Tanzania holds approximately 9,900 free-ranging lions in an estimated lion range of 380,000 km^2 (Dickman in prep.). Tanzania has around 32.2% of its land covered by protected areas, and 26.4% in game reserves (Di Minin et al. 2016). Tanzania contains about half of the continent's remaining lion population (Riggio et al. 2013), but the IUCN found significant declines, based on an analysis of five populations, one of which had trophy hunting (Bauer et al. 2016). There was

an overall decline of 66% in the lion populations between 1993 and 2014 – only one population (the Serengeti) increased, while the population with trophy hunting (Katavi) was apparently extirpated during that period, according to the IUCN data (Bauer et al. 2016; although this is disputed – see Section 2.1.1.3).

Tanzania has long hosted the largest lion trophy hunting industry, with 100–300 lions hunted per annum (Packer et al. 2010). The Selous Game Reserve is the largest uninhabited protected area in Africa (55,000 km^2) and is a premier destination for lion trophy hunters. Lions are considered to be declining in a significant proportion of Tanzanian hunting areas, with trophy hunting considered to be the primary driver of this decline outside (and inside some) protected areas (Packer et al. 2011). Lion harvests declined by 50% across Tanzania between 1996 and 2008, and hunting areas with the highest initial harvests suffered the steepest declines; the intensity of trophy hunting was the only significant factor in a statistical analysis of lion harvest trends (Packer et al. 2009).

Tanzania introduced a 6-year age minimum for lion trophies in 2012 (based on the recommendations of Whitman et al. 2004); lion offtakes have further declined in the past few years, with only 40 lions exported in 2014; it is not clear if this recent drop has resulted from hunting clients restricting their offtakes to lions aged 6yrs or older or from a continuation of the trend reported by Packer et al. (2009). Leader-Williams et al. (2009) and Packer (2015) note that Tanzania has a poor record of hunting governance, and the recent scandal over Green Mile Safaris (whose clients posted evidence of multiple trophy hunting and animal welfare infractions online, but who nevertheless were apparently permitted to continue hunting in Tanzania[23]) is one clear example of very poor management of the country's trophy hunting industry. Similarly, a recent report from East Africa has raised concerns that corrupt officials in Tanzania and Kenya in particular, have been compromised through bribes to allow the killings of wildlife and the illegal export of trophies[24].

While there is evidence that trophy hunting has had negative impacts on Tanzania's lion populations (Packer et al. 2011), other threats are more significant. Tanzania's National Action Plan for lions and leopards concluded that prey availability, land use and land cover change, anthropogenic killing, inadequate management and disease may

[23] http://www.huffingtonpost.com/entry/abusive-safari-company-tanzania_us_57769240e4b04164640fbba8
[24] http://allafrica.com/stories/201608291000.html

pose threats to those species, with retaliatory killing, land use change and problems arising from inadequate management the most important factors (TAWIRI 2007).

2.1.2.5 Significance of trophy hunting as a threat to lions in Zambia

Our latest data suggest that Zambia holds approximately 1,200 free-ranging lions in an estimated lion range of 135,000 km^2 (Dickman in prep.). The IUCN examined only one population in Zambia (Luangwa) for the IUCN Red Listing – this population was hunted for trophies and had declined by 28% between 1993 and 2014 (Bauer et al. 2016).

Di Minin et al. (2016) estimated that 37.8% of Zambia was covered by terrestrial protected areas, with 21.3% in hunting ranches. However, it is notable that despite this extensive coverage of hunting areas, which is second only to Tanzania and Botswana (before the ban), Zambia generates very little revenue from trophy hunting (see Table 3 for comparison of estimates). This concurs with the findings of Lindsey et al. (2012b), who stated that most Zambian trophy hunting concessions appear to be running at a loss, probably as a result of the depletion of prey populations due to human settlement and the bushmeat trade in Game Management Areas (Lewis and Alpert 1997; Simasiku et al. 2008). Quotas of lions have been excessive, are established arbitrarily and there is a lack of monitoring of wildlife populations or of trophies. Per annum, 39 lions are hunted, while 13–18 trophies are exported (Lindsey et al. 2007). This level of hunting is approximately 3.4% of the estimated population, so is a relatively high level compared to many other countries.

Zambia's national authorities appeared to consider trophy hunting as a significant threat to lions (hence the ban on big cat trophy hunting implemented in 2013) but later reversed the decision (with some adjustments to quotas and regulations), mainly because of concerns over a lack of revenue[25].

The Zambian lion management strategy highlights poor management of the trophy hunting process, and states that there is inconsistency in the collection of data at temporal scale and in terms of measurable variables making it difficult to assess trophy quality trends in the country. The management plan states that it is focusing on the "*promotion of age-based harvesting of lions and setting of hunting quotas based on empiri-*

[25] http://www.bbc.co.uk/news/world-africa-32815508

cal biological data in addition to the ongoing collection of trophy measurements" (Zambia Wildlife Authority 2009). The national lion management strategy also highlights the following issues relevant to improving trophy hunting within the country:

- Standardization of lion survey methods and conducting baseline survey of lion numbers
- Setting of sustainable lion off take quotas
- Monitoring and evaluation of the lion population in the context of existing conservation and tourism programmes
- Preparation and implementation of field age determination techniques
- Development of area-specific lion management strategies especially for Game Management Areas (GMAs)

However, that strategy was developed in 2009 and it is unclear how much progress, if any, has been made since then towards improving the management of lion trophy hunting in Zambia. Therefore, it is still possible that poorly-managed trophy hunting could be a threat to Zambia's lion populations.

2.1.2.6 Significance of trophy hunting as a threat to lions in Zimbabwe

Our latest data suggest that Zimbabwe holds approximately 1,500 free-ranging lions in an estimated lion range of 57,000 km^2 (Dickman in prep.). The IUCN Red Listing used data from five populations in Zimbabwe, four of which had trophy hunting. All populations showed a significant increase (the lowest level was in Hwange, but even that was 86%) so overall, there was a very impressive 1,252% increase in lion numbers across those areas between 1993 and 2014, mainly due to increases in relatively small populations (Bauer et al. 2016). The largest increase was in Gonarezhou, the non-hunted population, which had a 7,900% increase (from 1 lion to 80), and this was closely followed by Savé Valley Conservancy, with a 6,967% increase (3 lions to 212) (Bauer et al. 2016).

Di Minin et al. (2016) estimated that 27.2% of the country was covered by terrestrial protected areas, with game ranches covering 16.6%. From the 1970s lion trophy hunting harvests in Zimbabwe were some of the highest in relation to population size in Africa, with annual offtakes of between 90 and 141 lions between 1992 and 2002 (Loveridge et al. 2009; Packer et al. 2009), but quotas were reduced to 75 individuals in 2015 (ZPWMA 2015) and lion numbers are now increasing in several populations (Bauer et al. 2016). Since the elephant trophy import ban in the US, there is

anecdotal evidence that lion have become relatively more important to the national hunting industry economically.

Zimbabwe introduced a 5-year age limit on hunted lions in January 2006, and has used an adaptive age-based quota system with evidence of success. This calculates a fluid quota per area based on the previous season's performance in terms of hunting only older males. The Zimbabwean adaptive system has been associated with a rising age of hunted lions, a desirable outcome illustrating the role of quotas and age-based restrictions in influencing population demographics (ZPWMA 2015). The goal of the Zimbabwean system of inbuilt feedbacks is to discourage outfitters from hunting lions that are too young, thereby minimising negative impacts on the lion population whilst maximising the sustainable yield, and therefore the economic incentive to conserve lions. With these lowered quotas and age-based systems, there is little evidence that trophy hunting is negatively affecting Zimbabwe's lion population at a national scale.

2.1.3 Factors mediating the threat posed by trophy hunting

Despite the threats posed by trophy hunting to individual populations, trophy hunting has never (to our knowledge) been implicated as a significant factor in the extirpation of lions from a country. While Chardonnet's (2002) estimate that 32 African countries supported wild lions may have been optimistic, by 2015 seven of them no longer did so (Bauer et al. 2016); however, none of these countries had exported a lion trophy over that period [CITES trade database: http://trade.cites.org/en/cites_trade/ (Accessed 11 July 2016)].

It seems as if where trophy hunting is well-regulated, transparent and has a significant amount of power devolved to the landowners (for example in Namibia; Naidoo et al. 2016a), it has the potential to deliver significant conservation benefits in terms of protecting habitat and allowing lion populations to persist (NACSO 2011, 2015; Naidoo et al. 2016a). However, in many countries, poor governance[26] and weak enforcement of hunting regulations increases the threat posed by trophy hunting; indeed, Packer (2015) argues that corruption within the hunting industry

[26] *Lion hunting countries rank poorly in governance scores from Transparency International (www.transparency.org)*

and wider frameworks is the reason why lion hunting often fails to deliver the benefits to lion conservation that might be expected in principle, and Dickman et al. (2015) consider corruption as a limiting factor in delivering felid conservation in some countries.

According to the IUCN in 2009, good governance was absent from almost the entire trophy hunting sector in many countries, with those currently in control of the system not prepared to share power and undertake adjustments that would mean relinquishing control; a position that IUCN (2009) concludes serves individual interests, but not those of conservation, local communities or good governance (UICN/PACO 2009). However, even poor national governance does not always preclude relatively well-managed trophy hunting: Zimbabwe has recently implemented an age-based adaptive quota strategy (see Section 2.1.2.6), which has resulted in the reduction of hunting under-age animals (ZPWMA 2015).

Similarly, despite weak governance across much of Mozambique, age-based adaptive management of trophy hunting (and work to address other threats to lions) has been implemented effectively in the Niassa National Reserve, and lion populations are increasing there despite hunting (Bauer et al. 2016).

2.1.4 Significance of trophy hunting as a threat to lions at a regional scale

The IUCN 2006 regional conservation Strategies for lions (in West and Central Africa, and in Eastern and Southern Africa), considered possible threats to lions, and ranked them using a points-based system (IUCN 2006a, b).

The top five threats (i. *prey depletion*, ii. *conflict with humans*, iii. *small population size*, iv. *livestock encroachment* and v. *habitat loss*) were the same in each region, albeit in slightly different orders (see Figures 2a and 2b).

Trophy hunting was not ranked by experts as one of the top three threats to any lion populations across West and Central Africa (IUCN 2006a). Trophy hunting emerged as a higher threat across Eastern and Southern Africa than in West and Central Africa, but was not ranked as a high level threat.

2.1.5 Summary of the significance of trophy hunting as a threat to lions

Poor quota management and unregulated hunting of lions, in particular that of dominant males and pride females, can result in significant negative impacts at a population scale (e.g. Loveridge et al.

2007a; Packer et al. 2009; Croes et al. 2011; Packer et al. 2011; Becker et al. 2013). These negative impacts could be ameliorated (either in whole or in part, depending on the population) by restricting offtake to males of ⩾7 years, which should have reproduced, and in some areas by combining this with an area-based hunting quota. However, when assessed at either a national or a regional level, the negative impacts on lions from trophy hunting are deemed by experts to be substantially smaller than other threats, particularly those of human-lion conflict and loss of prey (IUCN 2006a, b).

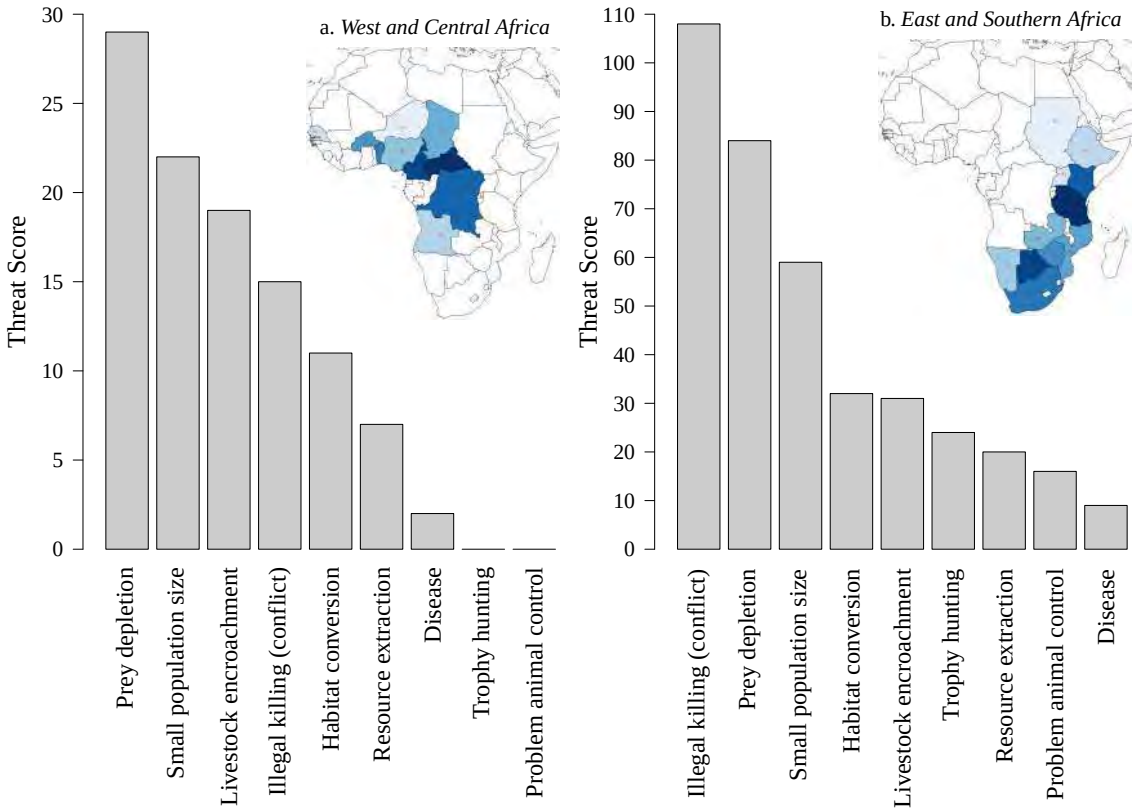


Figure 2: *Threat ranking for lions in (a) West and Central Africa, and (b) East and Southern Africa, as assessed by experts at the 2006 IUCN Lion Conservation Strategy meetings (note that the y-axes are different scales as the magnitude of threats was considered higher in East and Southern Africa). The maps show the countries assessed in the strategies, with the colour showing the relative lion population in the range country, with darker colour showing a larger population.*

2.2 Impacts associated with lion trophy hunting [27]

2.2.1 Ecological impacts

2.2.1.1 Habitat protection

The protection of wildlife habitat is the primary benefit associated with trophy hunting, as it reduces the major threat of habitat loss – conversion to other forms of land use such as agriculture is often irreversible. In 2007, Lindsey et al. estimated that a total area of at least 1,394,000 km^2 was conserved for trophy hunting in sub-Saharan Africa, which exceeded the area of national parks in those countries by 22%. In 2013, it was estimated that lions were hunted across at least 558,000 km^2, which comprised 27–32% of the lion range in countries where trophy hunting of lions was permitted (Lindsey et al. 2013), and at least 16% of the total lion distribution in Africa (Riggio et al. 2013). Given the dates of those studies, the extent of this hunting range will now have declined slightly since Botswana imposed its lion trophy hunting ban in 2014.

Many of the areas that are (or recently were) hunting zones are not currently suitable for photographic tourism (e.g. even in Botswana, which is one of Africa's premier destinations for photographic tourists, over three-quarters of hunting land in the Northern Conservation Zone had low potential for phototourism; Winterbach et al. 2015), so hunting enables this land to be maintained under a wildlife-based land use. This maintenance of habitat (even if lions themselves are negatively affected at some level) is by far the most significant benefit provided by trophy hunting of lions, particularly given the fact that habitat loss and degradation is such a significant threat to lions at all scales (IUCN 2006a, b; Fusari et al. 2010; Henschel et al. 2010; Henschel et al. 2014). Particularly in West and Central Africa, trophy hunting maintains lion habitat in areas where photographic tourism and philanthropy are absent – and those land uses are much less developed than in other regions. This is evident from the fact that lions have been extirpated from most protected areas in the region (Henschel et al. 2014) whereas the last two remaining substantial populations (>250 lions) are both within large complexes of National Parks interconnected and buffered by hunting zones that appear to be at least partially effective at reducing livestock encroachment, with hunting not

[27] *Throughout, we try to provide as much specific data as possible with regard to lion trophy hunting, but in some cases information is only available for trophy hunting in general.*

appearing to significantly affect the last remaining lion stronghold in West Africa, the W-Arly-Pendjari (WAP) ecosystem (Bouché et al. 2016).

Although lions are one of the main draws of trophy hunting areas and increase their financial viability, these areas are also very important for many other species, including some highly threatened ones. For example, in the case of the critically endangered black rhino (*Diceros bicornis*), only 10 'IUCN Key 1' populations remain (i.e. populations that are crucial to the survival of the species), and three of those occur on private hunting conservancies in Zimbabwe where lions are also key hunted species (N. Anderson, International Rhino Foundation, pers. comm.).

However, not all the ecological impacts of trophy hunting are positive. In areas managed predominantly for lions, high densities have negative impacts on the populations of smaller competitors, such as cheetahs (*Acinonyx jubatus*) and African wild dogs (*Lycaon pictus*). Where provided with adequate resources and protection (even where they are hunted), lion populations can achieve very rapid growth rates (e.g. Groom and Watermeyer 2015; Miller et al. 2015; du Preez et al. 2016a). High lion densities (particularly within fenced reserves, including non-consumptive photographic areas) can lead to significant ecological and social problems such as severe reductions in prey populations and intra-specific lion killing (Ferreira and Funston 2010; du Preez et al. 2015). The associated management issues (overpopulation and overpredation) may necessitate lethal control of the lions (Miller et al. 2015), or intensive management strategies such as contraception or translocation.

2.2.1.2 Reduction of other threats to lions and other wildlife

At least within well-managed trophy hunting areas, it is common to have significant anti-poaching patrols, which would reduce threats of human encroachment, such as the loss of lion prey through bushmeat hunting. For example, in Cameroon, where bushmeat poaching is a major conservation issue, observations between 2005 and 2010 suggested that anti-poaching efforts were higher in the hunting zones than National Parks, due to economic incentives to reduce poaching in hunting areas, and a lack of government funding to conduct similar anti-poaching efforts in Parks (Croes et al. 2011). Even in poorly-managed areas, funds from hunting can still play a major role in funding anti-poaching operations. For example, in Tanzania's Selous Game Reserve (which is allegedly beset by high levels of corruption), the 'Selous Retention Scheme' has recently been re-established, where 50% of hunting revenues from the Reserve are re-invested into conservation and anti-poaching (IUCN 2016). The Re-

serve's chief warden from 1994–2008 and 2012–2015 has raised serious concerns about the impacts of trophy import bans on the capacity of the reserve to successfully conduct anti-poaching efforts (IUCN 2016). However, anti-poaching efforts run by hunting operators vary considerably between countries and operators, and they tend to be seasonal rather than year-round.

2.2.2 Impacts of economic benefits generated from trophy hunting

There are several reasons for considering the economic contributions of trophy hunting, not least because of its possible role in the economic development of African nations and as a source of income to local people (though the significance of trophy hunting revenue is debated for both those factors). However, within the remit of this report, we focus on the connection between the economic impact of trophy hunting and conservation outcomes.

2.2.2.1 Level of trophy hunting revenue generated

There are a range of estimates of the degree of economic revenue generated by trophy hunting, but there is a lack of rigorous, independent data on the economics of trophy hunting. A report commissioned by Safari Club international, an organisation that is explicitly in favour of hunting, concluded that across eastern and southern Africa (Botswana, Ethiopia, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe) hunters spend US$326.5 million annually when accounting for all in-country expenditure, including not only the cost of the hunt and associated fees but also other costs such as transportation, food and souvenirs (Southwickes Associates 2015). They found the value-added contribution to GDP (using multipliers derived from World Travel and Tourism Council) to be US$426 million (Southwickes Associates 2015). They also found that trophy hunting supports 53,400 jobs, when including supporting sectors. However, in 2009 the IUCN criticised the low proportion of jobs created by the hunting industry in comparison to the proportional area of land it occupies – it cited figures of 15,000 salaried jobs across Africa, compared to a human population of 150 million in the eight main trophy hunting countries, where trophy hunting takes up 16% of their land (UICN/PACO 2009). However, this must be considered in the context of naturally low human density in wildlife areas, and the general incompatibility of (or inverse relationship between) large human populations and maintenance of wildlife populations.

There is variation in estimates given in the peer-reviewed literature regarding the level of trophy hunting revenue,

and those estimates usually do not provide value-added estimates or account for revenue to supporting sectors etc. Lindsey et al. (2007) estimated that trophy hunting generated gross revenues of at least US$201 million per year in sub-Saharan Africa, although this estimate has been criticised in a report prepared for The African Lion Coalition, which is composed of animal welfare groups, for relying on unreliable sources of data (Economists at Large 2013). Booth (2010) estimated gross revenues of at least US$190 million for South Africa, Namibia, Botswana (the paper was published prior to Botswana's trophy hunting ban that entered into effect in 2014), Zambia, Mozambique, Zimbabwe and Tanzania. Di Minin et al. (2016) estimated total annual hunting revenue to be approximately US$217.2 million in those same countries (see Table 3 for a summary of estimates of the revenue generated by trophy hunting per country). However, the report prepared for the African Lion Coalition argues that that the contribution of trophy hunting to national economies is insignificant because it constitutes only a small percentage of Gross Domestic Product (GDP) (Economists at Large 2013). The IUCN estimated trophy hunting revenue to contribute 0.19% of GDP in Botswana, 0.03% in Mozambique, 0.45% in Namibia, 0.04% in South Africa, 0.22% in Tanzania, 0.05% in Zambia and 0.29% in Zimbabwe (UICN/PACO 2009). Though small on a national scale, income from trophy hunting can be a significant source of income for the government bodies responsible for managing wildlife. For example, the Wildlife Division in Tanzania makes 60% of its income from trophy hunting licence fees (Estes 2015). The IUCN stated that a definite positive aspect of trophy hunting is that conservation results are financed completely by the hunters, without drawing from donors or requiring government commitment (UICN/PACO 2009).

Most of the figures discussed above concern trophy hunting as a whole, and only part of these are generated by trophy hunting of lions specifically. Lindsey et al. (2012b) estimated that lions generate 5–17% of gross trophy hunting income on national levels among Mozambique, Namibia, Tanzania, Zambia and Zimbabwe, but lions were not the species that generated the largest proportion of trophy hunting income in any of these countries.

2.2.2.2 The economic contribution of lion hunting and its impact on land-use

From a conservation perspective, the overriding concern is how the economic profitability of trophy hunting of lions affects land-use.

Table 3: *Estimates of revenue generated by trophy hunting per country.*

Country	Revenue year^{-1} (US$ m)	Source
Botswana	20	*Lindsey et al. 2007*
	40	*Di Minin et al. 2016*
	12.5	*Northumbrian 2001*
	40	*Booth 2010*
Burkina Faso	0.6	*Lindsey et al. 2007*
Cameroon	2	*Lindsey et al. 2007*
CAR	1.4	*Lindsey et al. 2007*
Ethiopia	1.3	*Lindsey et al. 2007*
Mozambique	5	*Di Minin et al. 2016*
Namibia	28.5	*Lindsey et al. 2007*
	28.5	*Di Minin et al. 2016*
	9.6	*Booth 2010*
South Africa	100	*Lindsey et al. 2007*
	68	*Di Minin et al. 2016*
	68.3	*Booth 2010*
Tanzania	27.6	*Lindsey et al. 2007*
	56.3	*Di Minin et al. 2016*
	6-7 *	*Mésochina et al. 2010*
Zambia	5	*Lindsey et al. 2007*
	3.6	*Di Minin et al. 2016*
Zimbabwe	16	*Lindsey et al. 2007*
	15.8	*Di Minin et al. 2016*
	18.5	*Booth 2002*

∗ *Figure for revenue from lion hunting only*

If a ban on the import of lion trophies (or other policies) impacted the profitability of trophy hunting operations to the extent that it becomes less profitable than alternative land-uses due to reduced demand, then it is likely that there will be a transition to more profitable land-uses. The type of the land-use that replaces trophy hunting is important to predict the effect on the conservation of lions and wildlife in general. Transition to agriculture or livestock grazing is a serious threat to the survival of the lion populations (Loveridge et al. 2007b) and is the likely alternative to trophy hunting across much of Africa, because it is profitable for land-owners, or in the case of government-owned land, because there is strong political pressure to turn these areas over to livestock production

(Loveridge et al. 2007b).

To consider the effect of curtailment of hunting of lions on land-use, information on the specific contribution of lions to the viability of trophy hunting operations is required. There is a paucity of information on this, but Lindsey et al. (2012b) estimated the significance of lions for the financial viability of trophy hunting in Mozambique, Namibia, Tanzania, Zambia and Zimbabwe. They found that the trophy hunting industry is not dependent on lions to remain viable in most areas, and that other species are more important in financial terms. However, they conclude that if lion hunting was precluded, trophy hunting could still become unviable across at least 59,538 km^2, which constitutes 11.5% of the area lions are hunted in the countries included in the analysis. Lion hunting was found to be important for financial viability of trophy hunting in Mozambique, Tanzania and Zambia, but of minor importance in Namibia and Zimbabwe. Lindsey et al. (2012b) further noted that had Benin, Burkina Faso and the Central African Republic been included in the analysis, the estimated size of the area where trophy hunting will be lost is likely to increase significantly as these countries have low numbers and diversity of other key trophy species. Crucially, trophy hunting becomes unfavourable as a land-use option not only if a trophy hunting business becomes unprofitable, but also if it becomes less profitable than the alternative land-use from the perspective of the owners/custodians of a piece of land, so the extent of habitat loss could be greater than 59,538 km^2. In some areas, the net returns from livestock is similar to those from trophy hunting (Lindsey et al. 2012b)so there might be a transition to livestock production even with only relatively small decreases in profitability of trophy hunting. Estimates of the profitability of trophy hunting per hectare differ. IUCN (2009) reported US$1.1 ha^{-1}, Lindsey et al. (2012b) estimated net earnings to be between US$0.24 to US$1.64 ha^{-1} year^{-1} depending on the country, and du Preez et al. (2016b) calculated that hunting in Zimbabwe's lowveld was worth approximately US$16.4 per hectare per year for all species and US$5.57 for lion hunting alone. Net returns from livestock in semi-arid African rangelands (US$0.1–US$0.3 per hectare per year in areas with 400–800 ml of annual rainfall (Cumming 2004) are similar to those from trophy hunting in some areas, so these areas are at risk of conversion (Lindsey et al. 2012b).

In the most attractive and accessible areas, land-use could shift from trophy hunting to non-consumptive wildlife use, e.g. photo-tourism, such that habitat is maintained without lions being killed. This could be the ideal outcome from conservation and welfare perspectives, as lion populations would be secured without the damaging ethical, ecological and welfare impacts of trophy hunting. Indeed, Barnes (2001) concluded that pho-

tographic tourism has greater benefits than consumptive use over about one-third of the wildlife estate in Botswana, finding that "*consumptive wildlife uses are relatively unimportant in terms of economic contribution*", whilst consumptive wildlife use is the only possibility across the "*less well-endowed two-thirds of the wildlife estate*".

However, only a subset of the areas that are currently used for trophy hunting are likely to be suitable for photographic tourism (Lindsey et al. 2006). For example, they might contain limited numbers of charismatic species, lack photogenic scenery, or be located in areas with high risk of tropical disease, poor infrastructure or political instability (IUCN 2016). Trophy hunters are less discouraged by these conditions than most tourists: during the first year of land-seizures in Zimbabwe, the tourism sector was reduced by 75% while profits from trophy hunting only dropped 12% (Booth 2002). Also, it is unknown whether there exists enough unsatisfied demand for photographic tourism to supply clients if current trophy hunting areas are converted to photographic tourism, or whether this would simply divert visitors from current protected areas. Across Africa, a large number of protected areas with high levels of biodiversity receive very few visitors (Balmford et al. 2015). This is not consistent with there being significant unsatisfied demand for photographic tourism opportunities, which suggests that the creation of new photographic tourism areas might divert visitors from existing protected areas, some of which are already operating at a loss.

Even where photographic tourism is financially viable, there is evidence for interdependence between this form of tourism and trophy hunting. In Namibia, trophy hunting was shown to be important for the establishment of conservancies because it generates benefits sooner than photographic tourism after establishment of a conservancy, so it can allow conservancies to remain financially viable while its photographic tourism is developing (Naidoo et al. 2016a). Furthermore, simulations show that a significant number of community-led Namibian conservancies would not be able to meet their operational costs if there was a ban on trophy hunting, which would remove both the incentive to maintain these protected areas and the financial means to manage them (Naidoo et al. 2016a).

However, where the land-owners value wildlife beyond their economic value they might be willing to tolerate low returns from their land in order to maintain wildlife habitat, if they have sufficient wealth to do so. In these cases, reductions in profitability of lion trophy hunting may not affect the conservation of lion habitat. It is uncertain to what extent land-owners perceive intrinsic value of wildlife, and considering that the host countries of lion hunting are developing

nations, the ability to absorb financial losses or reduced returns is likely to be low.

Although there is anecdotal evidence from such countries as Botswana and Zambia after recent trophy hunting bans (see text box below), there is no published literature on the specific impacts of the ban in terms of protecting lions, and very little information on actual land use changes. At present, we are limited to inference: Williams et al. (2016) documented substantial decreases in the density of lion, leopard, cheetah, African wild dog, spotted hyaena (*Crocuta crocuta*) and brown hyaena (*Hyaena brunnea*) as land was converted from hunting conservancies to agriculture, following land reform in Zimbabwe. Direct evidence demonstrates that local people are often unsupportive of a ban, and that significant loss of revenue to hunting zones occurs when lions can no longer be utilised (Hann 2015). Hann (2015) highlights the huge knowledge gaps regarding hunting and its association with wildlife declines. The IUCN notes that "*Revenues from trophy hunting are also important for conserving threatened species that are not hunted. Populations of Black Rhino and White Rhino and of the African Wild Dog on the Savé and Bubye Conservancies in Zimbabwe are not hunted, but proceeds from trophy hunting support their conservation*" (IUCN 2016).

2.2.2.3 Trophy hunting and economic incentives for lion conservation

Another way that the economic impact of lion trophy hunting is connected to conservation outcomes is through the revenue generated by trophy hunting that goes towards implementing conservation efforts and incentivises tolerance for lions and the maintenance of habitat for wildlife – reductions in the income generated from lion hunting could reduce these incentives among governments, local communities and private land-owners.

Governments require funds for wildlife management and income to justify the maintenance of land as game reserves/wildlife management areas in the face of increasing human populations and demand for land. Some of the funds generated by trophy hunting accrue to governments. For example, in Tanzania, direct and indirect tax flows to the government is approximately 44% of the estimated gross income of the trophy hunting industry (Booth 2010), and, based on data from 2008, 22% of the gross revenue generated by hunting is allocated to the Wildlife Division (Di Minin 2016). However, much of the income generated by the industry never enters the country, accruing instead to external parties (Booth 2010). In Namibia, 21% of the income generated is captured by the government through fees and taxes (Humavindu and Barnes 2003). Lewis

and Alpert (1997) report that in Zambia: ADMADE (Administrative Design from Game Management Areas) receives around 67% of all revenue generated by sport hunting activities in Zambia's Game Management Areas. Over half (53%) of ADMADE revenue is allocated directly to local wildlife management and the remainder to community development. However, is usually unclear how much of the revenue captured by governments across lion range countries is channelled into conservation efforts, especially in the context of high levels of corruption.

From the viewpoint of lion conservation, generating benefits for local communities from trophy hunting of lions is important because it incentivises local communities to tolerate lions despite the threat they can pose to livestock and human lives (Loveridge et al. 2007b) and the opportunity costs that they can often impose by restricting resource use. These benefits can be in the form of financial/material contributions to community development, employment or income for local producers and service providers. Before Botswana's ban on trophy hunting, 75% of the gross income generated by hunting tourism remained in the country, and of this 49% remained at the district level. This equated to approximately US$5 head^{-1} when translated to an income per capita at the national level but when attributed to the main hunting districts, the per capita income was US$48.5 head^{-1}. In Tanzania, 3.1% of estimated gross expenditure by hunting companies is spent on community development and fees paid to the community and 11.9% on wages and welfare (Booth 2010). In Namibia, agreements between conservancies and operators specify the portion of income the conservancy receives, typically 8–12% of total lodge revenue and 30–75% of trophy price (Naidoo et al. 2016a). Humavindu and Barnes (2003) found that in Namibia, 24% of the income accrues to poor segments of society in the form of wages and rentals/royalties, while Samuelsson and Stage (2007) estimated that 40% went to local communities and low income wage earners.

If trophy hunting became unviable, thousands of Zimbabwean households that benefit from the CAMPFIRE programme would lose a combined US$1.7 million per annum, and the programme's revenue has already been significantly reduced following the US ban on elephant trophy imports from Zimbabwe (C. Jonga, quoted in IUCN 2016)[28]. However, despite some successes and good examples of benefit-sharing, local communities rarely benefit from trophy hunting activities (Lindsey et al. 2006) and trophy hunting frequently occurs without meaningful community involvement or consultation, which in many countries is further complicated by corruption, lack of transparency and weak rule of law (IUCN 2009).

[28] http://www.newzimbabwe.com/news-21699-US+embargo+hits+Campfire+revenues/news.aspx

Case study: Botswana after the hunting ban in 2014

Since trophy hunting was banned in Botswana in 2014, there has been minimal uptake of hunting blocks for photographic tourism (Winterbach pers. comm.). Winterbach et al. (2015) conclude that only 22% (17,142 km^2) of the Northern Conservation Zone has intermediate to high potential for phototourism, while 78% has low phototourism potential (61,769 km^2). Ten concessions (out of 32) in the Northern Conservation Zone did not include high potential phototourism areas and only one of those ten was conducting photographic safaris (although the economic viability of this concession was reliant on access to the nearby Moremi Game Reserve). Although these ten concessions have been offered to public tender four times since the hunting ban in 2014, as of June 2016 still only one was operating phototourism, the other nine being without concessionaires or not operational. In terms of habitat connectivity between protected areas, those ten concessions are critical for ecosystem health and form a vital link between Moremi Game Reserve, Nxai/Makgadigadi Pans National Park, Chobe National Park in Botswana and Hwange National Park in Zimbabwe and surrounding concessions. While hosting what is possibly the geographically largest intact lion population in Africa, this is also a key wet season range for buffalo and elephant and hosts two long-range migration routes of zebra. Some blocks that are part of the Western corridor in southern Botswana have already been changed to agricultural use (livestock farming), disrupting the link between the Central Kalahari Game Reserve and the Kgalagadi Transfrontier Park and probably fragmenting the lion population of the Southern Conservation Zone. Although the Government of Botswana has a good conservation track record and there is no immediate threat to these areas, pressure from Botswana's livestock industry for access to areas with limited tourism potential is only likely to increase (Winterbach et al. 2015). Initial reports from some communities in Botswana suggest significantly reduced conservation incentives (including meat, jobs and pensions) and hardening negative attitudes toward wildlife since the ban was implemented (Naidoo et al. 2016b).

Furthermore, lions generate only part of the total trophy hunting revenue considered in the above figures. However, if there was no income generated by lions, communities could potentially wish to eradicate them from trophy hunting areas because they pose a threat to livestock in surrounding areas, and private land-owners might want to remove lions from their trophy hunting concessions because they predate other valuable trophy species (Funston et al. 2013).

2.3 Summary of the impacts associated with trophy hunting

Trophy hunting can have marked negative impacts on the ecology of lions at a population scale, and can also have negative impacts on other species when an area is managed primarily for lions. However, these impacts are generally small in comparison to other threats at a national and regional scale, and perhaps counter-intuitively, trophy hunting could in some areas be reducing some of the primary threats to lions, namely habitat loss and loss of prey. For example, across Africa, approximately ∼1.4 million km^2 has been estimated to be conserved for trophy hunting purposes. It is likely that without trophy hunting, parts of this vast area of land would become economically unviable if maintained as ecologically intact wildlife areas, and could well be converted to agricultural use with strong negative impacts on lions and other wildlife. Governments require incentives to justify the maintenance of wildlife habitat, local communities and private landowners require incentives to maintain wildlife habitat instead of converting the land to other uses, such as agriculture, and to tolerate the presence of lions, which can pose a threat to livestock and human life. Some revenue from trophy hunting accrues to governments and to local communities, but information is lacking for most areas and in many places benefit-sharing with communities is inadequate. Furthermore, only a small portion of total trophy hunting income is attributable to lions. However, without the income from lion hunting, trophy hunting is estimated to become unviable across 59,538 km^2 in five sub-Saharan countries alone, and a transition to alternative land-uses is likely. Photographic tourism is an alternative land-use that would allow lion populations to remain, but is likely only to be viable in a subset of current trophy hunting areas. The likely outcome for many areas would be conversion to agriculture or livestock grazing, which would seriously threaten the survival of the lion populations in those areas.

3. Current and recommended lion trophy hunting practices

Many of the detrimental effects on lion conservation associated with trophy hunting are to do with failure to establish and enforce regulatory systems based on now well-established scientific principles, and within those regulatory systems, failure to follow a good code of conduct. The UK can only affect a few of these issues directly, for example potentially through specific import regulations, but it would be good to put pressure on the hunting industry to ensure that best practices are met, with strict regulations both imposed and effectively implemented.

3.1 Lease length, allocation and fixed quotas

Short leases on hunting concessions are not conducive to conservation goals (Damm 2005). The argument is that when short leases are issued with no guarantee of a long-term stake, then there is no incentive to invest in conservation, and the maximum quota is always taken so as to maximise return on the cost of lease, even if this means that wildlife are over-exploited as a result. With greater security in the future of a concession comes greater incentive to invest in the resource, and thus conservation goals are more likely to be achieved.

As an illustration, multiple use concessions in Botswana were awarded on 15-year leases. Evaluation of tender documents included a Technical Management Plan, financial plan and financial bid, which all contributed to a total point score, which determine the winner of the tender. This provided the opportunity to have wildlife monitoring, corporate social responsibility, environmentally responsible camp management etc., and the management plan became part of the lease agreement. Biannual site visits by Department of Tourism, Department of Environmental Affairs and Department of Wildlife and National Parks were conducted to ensure compliance, and operational licences could be revoked if people were not adhering to the lease agreement. This carefully regulated system contrasts with the shortcomings of patronage, and associated over-harvesting, documented by (Packer 2015) as a major impediment to hunting delivering conservation benefits to lions.

Hunting blocks should also be allocated according to an open auction system (Dickson et al. 2009) that recognizes

the extent of past investments in each block while encouraging access by well-capitalized businesses or individuals and allows options for long-term leases in the case of well-managed tenure. In some countries (e.g. Tanzania), the outfitter has to pay a mandatory fee for the lions they are allocated to hunt, even if they are not shot. Packer et al. (2006) noted that that 'fixed' quotas do not provide any incentive for hunting operators to reject lions that are too young, leading to reduced trophy quality and unsustainable harvesting. In 2013, Lindsey et al. reported that Mozambique, Benin, Burkina Faso and Cameroon had no fixed quotas, with hunters only paying for the animals they shot, but other countries did have some mandatory fees regardless of the actual offtake (Lindsey et al. 2013). This fee (regardless of actual offtake) was apparently set at 30% of the quota in Zimbabwe, 40% in Tanzania, 50% in the Central African Republic, 60% in Zambia and 100% in Namibia, where concession rights are based on the sale of the quota rather than lease of the land (Lindsey et al. 2013). Best practice would be to have no fixed quotas, with hunters only paying trophy fees for the animals that are actually shot.

3.2 Restrictions on lions able to be hunted

The negative consequences of removing females from a population have been detailed above (see Section 2.1.1.1), so best practice would be to import only male lions.

To ensure that the benefit to lion conservation from trophy hunting (through habitat protection) outweighs the costs that may be imposed, it is important to estimate how many lions can be hunted from a particular management unit without imperilling the population, and in order to import any lions, national regulators should have some confidence that the country concerned is making their calculations based on good science. Calculations of 'safe' harvests would be difficult for most species because of the practical challenges of counting animal numbers and working out their population dynamics, but in the case of lions it is made much more difficult because their social system is such that the death of a pride male can trigger a perturbation effect with cascading consequences reducing recruitment (Loveridge et al. 2007a). To avoid the hazard of overharvest, two broad approaches have been proposed by experts on lion populations, one area-based and the other age-based. Both these approaches involve hunting only adult males and there is now an emerging case for, in some circumstances, combining them (Creel et al. 2016).

The area-based approach recommends capping the number of hunted male lions at a sufficiently low number that there is minimal risk that this offtake causes a decline in the population. In most populations, the offtake has been recommended as no more than 0.5 lions 1,000 km^{-2} (Packer et al. 2011), although there might be local variation – high-density populations such as the Selous could probably sustain an offtake of 1 lion 1,000 km^{-2} (Packer et al. 2011), as could well-managed and increasing populations such as those in Bubye Valley Conservancy (ZPWMA 2015), while in particularly low-density populations, the cap may have to be adjusted downwards. Lindsey et al. (2012b) present data showing that the introduction of a recommended quota of lion offtakes of 0.5 lions 1,000 km^{-2} would allow lion hunting to be sustainable, while retaining conservation incentives from trophy hunting. They conclude such a policy would result in only 7,005 km^2 of existing hunting estate potentially become financially unviable (representing ∼1% of the 516,738 km^2 where lions are currently hunted in the main lion hunting countries), and argue sustainability would be enhanced further if age-based regulations were also implemented.

The age-based approach recommends harvesting only older males that have had the opportunity to reproduce successfully and whose deaths will therefore have fewer repercussions for recruitment of cubs into the population. The assumption behind this approach is that the harvest of those males can be sustainable irrespective of population size or numbers taken, and has no deleterious effect on population genetic diversity (Whitman et al. 2007).

However, these general rules involve complications. The original computer models by Whitman et al. (2004 & 2007) indicated that so long as only males older than ⩾5 years were hunted, the numbers taken had little impact on the viability of the remaining lion population. However, as Whitman et al. (2004) cautioned, this model was based on data from a well-protected and growing lion population with an increasing prey base: conditions that may not apply to the majority of lion populations in hunting areas. Furthermore, a practical difficulty is aging the candidate trophy lions accurately under challenging field conditions, although new guidelines (and an associated training website) published by Miller et al. (2016) help with this, as well as the field guide produced by Whitman and Packer (2007). Revisiting Whitman et al.'s (2007) pioneering work, Creel et al. (2016) offer more precautionary guidelines to minimise the risk of a hunted population being extirpated, and advocated the hunting of only males aged 7 years or more (along with other measures such as recovery periods from hunting and area-based quotas). Indeed, these recent models conclude that even this strengthened age-based criterion does not necessarily en-

sure that the hunted population will not decline if other threats such as bushmeat poaching are present. However, the models show that the contribution of trophy hunting to population decline, within the suite of all the threats facing lions, will be minimised if only males of 7 years or older are removed. This is at least partly because setting the age limit higher reduces the impact of misjudging age in the field by a year or so (Creel et al. 2016). Individual lion age characteristics may vary regionally (Kays and Patterson 2002; West and Packer 2002; Patterson 2007; West and Packer 2013), and lion aging techniques differ pre- and post-mortem, with pre-mortem aging being less accurate and precise (Miller et al. 2016), and thus enforcing minimum age requirements in the field is often difficult. However, Miller et al. (2016) have shown that a suite of lion age traits, in combination with training workshops, may be used to improve significantly field assessment of lion age, and could thus be used to improve sustainability of harvest by reducing levels of underage offtake. Post mortem monitoring of age is possible (Winterbach et al. in review) but not without problems (White et al. 2016).

Therefore, and as a failsafe regulation under conditions (which often prevail) where threats such as human encroachment, poaching and prey depletion are present (but not increasing) Creel et al. (2016) suggested that a combined age- and area-based method be used. They determined that an age limit of $\geqslant$7 years AND a maximum offtake of $\sim$0.5 lion 1,000 km^{-2} AND interspersing fallow periods of recovery, in combination reduced the risk of population extirpation within 25 years to less than 10% (Creel et al. 2016). Although some people may view any risk of population extirpation as unacceptable, this level of risk is low compared to the risk implied by recent declines in lion populations (43% decline in 21 years), and should be weighed against the benefit of protecting lion habitat, the degradation of which has been a primary cause of rapid lion decline at a continental scale (Bauer et al. 2016). However, Creel et al. (2016) recognise that for some responsible operators this stringency could reduce current offtakes tenfold; they suggest a compensatory rise in trophy fees to maintain the same levels of economic return from the land (Creel et al. 2016), which would only be feasible in certain areas or markets. How the demand for lion trophies would be affected by the price is a significant gap in current knowledge.

We suggest that in order to be eligible to export trophies, countries should be able to demonstrate that they are effectively implementing a quota system based on this best available science, with hunting restricted to older males, possibly with an additional area-based component. More information on how this might feed into conditions for any imports is provided in Section 4.3.2.

4. Options to improve the conservation impact of trophy hunting

Regarding the importation of lions into the UK, an option for the UK Government is to maintain the status quo, which is conditional import, with those from some countries banned and others subject to assessment against strict criteria. Options are thus to make the judgment that trophy hunting has no part in conservation, which might lead to a ban on all imports, or whether to enhance existing criteria to give greater confidence of conservation benefit (and by working with other countries have a greater impact). When considering the impacts of banning trophy imports, we acknowledge that if the decisions made by the UK Government are only adopted by them, then the impacts will be negligible, but we are assuming that the approach decided on by the UK Government could influence the development of policies more widely.

4.1 Possible impacts of maintaining the status quo

Maintaining the status quo would probably anger elements of the UK public, who have been vociferous in their demand for the Government to take action to restrict the importation of trophies from lions (as well as from other species[29]), and would put the UK at odds with the US and two EU countries, Netherlands and France (as well as Australia and Costa Rica) with regard to their positions on trophy hunting. It would also miss the opportunity to incentivise for the trophy hunting industry to improve its performance, as is clearly needed, in delivering benefits to conservation and reducing its negative impacts on threatened lion populations. This is therefore probably the least desirable option for the UK Government.

4.2 Possible impacts of a total import ban

Another option would be for the UK to impose a total ban on all lion trophy imports, and this would please a vocal section of the British public. If such a ban was done in partnership with other countries then it would reduce the eco-

[29] http://www.express.co.uk/news/nature/600874/CECIL-S-LAW-Brian-May-demands-law-to-stop-hunters-importing-trophies-back-to-UK

nomic viability of trophy hunting, which might encourage land-owners to switch to non-consumptive forms of wildlife use. This would be more ethically acceptable to large numbers of people, although the degree to which this would or could happen is uncertain. The degree to which trophy hunting can be substituted by photographic tourism is debatable (see Section 2.2.2.2), and in many areas such a substitution seems unlikely, particularly in countries that are less appealing to photographic tourists such as Cameroon and the Central African Republic, and even large sections of well-visited countries such as Tanzania or Botswana.

The major risk of a total import ban would be the removal of economic incentives to maintain the land in lion hunting areas under a wildlife-based land use, and this could have significant detrimental impacts on lions. In 2012, Lindsey et al. judged that in Mozambique, Namibia, Tanzania, Zambia and Zimbabwe, trophy hunting was not dependent on lions for viability, with other species being financially more important. They also judged that trophy hunting could nonetheless become unviable across at least 59,538 km^2 in these 5 countries, representing 11.5% of the 516,738 km^2 where lions are currently hunted in these countries. Even where a safari area remained viable despite the loss of lion hunting this could affect the overall profitability of trophy hunting and thus reduce its competitiveness relative to alternative land uses that diminished the lion estate.

To predict the impact of a ban on the import of lion trophies it is also necessary to consider what further policies it is likely to give rise to. It is possible that a ban on lion hunting will precipitate pressure for restrictions on leopard hunting as well, and other charismatic threatened species, such as the elephant. There are already calls for such bans[30], and as these species are some of the most sought-after for hunters, their collective removal would certainly reduce the economic viability of trophy hunting areas quite significantly. This is particularly true regarding potential restrictions on leopard and elephant hunting; the leopard appeared as one of the top three most-hunted species in Tanzania, Botswana, Namibia, Zambia and Zimbabwe, while the elephant was amongst the top three in Tanzania, Botswana, Mozambique and Zimbabwe (Di Minin et al. 2016). Unless an alternative wildlife-based land use was implemented at the same time as hunting was stopped, or the land was managed under conservation philanthropy, there is a significant risk that a considerable area of current hunting land could be converted to non-wildlife based land uses, with the con-

[30] https://www.theguardian.com/environment/2016/jul/25/leopards-animal-welfare-groups-endangered-us

comitant increases in lion habitat loss associated with that.

Popular disdain for lion trophy hunting appears widespread in North America and Europe, but this mood is not universal. If adopted more widely, one speculation is that a ban on imports to North America and Europe could increase uptake of trophies by hunters from other countries instead, for example the Middle East and Asia, with possible unintended consequences for conservation and animal welfare. Similar shifts in the market have been seen with other import bans, such as with Asian giant tortoises (*Manouria emys*), where an import ban was well implemented by the EU and was associated with a two-year decrease in global imports before new markets were found – however, four years after the import ban, global imports approached twice the volume of the year of ban (Hann 2015). There is also a risk that if countries feel that external views are being continually imposed on them (for example through trade restrictions) then they may decide to opt out of agreements such as CITES, which would be extremely damaging for the future validity and operation of such international agreements. There were some calls in the African media for African nations to withdraw from CITES in the run-up to CoP 17 and "*reject the power of rich elites in Europe or America to dictate how they manage their affairs*"[31], although no countries actually did so.

4.3 Possible impacts of stricter controls on the import of lion trophies to the UK

4.3.1 Reasons for considering stricter controls

It is clear that poorly managed trophy hunting of lions can have serious negative impacts at a population scale (see Section 2.1.1), and potentially some impacts at a national or regional scale (IUCN 2006b). Where they occur, allowing these negative consequences to continue is unacceptable from the viewpoint of lion conservation, particularly considering the species' deteriorating status (Bauer et al. 2016). However, it is also clear that trophy hunting is currently the reason for a large percentage of the lion estate being maintained as land for wildlife – it has been estimated that four times as much of that estate is in hunting areas than Parks (Packer 2015). A central dilemma is that imposing total import bans on lion trophies would, in the absence of alternative in-

[31] http://www.dailymaverick.co.za/opinionista/2016-08-23-african-nations-should-withdraw-from-cites/

centives to conserve lions, risk perverse consequences that may worsen the conservation of lions (as well as everything covered under their conservation umbrella). Principally, this might occur by reducing the economic incentives for wildlife-based land uses, which increases the likelihood of land conversion out of the lion estate and exacerbates the main threats to lions (namely the degradation of habitat, poaching of prey and conflict with people; IUCN 2006a, b).

With the intention of creating the strongest possible incentive for the trophy hunting industry to take responsibility for improving its practices and regulations in ways that maximise the benefits to lion conservation, one solution to this dilemma would be to impose stricter conditions linked to conservation gain for the issuance of any lion trophy import permits to the UK. There are, of course, already strict conditions in CITES as implemented by the EU CITES Scientific Authorities through the Scientific Review Group (SRG). CITES conditions require that the trophy lion had been hunted according to regulations that avoided a significant detrimental impact on the lion population from which it came, so evidence of this, and encouragement to enhance conservation, could be strengthened. These dual goals, recommended to the UK government, align with those of the US Fish and Wildlife Service, which deem that, amongst other conditions, the import of any lion trophy to the USA should be contingent upon the management of lions benefiting the species in the wild (US Fish and Wildlife Service 2015). Under this scenario, the UK acts directly by permitting the importation of lion trophies only if stringent conditions that benefit lion conservation are met, and acts indirectly by convincing other nations to adopt those same conditions.

The main positive conservation enhancement associated with trophy hunting is securing habitat for both lions and other wildlife; that benefit is likely to be significant to lion conservation only in larger areas. Therefore, this report recommends setting a minimum size for areas from which trophy imports can even be considered; as a practical threshold, we suggest 500 km^2 to ensure that it is delivering conservation enhancements[32].

4.3.2 Possible options for stricter conditions

Current CITES requirements are that trophies can be approved for import where, at a minimum, it is demonstrated that hunting has no detrimental impact on the sustainability of the lion popula-

[32] *500 km^2 is not a firm cut-off for all scenarios, but is a necessarily somewhat arbitrary judgment on the smallest area usually likely to enable lions to be self-sustaining and ecologically functional, and deliver meaningful conservation benefits for lions (and other wildlife) at the landscape scale.*

tion; however, insofar as trophy hunting has been associated with over-harvesting, and declines in lion numbers, it is clear either that these requirements are not always properly applied, or the evidence to meet them has been inadequate. A second requirement could be added, namely that trophy hunting delivers conservation enhancement. A fundamental element of that enhancement is the maintenance of ecologically functional areas of lion habitat.

Although not necessarily prerequisites for trophy importation, UK government should also encourage additional benefits to conservation, e.g. anti-poaching patrols and/or wider co-benefits such as contributions to community wellbeing. This responsible custodianship of the wildlife estate might be considered appropriate requirements of any responsible business that relies upon wildlife use, whether that is consumptive (such as trophy hunting) or non-consumptive (such as eco-tourism).

The criteria for whether a lion trophy could be imported into the UK should be that its hunting (a) was unlikely to cause detriment to the lion population from which it was taken and (b) contributes to lion conservation. Although in CITES terms the burden of proof rests with the CITES exporting authority, there is a strong case that the requirement should be made of the industry to prove that lion trophies are from populations where (a) lion offtake is strictly regulated to levels that minimise the risk of extirpation and (b) 500 km ^{2} or more of wildlife habitat is maintained within the hunting zone. These conditions should sit alongside other requirements of a high code of professional practice, ensuring for example that robust animal welfare standards are met.

However, lions are hunted from populations with different conservation status, and under widely different conditions, in countries facing variously punishing poverty and infrastructural challenges, so these general principles need to be tuned accordingly. We propose categorising hunting operations into three categories, with varying import conditions. We propose that the UK takes the lead in an international effort to categorise hunting operations according to the sustainability of their practice as set out below, and applies concomitant import regimes with an effective import ban from the least sustainable operations.

We strongly recommend a best-practice approach based on robust and on-going surveys of lion populations and long-term population trends and threats, to obtain precise data from which a safe offtake can be calculated, and on the consequences of trophy hunting and other threats. However, due to constraints such as funding, there is a need to consider other methods, at least in the short-term, for ensuring that offtake is not detrimental.

It is incumbent upon the hunting area management to demonstrate that its lion hunting operations are sustainably managed. We would recommend accepting these methods of demonstrating appropriate levels of sustainability:

- Monitoring data to show that lion populations are sustainably managed (this would be considered best practice)
- Data to show that the population is managed using age-restricted hunting, aiming for an ideal threshold of ⩾7 year old males

4.3.2.1 Best-practice: Lion populations are sustainably managed, as determined by professional-standard science-based monitoring

In order to establish directly that trophy hunting of lions is sustainable, a prerequisite is that reliable, standardised, and independently verifiable surveys are conducted in the hunting area. Possible methods could include spoor counts (Funston et al. 2010), camera-trapping (Cusack et al. 2015) or by individual lion recognition depending on local circumstances. Once the lion population has been surveyed the information can be fed into a harvest rate model, such as that proposed by Caro et al. (2009), to calculate an appropriate, scientifically-based quota. Assuming the population is well managed and no external factors are jeopardising it, the harvest model should ensure that the hunted population increases or remains stable.

Within an appropriate monitoring system, successive surveys will reveal trends in the lion population, and should demonstrate sustainability. If it is increasing or stable within the hunting area (without causing negative impacts on any adjacent area), then there should be no grounds for significant concern that hunting is detrimental. Hunting areas that have achieved these 'ideal' conditions of an independently stable or increasing lion population would be eligible for best-practice hunting status, and could be advertised as such to responsible hunters.

4.3.2.2 Age-based harvesting

Two methods have been proposed for implementing age-based lion trophy hunting. One model would be to limit hunting to Creel et al.'s (2016) conservative prescription (i.e. only harvesting ⩾7 year old males at a level not exceeding 0.5 males per 1,000 km^2 – unless there is clear scientific evidence that the population can sustain a higher offtake without supplementation – with resting periods. As described above, this should carry a low risk of population extirpation and

still keep land in the lion estate[33]).

Alternatively, an option would be the implementation and enforcement of an adaptive age-based quota system. Such systems have been trialled in Mozambique's Niassa National Reserve and adopted in Zimbabwe, with apparent benefits to lion conservation. Each hunted lion results in points being awarded to (or taken away from) the outfitter based on the age of the lion, with the aim of rewarding hunters for hunting older males (ideally of ⩾7 years) and penalising them for hunting younger males.

An example of a possible points-based system (which may have to be adapted depending on the lion population) is shown in Appendix D.

4.3.2.3 Interim scenario

If a hunting block failed to qualify under the suggested criteria above, then the area would not be considered suitable for importing trophies into the UK until it qualified for one of them. Mindful of the risk of such land being lost from the lion estate, this disqualification might, at the discretion of the UK importing authorities, be postponed for a grace period of up to 3 years under very strict criteria and annual review by the national committee. For continuation of the grace period within those 3 years, the managers should demonstrate at each annual review that significant progress has been made towards implementing the necessary criteria. While it takes time for changes to take full effect, Zimbabwe has seen marked improvements with benefits for lion conservation within three years so that should be a sufficient period for change. During any grace period, lion trophy hunting should be limited to a minimum area and age-based quota, such as a maximum of 0.5 lions 1,000 km^{-2} aged ⩾7 years, or similar precautionary figure calculated to be locally appropriate. Failure to meet the required conditions after the grace period would result in a moratorium on UK imports from the area until they are in place. In these circumstances, every effort should be made to ensure that the land was not lost from the lion estate. This scenario is intended to ensure minimal detrimental impact on the lion population during the grace period, while incentivising improved management that will benefit lion conservation.

[33] *When considering a precautionary off-take that will be sustainable we have followed Creel et al.'s (2016) simulation as a safe starting point. However, the number of male lions that can be hunted sustainably will obviously vary with their population density and this will certainly vary between populations and may vary in any one population at different times.*

4.3.2.4 Dealing with areas which do not meet the desired conditions

Trophy hunting areas whose management does not meet the conditions set out in the three systems described above would not usually be able to import their trophies into the UK. In the highly undesirable event that a hunted lion population is declining unsustainably, under any of these systems, and thus that hunting further lions would risk additive mortality and worsening the conservation of lions, then no import permit would normally be issued. Indeed, under circumstances where a hunted population is declining unsustainably best hunting practice would normally not countenance further hunting until the population was stable, and the strongest pressure should be applied to the operator to remedy the situation. However, we are mindful of a scenario that, although perhaps uncommon, could perversely damage lion conservation. That is, if the cessation of lion hunting caused the financial viability of the hunting operation to collapse and thereby the land to be converted to agriculture and lost, effectively irretrievably, from the wildlife estate. Where the risk of this outcome was imminent, the local auditing committee should look assiduously, on a case-by-case basis, for any interim steps to forestall the loss of land from the wildlife estate – this being the ultimate disbenefit to conservation. A judgement would have to be made, with lion conservation as the criterion, on whether a short, interim period of grace, perhaps involving a very low quota, was justifiable on the grounds of providing sufficient respite to enable the situation to be remedied and the lion population returned to a sustainable state and the area retained for wildlife.

4.3.3 Notes on scale and conditions of import

4.3.3.1 Recommended scale at which criteria are applied

The foregoing criteria should ideally be applied at ***the scale of the hunting area and not the national level***. This is because, while exports and imports are legally conducted at a national scale, allowing imports only from a country where all operators have implemented best-practice hunting would disincentivise good operators within a poorly-regulated country and would therefore risk damage to lion conservation. There is already precedent for this scale of operation – for example, the EU approved trophy imports from Niassa due its good management rather than the whole of Mozambique (Sigsworth, pers. comm.). The exporting country should, via an independent panel

of stakeholders, transparently assess its hunting areas and report (with requisite proof) which ones fulfil the criteria above, and the UK Government could determine the scale of imports depending on the extent of compliance.

4.3.3.2 Verification of hunting practices

Each lion-hunting country should have an independent, competent and inclusive committee that is tasked with regulating and enforcing hunting practices. Ideally committees of this sort would be overseen by an independent international organization such as International Organisation for Standardisation (ISO). Their remit should involve the following components, some of which have also been recommended by Di Minin et al. (2016):

i. Auditing to ensure that lion monitoring practices (where they are in place; e.g. for the gold standard scenario) meet the required standards

ii. Setting quotas where necessary, i.e. based on the results of the population monitoring (for the gold-standard blocks) or based on the adaptive points system

iii. Ensuring that minimal quotas (e.g. of 0.5 lions 1,000 km^{-2} or less for low-density areas) are adhered to, unless there is clear scientific evidence that the population can sustain a higher level

iv. Encouraging certification of hunting-block operators modelled after a well-defined system such as FSC, etc., and which should ideally require considerable investments by the operator in anti-poaching, community benefit programmes etc.

v. Facilitating training of Professional Hunters regarding field assessment of lion age (e.g. Miller et al. 2016) and helping set formal appropriate standards for lion hunts, particularly with regard to welfare concerns (e.g. demonstrating adequate evidence of competence in shooting and other necessary skills, rapid dispatch of wounded animals, using large-bore rifles, no night-hunting, etc.)

vi. Ensuring transparency of the process: there should be full disclosure to the public of results and reasons for block allocations (which should be allocated in order to maximise the funds available for conservation), results of lion surveys, results of trophy age verification trophy inspection, offtake levels and other relevant information, and all records (e.g. of samples for lion ageing) must be kept for any later inspection

vii. Ensuring compliance, so that the same criteria are imposed on all block holders, enabling independent observers to be placed without advance warning on

trophy hunts, and ensuring that trophies and permits are confiscated if illegal practices are discovered, and that operators who break the laws are barred from future hunting

viii. Verifying the age of trophy hunted animals before export. This should be based on the following information:

- *Hunt report forms confirming information such as the date and location of the hunt.* These forms are also required to be completed for blocks even if no successful lion hunt is completed in that area that year in order to encourage complete information and discourage underreporting.
- *Photos of the lion immediately postmortem*, to allow inspection of a range of indicators of age, e.g. mane development, facial markings and scars, nose and teeth colour. The photos must be stamped with the date and time or they would be considered ineligible.
- *X-rays of the upper premolar PM2 and examination the degree of pulp closure in that tooth*, as this has been shown to be a very accurate measure of lion age (White et al. 2016). Both the upper premolars should be presented to the inspection team to reduce the chance of fraud. Presentation of the skull will also allow wear on the premolars and canines to be easily judged – this could be an alternative method of age estimation if an X-ray is not possible, but all efforts should be made to obtain the X-rays. It would also be desirable to take and bank DNA from all hunted lions.

5. An overview: Framing trophy hunting in the context of wider lion conservation

Although many of the topics covered in this report are hotly debated – such as the amount of revenue generated by trophy hunting, or its replaceability with photo-tourism – some points are beyond debate. Key amongst those is that the lion – one of the world's most iconic species – has undergone severe declines in numbers and range over the past few decades. Lions now remain in only 8% of their historic range, with fewer wild lions now thought to exist in Africa than rhinos (Bauer et al. 2016). Nobody knows how many lions there were in Africa a century ago, but the widely quoted speculation that there were about 200,000 is a tenfold contrast with current estimates closer to 20,000 (Bauer et al. 2016).

African lion populations are likely to be to be declining everywhere, except in four southern countries (Botswana, Namibia, South Africa, and Zimbabwe; Bauer et al. 2015). The contrast between countries in southern Africa and the rest of the continent is related to their lower human population densities, better management budgets and the less damaging impacts on prey abundance and lion by-catch of unsustainable and increasingly commercialized bushmeat trade. Furthermore, Packer et al. (2013b) showed that presence of wildlife-proof fencing, which is more common in southern Africa, was an important determinant of short-term population trends. Awkwardly, the populations that seem to be declining fastest are also those that are least well-monitored (and probably have the least conservation effort), so inadequate data may be shrouding an even worse situation. However, Bauer et al.'s (2015) population models suggest that the chance of populations declining by half over the next two decades is 67% in West and Central Africa and 37% in East Africa. So it is indisputable that effective, range-wide lion conservation strategies are urgently needed to halt this precipitous decline.

The overarching priority is to secure and better manage existing populations of lions – although there is a pressing need for more surveys of lion populations to assess numbers and trends. Dickman et al. (in prep.) used the latest available data and concluded that there are only six remaining populations (Selous-Niassa, Serengeti-Mara, Kavango-Zambezi, Greater Limpopo, Katavi-Ruaha and Kgalagadi) with more than 1,000 lions. These 6 are amongst 60 priority areas where lions are far from secure, over half of them with fewer than 100 lions left. An apt conservation slogan, and call to arms, would therefore

be: *secure the six, and save the sixty.*

Rising to this challenge will require us to secure and better manage existing protected areas (which form the core of lion populations), establish and monitor lion presence and population trends across lion range, improve the economic security of local people to reduce the intensity of bushmeat poaching, and ensure that people have some power over wildlife on their land and receive sufficient economic benefits from their presence to outweigh any costs and incentivise their protection.

These steps cannot be taken by conservationists alone – they will require effective collaboration across a huge diversity of stakeholders, including protected area managers, development experts, economists, national and local governments, and those people who live with lions on their land every day. Most importantly, enacting real change at a range-wide scale will require a level of funding that is orders of magnitude higher than that allocated to wildlife conservation today. For example, Panthera et al. (2016) estimate that just effectively managing all protected areas within current lion range would require an annual budget of at least US$1.25 billion – and many lions live outside those protected areas, very many of them on trophy hunting concessions.

Especially because constellations of threats may interact, and because the impacts of each threat may often be difficult to measure, it is hard to be precise when ranking them, and the ranking anyway varies from place to place. Nonetheless, overall the major threats to lions are the loss and degradation of habitat, the loss of prey, and conflict with people over livestock, and those pressures are exacerbated when the lion populations being affected are small, isolated and poorly managed, as is often the case (IUCN 2006a, b; Henschel et al. 2014). Experts agree that – certainly at a national and regional scale – trophy hunting ranks low amongst the threats to lion populations (IUCN 2006a, b), and that it can, perhaps counter-intuitively, have positive impacts through habitat protection and funding national wildlife agencies (Di Minin et al. 2016; IUCN 2016). The fact that trophy hunting occurs in an area does not necessarily make it a threat to the lion population there, although it can be.

So, trophy hunting can be a locally important threat to lion conservation, and should be fiercely regulated to avoid this. A broader perspective, however, ranks trophy hunting generally not in the first division of threats to lion conservation. Scanning the horizon, the greatest threats over the next few decades are likely to descend from the increasing footprint of a human population set to double, or more, by 2050. With this perspective, the real challenge for the UK Government, and the community of those concerned for this iconic species

(and all the species for which it is an ambassador), is to develop holistic conservation strategies likely to require long-term partnerships with stakeholders across the world, chiefly the Governments and local people in countries that still manage lions.

5.1 Summary of lion trophy hunting in the context of conservation

So, finally to take stock, why is trophy hunting of lions a topic of concern to conservation? Because lions are charismatic top predators, already classified as threatened or endangered (depending on the area) by the IUCN and demonstrably declining fast in parts of their range, and trophy hunting is an obvious concern because it involves killing them. There are two categories of reasons why this may attract the attention of conservationists and wider society. First, the killing of individuals of a threatened species for sport may be ethically unacceptable to some people and for those that hold this as a moral absolute, trophy hunting of wild lions (and, obviously, farmed lions) will be ruled out. Second, for those who could countenance sport hunting of a threatened species, perhaps on utilitarian grounds of securing a greater good to conservation such as habitat protection (Macdonald et al. 2016b), the killing of lions nonetheless raises two obvious fears of over-harvest and thus unsustainability. First, lions are difficult to count and therefore harvests may be miscalculated and, anyway, there is an incentive to over-harvest for short-term profit, and documented evidence shows that this happens (sometimes with dire consequences that have drawn a comparison with strip-mining; Packer 2015). Trophy hunting is most straightforwardly[34] acceptable to conservation if it is demonstrably sustainable (it should also adhere to high standards of animal welfare), and demonstrating

[34] *The adverb 'straightforwardly' acceptable is not a descent into weasel words, but a caveat necessary to take account of argument in extremis with respect to the priority of retaining land in the lion estate and under wildlife use. The straightforward case is that trophy hunting is demonstrably sustainable, and that demonstration necessitates monitoring data, and therefore for trophy hunting to be acceptable there must be monitoring data and they must demonstrate sustainability. This should be the driving logic behind the regulation of trophy hunting as a potential contributor to lion conservation. However, and without relenting on the drive to demand high standards of trophy hunting, or other uses of wildlife, the logical possibility of an extreme possibility requires mention: even undesirably unsustainable trophy hunting may, in the short term, 'buy time' in keeping land in the lion estate and, irreversibly, out of agriculture, and this situation, while infuriating and lamentable, may be more tolerable than losing the land to wildlife.*

its sustainability requires adequate data on lion numbers and their ages, ergo trophy hunting is straightforwardly acceptable only where lion numbers are monitored – and there are direct and indirect methods of doing this.

The most strongly evidenced benefit of trophy hunting to lion conservation is that it gives lions monetary value, which can provide a marginal economic advantage to keeping some land under wildlife use that would otherwise more profitably be converted to other uses and thereby lost from the lion estate (at a time when this is already shrinking perilously). All else being equal, there might be no difference in the conservation outcome if lions are given the necessary monetary value by trophy hunting or by some other means (for example, some form of international payment to encourage coexistence; Dickman et al. 2011). However, all else is often not equal; killing animals that are members of complex societies where they will be survived by sentient companions capable of behavioural and psychological perturbation, may contribute to a mood in at least some sections of society that, even if sustainable and a benefit to conservation, hunting lions for sport is a recreation that is not compatible with 21st-century civilization. A plausible speculation is that this opinion will soon prevail (notwithstanding clear cultural differences between East and West, North and South). Insofar as this creates pressure for a ban on trophy hunting it also risks unintended consequences for lion conservation if it causes the marginal value of land previously retained under wildlife use for hunting to fall below that for non-wildlife uses (such as farming), and thus the lion estate to be diminished. Anticipating that possibility, there is an urgent imperative to find alternative means of giving those threatened parts of the lion estate sufficient monetary value to prevent their degradation. Indeed, the report strongly re-emphasises Bauer et al.'s (2015) conclusion that unless political and funding commitments are scaled up to address mounting levels of threat, lions may disappear from most of Africa.

It seems that public opinion, in many places, is strongly against trophy hunting, particularly of threatened species (Macdonald et al. 2016a). This creates pressure for a ban on trophy hunting, but also risks unintended consequences for lion conservation. This report acknowledges that where there is evidence of scientifically-based regulation that is strictly enforced, lion hunting can contribute to lion conservation, and that this constitutes a good reason to tolerate it at least on land that might otherwise be lost to the lion estate. However, societal pressure may stop this recreation; were this to happen before some alternative means of giving lions monetary value were in place (where photo-tourism cannot do so), there are grounds to be fearful of serious detriment to the lions' already deteriorating conservation status. In this regard, Macdonald et al. (2016a)

contrast the consequences of a jump versus a journey: a precipitate jump to ending lion trophy hunting might risk grave unintended consequences for the species' conservation, consequences that could be avoided by a carefully planned journey to that end. An obvious, and perhaps the only plausible, mechanism to achieve this would be some form of international payment to encourage coexistence with lions; to the nearest order of magnitude, and considering only the costs of substituting other land uses for trophy hunting, this could cost as much as the US$1.25 billion estimates by Panthera et al. (2016) adequately to safeguard current protected areas for lions. For perspective, and while mindful that society may face parallel expenses in funding custody of other global commons, the amount needed seems less daunting when we realise that US$12 billion is spent annually in Europe and the US on perfume alone[35]. Until such a mechanism is in place, the risk to lion conservation of a complete ban on trophy hunting is too great to take, but in the meantime the establishment of strictly enforced regulations to ensure that trophy hunting does benefit lion conservation is a priority.

[35] http://www.worldwatch.org/node/764

Barry, Anna <anna_barry@fws.gov>

Fwd: Supplement to info submitted re: applicants Chancellor, Greenawalt, Horrocks (PRT MA86474B), Smithers (PRT MA86472B)

3 messages

Vannorman, Tim <tim_vannorman@fws.gov> Mon, Feb 1, 2016 at 12:58 PM
To: Anna Barry <anna_barry@fws.gov>

Anna,

You are down for doing the leg work for Zimbabwe lions. Are you still good with this or are you swamped with other permitting actions?

Tim

---------- Forwarded message ----------
From: Regina A. Lennox <regina.lennox@conservationforce.org>
Date: Mon, Feb 1, 2016 at 12:44 PM
Subject: Supplement to info submitted re: applicants Chancellor, Greenawalt, Horrocks (PRT MA86474B), Smithers (PRT MA86472B)
To: "Vannorman, Tim" <tim_vannorman@fws.gov>
Cc: bryan_arroyo@fws.gov, dan_ashe@fws.gov, "John J. Jackson, III" <jjw-no2@att.net>

Dear Tim,
Attached please find additional information on lion management in Zimbabwe. This supplements the information already submitted in support of the permit applications for Chancellor, Greenawalt, Horrocks (PRT MA86474B), and Smithers (PRT MA86472B).
The attached report includes an updated wildlife map of Zimbabwe and additional information on Save Valley Conservancy's lion population, Bubye Valley Conservancy's community assistance program, and the financial breakdown of lion hunting and investment in conservation.
Please let us know if you have any questions about this document.
Kind regards,

--
Regina A. Lennox
Conservation Force
3240 S I-10 Service Road W, Suite 200
Metairie, Louisiana 70001 USA
504-837-1233 (office)
919-452-8652 (cell)
regina.lennox@conservationforce.org

--
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

ZIMBABWE LION HUNTING & RESEARCH REPORT USFWS BdP 20160131.pdf
6441K

United States Department of the Interior

FISH AND WILDLIFE SERVICE
International Affairs
5275 Leesburg Pike, MS: IA
Falls Church, VA 22041-3803

Olivia Mufute
Parks and Wildlife Management Authority
P.O. Box CY 140
Harare, Zimbabwe

FEB - 1 2015

Dear Olivia,

As you are aware, The U.S. Fish and Wildlife Service (Service) published a final rule on December 23, 2015, listing the lion under the Endangered Species Act (ESA). After evaluating the available information on lion, the Service determined that *Panthera leo leo*[1], located in India and western and central Africa, should be listed as endangered, and *P. l. melanochaita*[1], located in eastern and southern Africa, should be listed as threatened. I encourage you to visit the Service's web page for more information (www.fws.gov/endangered).

Due to the listing under the ESA, our stricter domestic measure, any imports of a sport-hunted lion trophy into the United States, regardless of the subspecies, would require an import permit. In order to issue a permit, the Service, through its Division of Management Authority, must determine that the import of a sport-hunted lion trophy will enhance the propagation or survival of the species in the wild. This is the same finding that we have to make for the import of sport-hunted elephants, although no permit is required for elephants. The Service will examine the overall conservation and management of the species and whether that management addresses the three main threats that have been identified as to the decline of the species: Habitat loss, loss of prey base, and human-lion conflict. In that review, we will evaluate whether the import contributes to the overall conservation of the species by considering whether the biological, social, and economic aspects of a program from which the specimen was obtained provide a net benefit to the species and its ecosystem, and how U.S. hunters are contributing to this effort.

In evaluating these factors, we have found that the IUCN Species Survival Commission (SSC) Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0 (IUCN SSC 2012), provides useful principles, which, considered in conjunction with our permit issuance criteria, will aid us when making the required enhancement finding for importation of sport-hunted trophies. This document sets out guidance from experts in the field on the use of trophy hunting as a tool for "creating incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources" (IUCN SSC 2012, p. 2)

[1] Based on new taxonomy identified in: Bauer, H., Packer, C., Funston, P.F., Henschel, P., & Nowell, K. (2015). *Panthera leo*. The IUCN Red List of Threatened Species. Version 2015.2. (http://www.iucnredlist.org/details/full/15951/0).

and recognizes that recreational hunting, particularly trophy hunting, can contribute to biodiversity conservation and more specifically, the conservation of the hunted species. The SSC document lays out five guiding: (a) Biological sustainability: The hunting program cannot contribute to the long-term decline of the hunted species; (b) Net Conservation Benefit: The biologically sustainable hunting program should be based on laws, regulations, and scientifically based quotas, established with local input, that are transparent and periodically reviewed; (c) Socio-Economic-Cultural Benefit: A well-managed hunting program can serve as a conservation tool when it respects the local cultural values and practices; (d) Adaptive Management: Planning, Monitoring, and Reporting: Hunting can enhance the species when it is based on appropriate resource assessments and monitoring (e.g., population counts, trend data), upon which specific science-based quotas and hunting programs can be established; and (e) Accountable and Effective Governance: A biologically sustainable trophy-hunting program should be subject to a governance structure that clearly allocates management responsibilities.

As has been stated many times over the last few years, the Service believes that hunting can generate significant economic benefits if properly conducted. To assist us in our evaluation, I have included a list of questions regarding the management and conservation of lions in your country, the population status, your hunting regulations, and hunting program. Given the numerous discussions and exchange of information we have had over the last several years, we have a large amount of information regarding Zimbabwe's overall management process, but very little on lions themselves. If your office has the time and resources, we would greatly appreciate your effort in addressing the attached questions.

We hope that through authorization of import of sport-hunted lion from your country, the United States can assist in the conservation of the lion. While the United States has specific stricter domestic measures that require additional findings beyond those required for the issuance of an export permit by your country, there is every reason to believe that through scientifically based management programs and close monitoring and control of hunting within your country, that U.S. hunters can both enjoy their hunting experiences within your country and provide a significant benefit to African lion conservation within your country. If you have any questions, please feel free to contact me by mail, email, or telephone (Tim_VanNorman@fws.gov; (703) 358-2350).

Sincerely,



Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service

I. Overview

The lion is listed in Appendix II of CITES. As such, the Scientific Authority of the exporting country must make a determination that the export of a sport-hunted trophy will not be detrimental to the survival of the species (Article III, 2(a)). While the finding that the U.S. Fish and Wildlife Service must go beyond the "Non-detriment" standard, it would be very beneficial to our review if you could provide a copy of a recent "Non-detriment" finding made by your Scientific Authority.

II. Management Plan (a comprehensive plan addressing specific management goals or actions)

1. It is our understanding that Zimbabwe has a national management plan for lions. Could you please provide a copy? Are there regional plans as well, and if so, could you please provide copies?

2. Have you developed a mechanism (i.e., adaptive management approach) for implementing the plan(s) and determining its effectiveness? Could you describe how implementation of the plan is progressing and if there are management or logistical problems that still need to be addressed?

3. Are there any other management plans or conservation plans that contribute to or interact with the lion management plan(s) (i.e., regional plans, hunting concession plans)?

II. Population Status

1. What is the status of lion populations within your country (e.g., population numbers; population trends; sex and age class distribution)?

2. Do you have a standardized process to conduct population censuses? If so, how often? What areas are censused? Do they include all hunting areas? What is the censusing methodology?

3. What is the current distribution of lions within your country (i.e., widespread, environmentally confined to specific areas, confined to national or regional protected areas)?

4. Even with protection activities and legal intervention, poaching could still occur. Do you have any estimates on the number of specimens lost to illegal killing annually?

5. What impact are human-lion conflicts having on local or national populations? Is there a standardized national policy to address such conflicts and problem lion control? If so, does this policy include culling of surplus animals and removal of nuisance animals? Is there domestic harvesting of lions for local consumption or use?

III. Conservation and Management

1. Please describe potential threats to the species, such as poaching and human-animal conflicts, and how these threats are being addressed.

2. Is your agency currently conducting any research efforts addressing conservation issues involving lion? What about other agencies or departments within your national or regional governments and what are their roles? Are you aware of any NGO projects currently underway that

involve lion conservation or management? If so, could you describe such projects or provide contact information to the organization carrying out the work?

IV. Hunting Policies/Regulations

1. Is it correct to state that the hunting program for lions functions in the same manner as elephant hunting? Specifically, do you have an established national/regional hunting quota? How is this quota determined? It is our understanding that Zimbabwe has established an age restrictions on harvesting lions and uses this requirement as an incentive/deterrent to professional hunters in future distributions of quotas. Please describe the age restrictions and how quotas are adjusted for professional hunters that abide by it or disregard it?

2 How much do hunting licenses cost foreign hunters? How does your government utilize this revenue? Does a percentage go directly back to lion conservation efforts or into more general wildlife management efforts? If so, what percentage is allocated to each? Is any of this revenue provided to local communities? If so, what percentage?

3. How does the sport-hunting program provide any other tangible benefits, besides revenue, to local communities (i.e., increase employment, jobs in antipoaching units)?

CellPress

[1]Department of Biology, Colorado State University, 1878 Campus Delivery, Fort Collins, CO 80523, USA
[2]Kellogg Biological Station, Michigan State University, Hickory Corners, MI 49060, USA
[3]Graduate Degree Program in Ecology, Colorado State University, Fort Collins, CO 80523, USA

*Correspondence: justin.havird@colostate.edu (J.C. Havird).

http://dx.doi.org/10.1016/j.tree.2015.11.012

References
1. Whiteley, A.R. *et al.* (2015) Genetic rescue to the rescue. *Trends Ecol. Evol.* 30, 42–49
2. Frankham, R. (2015) Genetic rescue of small inbred populations: meta-analysis reveals large and consistent benefits of gene flow. *Mol. Ecol.* 24, 2610–2618
3. Waller, D.M. (2015) Genetic rescue: a safe or risky bet? *Mol. Ecol.* 24, 2595–2597
4. Tallmon, D.A. *et al.* (2004) The alluring simplicity and complex reality of genetic rescue. *Trends Ecol. Evol.* 19, 489–496
5. Frankham, R. *et al.* (2011) Predicting the probability of outbreeding depression. *Conserv. Biol.* 25, 465–475
6. Gemmell, N.J. and Allendorf, F.W. (2001) Mitochondrial mutations may decrease population viability. *Trends Ecol. Evol.* 16, 115–117
7. Gemmell, N.J. *et al.* (2004) Mother's curse: the effect of mtDNA on individual fitness and population viability. *Trends Ecol. Evol.* 19, 238–244
8. Reinhardt, K. *et al.* (2013) Medicine. Mitochondrial replacement, evolution, and the clinic. *Science* 341, 1345–1346
9. Burton, R.S. *et al.* (2013) Cytonuclear genomic interactions and hybrid breakdown. *Annu. Rev. Ecol. Evol. Syst.* 44, 281–302
10. Zajitschek, S.R.K. *et al.* (2009) Demographic costs of inbreeding revealed by sex-specific genetic rescue effects. *BMC Evol. Biol.* 9, 289
11. Hwang, A.S. *et al.* (2012) Long-term experimental hybrid swarms between nearly incompatible *Tigriopus californicus* populations: persistent fitness problems and assimilation by the superior population. *Conserv. Genet.* 13, 567–579
12. Johnson, W.E. *et al.* (2010) Genetic restoration of the Florida panther. *Science* 329, 1641–1645

Science & Society

Banning Trophy Hunting Will Exacerbate Biodiversity Loss

Enrico Di Minin,[1,2,*] Nigel Leader-Williams,[3] and Corey J.A. Bradshaw[4,5]

International pressure to ban trophy hunting is increasing. However, we argue that trophy hunting can be an important conservation tool, provided it can be done in a controlled manner to benefit biodiversity conservation and local people. Where political and governance structures are adequate, trophy hunting can help address the ongoing loss of species.

International Outrage over Trophy Hunting in Africa

An American hunter killed a charismatic male lion (*Panthera leo*) called Cecil in Zimbabwe in July 2015. This sparked international outrage, mainly via a storm of social and other media. Several alleged aspects of the hunt itself, such as baiting close to national park boundaries, were done illegally and apparently against the spirit and ethical norms of well-managed trophy hunts. Online outrage had also been sparked earlier in 2015 by the legal hunt of a Critically Endangered male black rhino (*Diceros bicornis*). This hunt was sanctioned by the Namibian Government via an auctioned permit that cost the hunter US$350 000 for the privilege. This outrage arose even though the male was considered 'surplus' to the national black rhino management plan, and the revenue generated from the hunt was to be reinvested into a conservation trust fund to the wider good of conservation in Namibia. These two high-profile hunts and the ensuing public backlash against the ethics and conduct of trophy hunting in general have led to proposals to ban the practice throughout Africa. Furthermore, some commercial passenger and cargo airlines have decided to stop, or may soon stop, the transport of trophies of hunted animals shot legally and sustainably by foreign tourists, irrespective of international conventions, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and national laws that allow trophy hunting.

Hunting Industry in Sub-Saharan Africa

Trophy hunting strongly contributes to the conservation enterprise in sub-Saharan Africa, where large areas support important terrestrial biodiversity that is currently allocated to trophy hunting use (Table 1). While most of the hunted individuals (e.g., 96% in South Africa in 2012) [1] are often from more common and less valuable species (Table 1), most of the trophy hunting revenue is generated from a few species carrying valuable trophies, particularly the charismatic 'Big Five' (lion leopard *Panthera pardus*; elephant *Loxodonta africana*; buffalo *Syncerus caffer*; and black or white rhinoceros *Ceratotherium simum*) [2]. Out of the US$68 million of gross revenue generated from trophy hunting in South Africa in 2012, over US$28 million (at least 41%) was generated from the Big Five alone (i.e., $5 635 625 from 635 buffaloes; $1 194 600 from 33 elephants; $647 500 from 37 leopards; $15 270 750 from 617 lions, $300 000 from one black rhinoceros; and $5 355 000 from 63 white rhinoceroses) [1]. Southern African countries and Tanzania exported most of the Big Five trophies between 2009 and 2013 (Figure 1). At the same time, two countries that do not typically attract many tourists (the Central African Republic, currently undergoing a conflict, and Cameroon, where poaching pressure is high) allowed trophy hunting of big cats and elephants, respectively, over the same period (Figure 1).

Concerns about Trophy Hunting

Overall, land allocated to trophy hunting has the potential to assist countries to achieve biodiversity conservation goals [3]. However, the contribution of hunting to conservation is often contentious for various reasons. There can be uncertainty over the sustainability of offtake rates and their potential impact on wildlife populations [4]. This concern arises because quotas and offtakes are not often based on scientific assessments. Furthermore, restrictions on the age of hunted

Table 1. Hunting Contribution to Biodiversity Conservation and National Economies in Sub Saharan Countries

Country	Area Covered by Game Ranches (% of Total Land Area)[a]	Terrestrial Protected Areas (% of Total Land Area)[b]	Top 3 Most Exported Trophies in 2012[c,d]	Annual Revenue (US$ million)[e]
South Africa	13.1	6.2	impala, warthog, kudu	68.0[f]
Tanzania	26.4	32.2	leopard, hippopotamus, elephant	56.3[g]
Botswana	23.0	37.2	elephant, leopard, lechwe	40.0[g]
Namibia	11.4	43.2	zebra, chacma baboon, leopard	28.5[h]
Zimbabwe	16.6	27.2	elephant, leopard, chacma baboon	15.8[g]
Mozambique	10.5	17.6	Nile crocodile, elephant, hippopotamus	5.0[g]
Zambia	21.3	37.8	lechwe, hippopotamus, leopard	3.6[g]
Total				217.2

[a][13].
[b]World Bank (http://data.worldbank.org/indicator/ER.LND.PTLD.ZS).
[c]CITES trade database (http://trade.cites.org/).
[d]Chacma baboon (*Papio ursinus*), elephant (*Loxodonto africana*), hippopotamus (*Hippopotamus amphibius*), impala (*Aepyceros melampus*), greater kudu (*Tragelaphus strepsiceros*), lechwe (*Kobus leche*), leopard (*Panthera pardus*), Nile crocodile (*Crocodylus niloticus*), warthog (*Phacochoerus africanus*), zebra (*Equus quagga*).
[e]Data not adjusted for inflation.
[f][1].
[g][6] (data for 2008 for Botswana, Tanzania and Mozambique, 2007 for Zimbabwe, and 2002 for Zambia).
[h]African Indaba (http://www.africanindaba.com/wp content/uploads/2014/03/AfricanIndabaVol3 4.pdf).

individuals are not often implemented [5]. In addition, the contribution of some forms of trophy hunting to conservation is debatable. This is particularly the case for 'canned lion hunting', where future targets are bred and raised in captivity and kept in confined enclosures until shot, to ensure that hunters are guaranteed a kill. In South Africa, which is by far the largest exporter of lion trophies across sub-Saharan Africa (Figure 1), 80% of the trophies between 2009 and 2013 were from lions raised in captivity or ranched. The ethics of canned hunting are dubious, and this abhorrent practice requires reform before it brings down ethically practiced hunting.

The profitability of their respective hunting industries is hard to compare across sub-Saharan countries [5]. Nevertheless, it is known that the gross annual revenue generated by the hunting industry comprises tens of millions of US$ in countries such as South Africa, Tanzania, and Botswana (Table 1). Despite this, the amount of accrued revenue allocated to conservation authorities that could in principle be reinvested in improved management appears to be limited. In Tanzania, for example, the accrued revenue allocated to the Wildlife Division in 2008 amounted to 22% (US$12 353 180) of the gross revenue generated by hunting in that year [5]. The remainder of the revenue went to the private sector.

Another limitation is that revenue generated from trophy hunting currently provides few benefits to local communities sharing habitats with biodiversity [6,7]. In Namibia, however, revenue generated from trophy hunting has encouraged local community participation in conservation, which in turn has resulted in substantial increases in the abundance of many wildlife species and in the total area of land falling under community protection through conservancies [6]. It is less clear in other African countries what proportions of hunting-permit revenue are directed to community-development projects, whether they are payments to community-based organizations, or payments to communities for concession fees, resource fees, or payments for welfare and education. Finally, legal controls over biological, ethical, and financial aspects of the hunting industry can be more easily circumvented in many sub-Saharan countries where management capacity and governance structures are ineffective [8].

Why Blanket Bans Could Exacerbate Biodiversity Loss

One currently promoted solution to address such concerns is to ban trophy hunting altogether. However, a blanket ban on trophy hunting could lead to worse conservation outcomes for three main reasons. First, financial resources for conservation are limited, particularly in developing countries. Hence, both nonconsumptive and consumptive uses of wildlife are necessary to generate enough funding to support meaningful conservation success over large areas [9]. While ecotourism can help reduce poverty in communities coexisting with biodiversity [3], ecotourists generally prefer travelling to more accessible areas [10], greatly limiting the opportunities for conservation in more remote regions. Instead, sustainable hunting can create important incentives for biodiversity conservation in areas where ecotourism is not economically viable [11]. At a time when greater proportions of conservation budgets are being spent on enforcement, the revenue from trophy hunting can empower

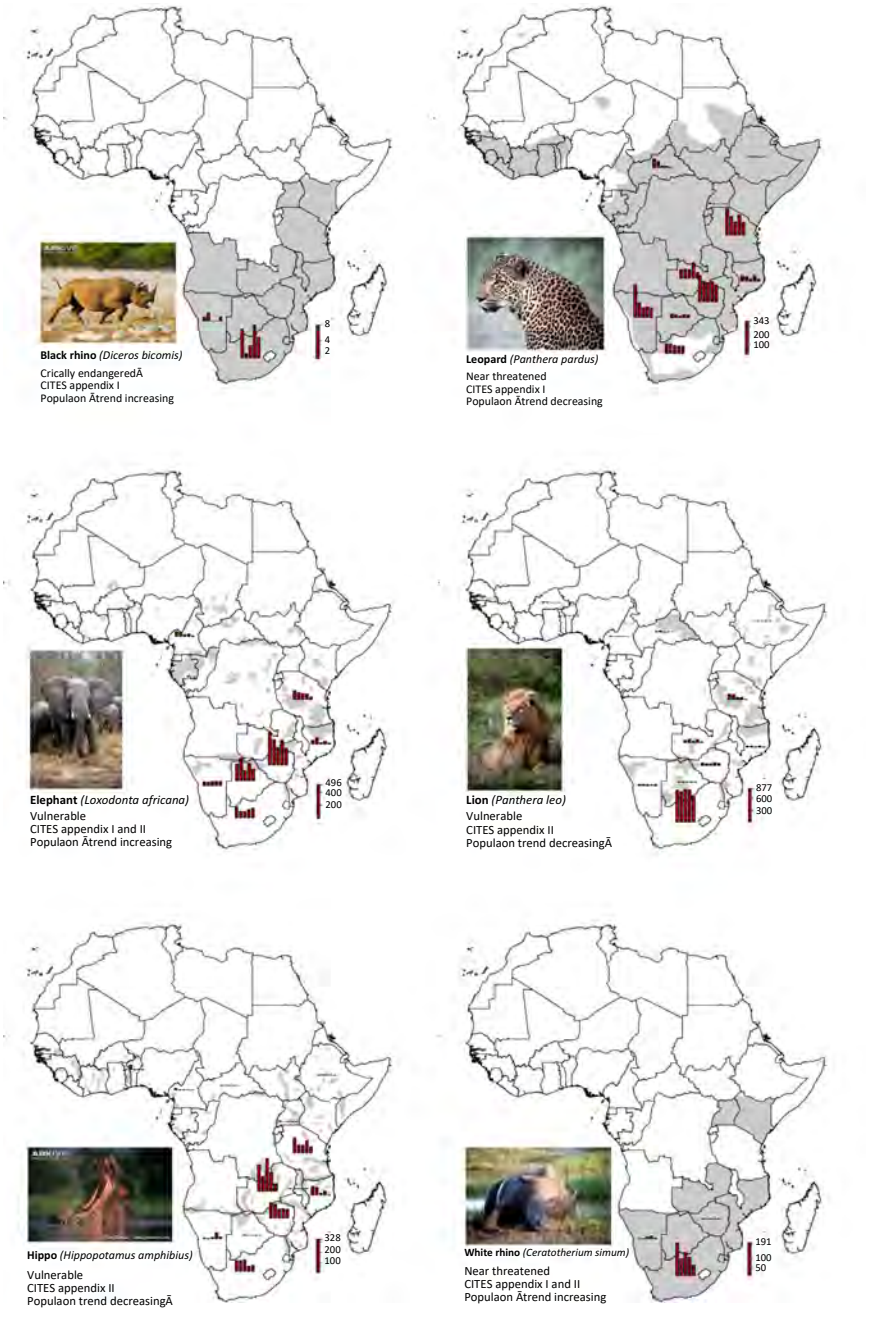


Figure 1. Number of Trophies Exported from 2009 to 2013 (Red Bars) for Six Charismatic African Species Subject to Trophy Hunting. Gray shaded areas correspond to the range maps of species obtained from www.iucnredlist.org/technical documents/spatial data. Each species is listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Net export data for each species retrieved from the CITES Trade Database (http://trade.cites.org) by searching for 'trophies' under the 'trade terms' bar. Information about the conservation status, population trend, and CITES listing retrieved from www.iucnredlist.org and www.cites.org. Numbers next to the external bar in each panel indicate the scale to interpret bar charts of annual trophies taken per species and per country.

communities to protect their resources by the employment of more antipoaching rangers or the construction of disincentive infrastructure [12]. If revenue cannot be generated from trophy hunting, natural habitats will be transformed to other forms of land use that provide higher return on investments compared with conservation [3], but have negative impacts on biodiversity.

Second, trophy hunting can have a smaller footprint than ecotourism in terms of carbon emissions, infrastructure development, and personnel, and can generate more revenue from a lower volume of tourist hunters. An often-neglected relation exists between ecotourism and aviation with regard to energy use and greenhouse gas emissions. Compared with ecotourism, the trophy-hunting industry relies on fewer tourist hunters, because the income generated per hunter is higher [13]. Additionally, hunters are interested in maintaining good-quality habitat for the simple reason that the quality of the individuals harvested therein is also high [14]. Finally, hunters are prepared to hunt in areas lacking attractive scenery, and require less infrastructure, therefore minimizing habitat degradation.

Third, management for hunting places emphasis on maintaining large wildlife populations for offtake, as opposed to ecotourism, where the presence of only a few individual animals is sufficient to maximize profits [2]. Both the consumptive and nonconsumptive uses of biodiversity can generate important revenue, so allowing local stakeholders, such as private landowners and communities, to retain property rights over these species is a necessary precursor for them to justify offsetting the direct and opportunity costs of conservation. Thus, the economic models underlying ecotourism and trophy hunting may lead to diverging management strategies. Empirical evidence shows that the strategy of artificially managing small populations within electrified fences to maximize economic return from

Box 1. Prescriptions to Make Trophy Hunting More Effective for Conservation

1. Net Conservation Benefit

1.1 Mandatory levies imposed on safari operators by governments that are invested directly into trust funds for conservation and management.

1.2 Ecolabeling certification schemes adopted for trophies originating from areas that contribute to broader biodiversity conservation and respect animal welfare concerns.

2. Biological Sustainability

2.1 Mandatory population viability analyses to ensure that harvests cause no net population decline.

2.2 Ban posthunt sales of any portion of the quarry shot, to avoid illegal wildlife trade.

3. Socio-Economic-Cultural Benefit

3.1 Promote and fund trophy hunting enterprises run (or leased) by local communities.

3.2 Create trusts to facilitate equitable benefit sharing within local communities and promote long term economic sustainability.

4. Adaptive Management: Planning, Monitoring, and Reporting

4.1 Mandatory scientific sampling of hunted animals, including tissue for genetics, teeth for age analysis, stomach contents, full morphometrics, disease screening, and so on.

4.2 Mandatory 5 year reviews of all individuals hunted and detailed population management plans submitted to government legislators to extend permits.

5. Accountable and Effective Governance

5.1 Full disclosure to the public of all data collected (including levied amounts), although personal details of proponents held by government legislators only.

5.2 Independent government observers placed randomly and without forewarning on safari hunts as they happen.

5.3 Trophies are confiscated and permits are revoked when illegal practices are disclosed.

6. Animal welfare

6.1 Backup professional shooters and trackers present for all hunts to minimize welfare concerns

ecotourism and minimize management costs might be the most appropriate to enhance tourist experiences [2]. By contrast, wildlife populations potentially have higher hunting value when their sizes are larger (i.e., are more viable) and populations are better connected to enhance gene flow, because the latter can affect the fitness and quality of the individuals harvested.

Concluding Remarks

Inadequate political, legal, and governance structures are currently preventing trophy hunting from being an effective tool for creating conservation incentives in sub-Saharan Africa. At the same time, banning trophy hunting might not be the best solution because biodiversity loss could even be worse in its absence. Therefore, we propose a set of prescriptions that could enhance the contribution of trophy hunting to conservation and to the equitable sharing of the benefits with local people (Box 1). To make these prescriptions more relevant for decision-makers, we have summarized them according to the guiding principles on trophy hunting promoted by the International Union for the Conservation of Nature [15]. In particular, we make suggestions on how net biodiversity benefits and stakeholder returns can be achieved simultaneously, and highlight how the hunting industry and governance structures can be made more transparent to avoid unethical or illegal practices. Finally, we provide additional guidelines to account for animal welfare concerns. Promoting these and other prescriptions could enhance the role of trophy hunting in addressing the ongoing loss of species.

Acknowledgments

We thank M. Festa Bianchet and an anonymous reviewer for comments that helped improve the manuscript. E.D.M. acknowledges ERC StG Grant 260393 (GEDA) and the Academy of Finland Centre of Excellence Programme 2012–2017 (Grant 250444) for support. Unless specified otherwise, photographs in Figure 1 by E.D.M.

[1]Department of Biosciences, University of Helsinki, FI-00014, Helsinki, Finland
[2]School of Life Sciences, University of KwaZulu-Natal, Private Bag X 54001, Durban 4000, South Africa
[3]Department of Geography, University of Cambridge, Downing Place, Cambridge, CB2 3EN, UK
[4]The Environment Institute and School of Biological Sciences, The University of Adelaide, Adelaide, SA 5005, Australia
[5]Laboratoire Écologie, Systématique et Évolution – UMR CNRS 8079, Université Paris-Sud, Bat 362, F-91405, Orsay Cedex, France

*Correspondence: enrico.di.minin@helsinki.fi (E. Di Minin).

http://dx.doi.org/10.1016/j.tree.2015.12.006

References

1. Cloete, P.C. *et al.* (2015) *Game Ranch Profitability in South Africa,* Caxton Printers
2. Di Minin, E. *et al.* (2013) Understanding heterogeneous preference of tourists for big game species: implications for conservation and management. *Anim. Conserv.* 16, 249–258
3. Di Minin, E. *et al.* (2013) Conservation businesses and conservation planning in a biological diversity hotspot. *Conserv. Biol.* 27, 808–820
4. Bradshaw, C.J.A. *et al.* (2006) Incorporating known sources of uncertainty to determine precautionary harvests of saltwater crocodiles. *Ecol. Appl.* 16, 1436–1448
5. Packer, C. *et al.* (2011) Effects of trophy hunting on lion and leopard populations in Tanzania. *Conserv. Biol.* 25, 142–153
6. Booth, V.R. (2010) *The Contribution of Hunting Tourism: How Significant is this to National Economies, CIC Technical Series Publication,* FAO
7. NACSO (2014) *The State of Community Conservation in Namibia – A Review Of Communal Conservancies, Community Forests and Other CBNRM Initiatives,* NACSO
8. Leader-Williams, N. *et al.* (2009) The influence of corruption on the conduct of recreational hunting. In *Recreational Hunting, Conservation and Rural Livelihoods: Science and Practice* (7) (Dickson, B. *et al.*, eds), In pp. 296–316, Blackwell Publishing
9. Naidoo, R. *et al.* (2015) Complementary benefits of tourism and hunting to communal conservancies in Namibia. *Conserv. Biol.* Published online October 13, 2015. http://dx.doi.org/10.1111/cobi.12643
10. Balmford, A. *et al.* (2015) Walk on the wild side: estimating the global magnitude of visits to protected areas. *PLOS Biol.* 13, e1002074
11. Lindsey, P.A. *et al.* (2006) Potential of trophy hunting to create incentives for wildlife conservation in Africa where alternative wildlife-based land uses may not be viable. *Anim. Conserv.* 9, 283–291
12. Di Minin, E. *et al.* (2015) Identification of policies for a sustainable legal trade in rhinoceros horn based on population projection and socioeconomic models. *Conserv. Biol.* 29, 545–555
13. Lindsey, P.A. *et al.* (2007) Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. *Biol. Conserv.* 134, 455–469
14. Ramanzin, M. and Sturaro, E. (2014) Habitat quality influences relative antler size and hunters' selectivity in roe deer. *Eur. J. Wildl. Res.* 60, 1–10
15. IUCN (2012) *Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives,* IUCN

Barry, Anna <anna_barry@fws.gov>

ARTICLE: Banning Trophy Hunting will Exacerbate Biodiversity Loss

1 message

Moore, Kathleen <kathleen_moore@fws.gov> Tue, Feb 2, 2016 at 11:52 AM
To: FWHQ AIA-STAFF <fwhq_arl_aia-staff@fws.gov>

Thought folks would be interested in this publication in Trends in Ecology and Evolution.

Very short article. Not real innovative but interesting nonetheless.

--
Kathleen Moore
USFWS/Division of Management Authority
Branch of Permits, MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803
1-800-358-2104 (Phone)

Check out the new CITES species database at www.speciesplus.net to find out more information about how species are listed and protected under the Convention.

Minon et al. 2016 Banning Trophy Hunting will Exacerbate Biodiversity Loss.pdf
1176K

Vargas, Darcy <darcy_vargas@fws.gov>

Re: Conservation Status of African Lion in Zimbabwe

Vannorman, Tim <tim_vannorman@fws.gov> Tue, Feb 16, 2016 at 11:29 AM
To: Olivia Mufute <omufute@zimparks.co.zw>
Cc: Darcy Vargas <darcy_vargas@fws.gov>

Dear Olivia,

Thank you for the e-mail this morning. There was not a document attached, but I am assuming that it is the same document that is currently on your web page; is that correct? If so, I can download it from the web site, so there is no need to resend the document.

I also see that there is a document on captive-bred lions on the web page. While the document defines "canned hunts", it does not state that canned hunting is illegal. Is it legal to hunt a captive-bred lion and, if so, how are these hunts handled in regards to conservation of wild lions?

On the subject of elephants, when I met with your colleagues in Las Vegas, I learned that Zimbabwe had finalized the national elephant strategy (I have a copy of this document), as well as the four regional plans. I don't have a copy of the regional plans. Would it be possible to send me copies of these documents? I did not see them posted on your web page, but if they are there I could download them.

Thank you again.

Tim

On Tue, Feb 16, 2016 at 10:49 AM, Olivia Mufute <omufute@zimparks.co.zw> wrote:

> Dear Tim,
>
> Further to the meeting at the 44th SCI Convention in Las Vegas, please find attached a document: Conservation Status of African Lions in Zimbabwe.
>
> Regards
>
> Olivia Mufute
>
> Zimbabwe Parks and Wildlife
>
> Chief Ecologist
>
> Direct line: +263-4-790570



Click here to view our website

Disclaimer

–
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

***Sign up* for our e-newsletter to learn how we're working around the globe to protect species and their habitats!**

Barry, Anna <anna_barry@fws.gov>

Additional document for tomorrow's lion discussion

1 message

Vannorman, Tim <tim_vannorman@fws.gov> Wed, May 4, 2016 at 1:41 PM
To: FWHQ DMA-BOP-BIO'S <fwhq_dma_bop_bio@fws.gov>

All,

Here is an additional document you might want to scan before tomorrow's discussion on lion enhancement. The IUCN SSC Guiding Principles on Trophy Hunting was referenced in the lion listing final rule and provides a good overview of what we would be looking for when making an enhancement finding.

Tim

--
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

iucn_ssc_guiding_principles_on_trophy_hunting_ver1_09aug2012.pdf
66K

IUCN SSC Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives

Ver. 1.0 (09 August 2012)

Citation: IUCN SSC (2012). IUCN SSC Guiding principles on trophy hunting as a tool for creating conservation incentives. Ver. 1.0. IUCN, Gland.

Section I. Introduction

IUCN has long recognized that the wise and sustainable use of wildlife can be consistent with and contribute to conservation, because the social and economic benefits derived from use of species can provide incentives for people to conserve them and their habitats. This document builds on existing IUCN policies by setting forth SSC guiding principles on the use of "trophy hunting", as defined in Section II, as a tool for creating incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources.

Trophy hunting is often a contentious activity, with people supporting or opposing it on a variety of biological, economic, ideological or cultural bases. This document is focused solely on the relevance of trophy hunting for conservation and associated local livelihoods. Nothing in this document is intended to support or condone trophy hunting activities that are unsustainable; adversely affect habitats; increase extinction risks; undermine the rights of local communities to manage, steward, and benefit from their wildlife resources; or foster corruption or poor governance.

Section II. Scope of this guidance

The term "trophy hunting" is here used to refer to hunting that is:

- Managed as part of a programme administered by a government, community-based organization, NGO, or other legitimate body;
- Characterized by hunters paying a high fee to hunt an animal with specific "trophy" characteristics (recognizing that hunters each have individual motivations);
- Characterized by low off-take volume;
- Usually (but not necessarily) undertaken by hunters from outside the local area (often from countries other than where the hunt occurs).

These elements differentiate the hunting at issue here from a broad array of other hunting activities, although it is recognized that what is here defined as trophy hunting may be given a different name in some countries. Thus these guiding principles are not intended to apply to subsistence hunting, to legal hunting of relatively common species, or to management activities undertaken by wildlife management agencies, although some elements of them may be relevant to these activities. Such hunting activities may also generate incentives for conservation, but are beyond the scope of this guidance.

These guiding principles apply specifically to trophy hunting programmes oriented to terrestrial wild animals in their native geographic ranges. Existing IUCN policy does not support moving species outside their native ranges for the primary purpose of trophy hunting[1]. In keeping with existing IUCN policy (IUCN Recommendation 3.093, adopted by the IUCN Congress at its 3rd Session in Bangkok, Thailand, 17-25 November 2004, which condemned "the killing of animals in enclosures or where they do not exist as free-ranging"), the IUCN SSC does not support trophy hunting of animals in enclosures where they cannot be considered "free-ranging" and cannot use their natural abilities to escape.

Section III: The policy context

IUCN's formal recognition that the ethical and sustainable use of wildlife can form an integral

[1] See: IUCN Position Statement on Translocation of Living Organisms (http://www.iucnsscrsg.org/download/IUCNPositionStatement.pdf) and IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species (http://intranet.iucn.org/webfiles/doc/SSC/SSCwebsite/Policy_statements/IUCN_Guidelines_for_the_Prevention_of_Biodiversity_Loss_caused_by_Alien_Invasive_Species.pdf)

and legitimate component of conservation programs dates back to the World Conservation Strategy in 1980, and was affirmed in Recommendation 18.24 at the 1990 IUCN General Assembly in Perth. IUCN's "Policy Statement on Sustainable Use of Wild Living Resources", adopted as Resolution 2.29 at the IUCN World Conservation Congress in Amman in October 2000, affirms that use of wildlife, if sustainable, can be consistent with and contribute to biodiversity conservation. IUCN recognizes that where an economic value can be attached to a wild living resource, perverse incentives removed, and costs and benefits internalized, favourable conditions can be created for investment in the conservation and the sustainable use of the resource, thus reducing the risk of resource degradation, depletion, and habitat conversion. In managing such use to enhance sustainability, the Policy Statement draws attention to the following key considerations:

- the need for adaptive management, incorporating monitoring and the ability to modify management to take account of risk and uncertainty;
- the supply of biological products and ecological services available for use is limited by intrinsic biological characteristics of both species and ecosystems, including productivity, resilience, and stability, which themselves are subject to extrinsic environmental change;
- institutional structures of management and control require both positive incentives and negative sanctions, good governance, and implementation at an appropriate scale. Such structures should include participation of relevant stake-holders and take account of land tenure, access rights, regulatory systems, traditional knowledge, and customary law.

More specifically, and with particular reference to southern Africa, IUCN has recognized that recreational hunting can contribute to biodiversity conservation. The IUCN at the 2004 WCC adopted Recommendation 3.093 stating that it "Supports the philosophy and practice that on state, communal and privately-owned land in southern Africa the sustainable and well-managed consumptive use of wildlife makes a contribution to biodiversity conservation" and further, that it "accepts that well-managed recreational hunting has a role in the managed sustainable consumptive use of wildlife populations".

Further, the IUCN SSC Caprinae Specialist Group adopted a formal position statement in December, 2000, recognizing that hunting, and in particular trophy hunting, can form a major component in conservation programmes for wild sheep and goats. This statement noted that "Trophy hunting usually generates substantial funds that could be used for conservation activities such as habitat protection, population monitoring, law enforcement, research, or management programs. Equally importantly, the revenues from trophy hunting can provide a strong incentive for conservation or habitat protection…"

The Convention on Biological Diversity has developed several statements of principles relevant for the management of trophy hunting. Most importantly, the 7th Conference of Parties to the CBD (Kuala Lumpur, February 2004) adopted the Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity (AAPG), and IUCN members party to the CBD were urged to honour these commitments by Resolution 3.074 of the 3rd IUCN World Conservation Congress (Bangkok, October 2004). The AAPG are based on the assumption that it is possible to use biodiversity in a manner in which ecological processes, species, and genetic variability remain above the thresholds needed for long term viability, and that all resource managers and users have the responsibility to ensure that such use does not exceed these. Some key relevant principles from the Addis Ababa Principles and Guidance include:

- Recognizing the need for a governing framework consistent with international/national laws, local users of biodiversity components should be sufficiently empowered and supported by rights to be responsible and accountable for use of the resources concerned (Principle 2);
- Adaptive management should be practiced, based on:

    - Science and traditional and local knowledge;
    - Iterative, timely and transparent feedback derived from monitoring the use, environmental and socio-economic impacts, and the status of the resource being used; and
    - Adjusting management based on timely feedback from the monitoring procedures (Principle 4)
- Sustainable use management goals and practices should avoid or minimize adverse impacts on ecosystem services, structure, and functions as well as other components of ecosystems (Principle 5);
- An interdisciplinary, participatory approach should be applied at the appropriate levels of management and governance related to the use (Principle 9);
- Users of biodiversity should seek to minimize waste and adverse environmental impact, and optimize benefits from uses (Principle 11);
  The costs of management and conservation of biological diversity should be internalized within the area of management and reflected in the distribution of the benefits from the use (Principle 13).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) provides for the authorization of trade of trophies in certain specimens of Appendix I-listed taxa for personal use (Res. Conf. 2.11 (rev. CoP 9). CITES has adopted a series of Resolutions for certain Appendix I-listed species subject to trophy hunting (Res. Conf 10.14 (rev. CoP 14) on Leopard *Panthera pardus*; Res. Conf 10.15 (rev. CoP 14) on Markhor *Capra falconeri;* and Res. Conf 13.5 (rev. CoP 14) on Black Rhinoceros *Diceros bicornis*), which set out quotas and conditions for such trade.

The European Charter on Hunting and Biodiversity (ECHB), adopted under the European Bern Convention, provides specific guidance on hunting and conservation. In Resolution 4.026, adopted at the 4th World Conservation Congress Barcelona, October 2008), IUCN requested that its members promote the ECHB in the implementation of IUCN's policies and Programme for 2009-2012. While the ECHB explicitly addresses sustainable hunting in Europe, its principles and guidelines are relevant and pertinent in a wider geographic context. Key principles of the ECHB include:

- ensuring that harvest is ecologically sustainable (Principle 3);
- maintaining wild populations of indigenous species with adaptive gene pools (Principle 4);
- maintaining environments that support healthy and robust populations of harvestable species (Principle 5);
- encouraging use to provide economic incentives for conservation (Principle 6); and
- empowering local stakeholders and holding them accountable (Principle 9).

Section IV. Trophy hunting and conservation

Trophy hunting is a form of wildlife use that, when well managed, may assist in furthering conservation objectives by creating the revenue and economic incentives for the management and conservation of the target species and its habitat, as well as supporting local livelihoods. However, if poorly managed, it can fail to deliver these benefits. Although a wide variety of species (many of which are both common and secure) are hunted for trophies, some species that are rare or threatened may be included in trophy hunting as part of site-specific conservation strategies. Examples include Cheetah *Acinonyx jubatus* and Black Rhinoceros in southern Africa, and Straight-Horned Markhor *Capra falconeri megaceros* in the Torghar Valley of Pakistan, all of which are species listed on Appendix I of CITES.

Trophy hunting takes place in both North America and Europe, and in developing countries where wildlife management infrastructure is often less fully developed. These hunts are usually conducted by persons willing and able to pay substantial amounts of money for the opportunity. They typically involve taking small numbers of individual animals and require limited development infrastructure. They are thus high in value but low in impact. In some cases, trophy hunting forms an important component of Community-Based Conservation/Community-Based Natural Resource Management, which aim to devolve responsibility for the sustainable use and management of wildlife resources from distant bureaucracies to more local levels.

Understanding the context within which trophy hunting occurs is critical to understanding its potential to benefit conservation. In many parts of the world, much wildlife exists outside of protected areas. Wildlife shares landscapes with people, and typically competes for space and environmental resources with other forms of economically productive land uses, such as agriculture and pastoralism, upon which the livelihoods of local people depend. Wildlife can impose serious costs on local people, including physical harm, damaging crops, and competing with livestock for forage. Where wildlife provides few benefits to local people and/or imposes substantial costs, it is often killed (legally or illegally) for food, various commercially valuable wildlife products, or as problem animals, and its habitats are degraded or lost to other forms of land use. In some circumstances trophy hunting can address this problem by effectively making wildlife more valuable than, and/or complementary to, other forms of land use. It can return benefits to local people (preferably through effective co-management), encouraging their support for wildlife, and motivating investment at community, private, and government levels for research, monitoring, habitat protection, and enforcement against illegal use (see Annex 1 for examples). Trophy hunting, if well managed, is often a higher value, lower impact land use than alternatives such as agriculture or tourism.

However, where poorly managed, trophy hunting can have negative ecological impacts including altered age/sex structures, social disruption, deleterious genetic effects, and in extreme cases, population declines. It can also be difficult to ensure that benefits from hunting accrue to those in the best position to help conservation.

Section V: The Guiding Principles

The IUCN SSC considers that trophy hunting, as described in Section II above, is likely to contribute to conservation and to the equitable sharing of the benefits of use of natural resources when programmes incorporate the following five components: Biological Sustainability; Net Conservation Benefit; Socio-Economic-Cultural Benefit; Adaptive Management: Planning, Monitoring, and Reporting; and Accountable and Effective Governance

Biological Sustainability

Trophy hunting as described in Section II, can serve as a conservation tool when it:

1. Does not contribute to long-term population declines of the hunted species or of other species sharing its habitat, noting that a sustainably harvested population may be smaller than an unharvested one;
2. Does not substantially alter processes of natural selection and ecosystem function; that is, it maintains "wild populations of indigenous species with adaptive gene pools.[2]" This generally requires that hunting offtake produces only minor alterations to naturally occurring demographic structure. It also requires avoidance of breeding or culling to deliberately enhance population-genetic characteristics of species subject to hunting that are inconsistent with natural selection;
3. Does not inadvertently facilitate poaching or illegal trade of wildlife;

[2] Direct quote from Principle 4 of the European Charter on Hunting and Biodiversity.

4. Does not artificially and/or substantially manipulate ecosystems or their component elements in ways that are incompatible with the objective of supporting the full range of native biodiversity.

Net Conservation Benefit

Trophy hunting can serve as a conservation tool when it:

1. Is linked to identifiable and specific parcels of land where habitat for wildlife is a priority (albeit not necessarily the sole priority or only legitimate use); and on which the "costs of management and conservation of biological diversity [are] internalized within the area of management and reflected in the distribution of the benefits from the use[3]";
2. Produces income, employment, and/or other benefits that generate incentives for reduction in pressures on populations of target species, and/or help justify retention, enhancement, or rehabilitation of habitats in which native biodiversity is prioritized. Benefits may create incentives for local residents to co-exist with such problematic species as large carnivores, herbivores competing for grazing, or animals considered to be dangerous or a threat to the welfare of humans and their personal property;
3. Is part of a legally recognized governance system that supports conservation adequately and of a system of implementation and enforcement capable of achieving these governance objectives.

Socio-Economic-Cultural Benefit

Trophy hunting can serve as a conservation tool when it:

1. Respects local cultural values and practices (where "local" is defined as sharing living space with the focal wildlife species), and is accepted by (and preferably, co-managed and actively supported by) most members of the local community on whose land it occurs;
2. Involves and benefits local residents in an equitable manner, and in ways that meet their priorities;
3. Adopts business practices that promote long-term economic sustainability.

Adaptive Management: Planning, Monitoring, and Reporting

Trophy hunting can serve as a conservation tool when it:

1. Is premised on appropriate resource assessments and/or monitoring of hunting indices, upon which specific quotas and hunting plans can be established through a collaborative process. Optimally, such a process should (where relevant) include local communities and draw on local/indigenous knowledge. Such resource assessments (examples might include counts or indices of population performance such as sighting frequencies, spoor counts) or hunting indices (examples might include trophy size, animal age, hunting success rates and catch per hunting effort) are objective, well documented, and use the best science and technology feasible and appropriate given the circumstances and available resources;
2. Involves adaptive management of hunting quotas and plans in line with results of resource assessments and/or monitoring of indices, ensuring quotas are adjusted in line with changes in the resource base (caused by ecological changes, weather patterns, or anthropogenic impacts, including hunting offtake);
3. Is based on laws, regulations, and quotas (preferably established with local input) that are transparent and clear, and are periodically reviewed and updated;
4. Monitors hunting activities to verify that quotas and sex/age restrictions of harvested animals are being met;

[3] Direct quote from Practical Principle 13 of the Addis Ababa Principles and Guidelines on Sustainable Use of Biodiversity.

5. Produces reliable and periodic documentation of its biological sustainability and conservation benefits (if this is not already produced by existing reporting mechanisms).

Accountable and Effective Governance

A trophy hunting programme can serve as a conservation tool when it:

1. Is subject to a governance structure that clearly allocates management responsibilities;
2. Accounts for revenues in a transparent manner and distributes net revenues to conservation and community beneficiaries according to properly agreed decisions;
3. Takes all necessary steps to eliminate corruption; and
4. Ensures compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.

Section VI: Appropriate use of these guiding principles

SSC's intention is that these guiding principles may serve to assist authorities responsible for national and subnational policy, law and planning; managers responsible at the site level; and local communities in designing and implementing trophy hunting programs where biodiversity conservation and equitable sharing of natural resources are objectives.

These guiding principles should not be interpreted as in any way dismissing the values – whether they are biological, social, cultural or economic – of hunting programs that may be truly sustainable, but that do not produce incentives for conservation and associated conservation benefits.

Although IUCN and SSC are not currently engaged in endorsing or certifying trophy hunting programmes, they consider that for any such endorsement or certification to be credible, it should be conducted by a recognized independent body. Nothing in this document is intended to be interpreted in any way as a specific endorsement or criticism of a particular trophy hunting programme.

Annex 1. Examples of trophy hunting as part of a conservation strategy

Note: *Due to the varied potential conservation impacts of trophy hunting it is useful to provide a small set of illustrative case studies highlighting both positive and negative conservation impacts. We have here included two illustrations of generally positive conservation impacts. We would welcome suggestions for further examples, both positive and negative, noting that in the case of negative examples we are sensitive to not casting blame or criticizing member groups and member states.*

Case study 1: Trophy hunting in Namibian communal Conservancies

Namibia's communal Conservancy programme is widely viewed as a conservation and rural development success story, and trophy hunting plays a central role in this success. Innovative legislative reforms in the mid-1990s devolved conditional rights to use and manage wildlife on communal lands to communities, if they organized to form a Conservancy. The intent of this approach was to devolve rights and benefits from wildlife to communities – people often viewed by colonial conservationists as "poachers" - to create incentives for communities to live with, value, and benefit from wildlife. Forming a Conservancy requires that the community defines its membership, borders, and management committee; develops a Constitution; agrees a method for equitable distribution of benefits; and develops a sustainable game management and utilization plan. Conservancies can use wildlife consumptively in various ways, including trophy hunting, own-use hunting game cropping, and live sales; and organize nonconsumptive use through tourism. Conservancies retain all the revenue gained from utilization and management.

The spread of the conservancy movement has been rapid, and conservation impacts extensive and widespread. Today there are 71 registered communal Conservancies covering 14.98 million ha (with another 20 conservancies under development) and include around 240 000 members. Current communal Conservancies alone mean that 18.2% of Namibia's land surface is under conservation management. This is a contrast from the previous status of these areas as subject to long-term human-wildlife conflict, uncontrolled poaching, and low levels of wildlife.

Sustainable use of wildlife has been a strong catalyst to the recovery of wildlife in communal areas. Prior to the introduction of conservancies, wildlife in Namibia's communal areas had been decimated and was at historic lows in many instances. Wildlife was perceived by communities mainly as a threat to livelihoods, with its best use being illegal poaching for meat for the pot. The advent of Conservancies drastically altered this attitude. Wildlife is now increasingly seen as a valued asset, with growing wildlife populations meaning more income for conservancies, more jobs for conservancy members, more game meat at the household level, and more funds to support rural development. As a result, poaching has become socially unacceptable and game numbers have staged remarkable recoveries in most areas where Conservancies have operated for a period of time. For instance, on communal lands in northeast Namibia, from 1994 to 2011, elephant have increased from 12,908 to an estimated 16,993; sable from 724 to an estimated 1,474; and common impala from 439 to 9,374. In northwest Namibia[4], from the early 1980s to today, desert elephants have increased from approx. 150 to approx. 750; Hartmann's Mountain Zebra from est. <1,000 to > 27,000; and black rhino have more than tripled, making it the biggest free-roaming population of rhino in the world. From 1995, the population of lion in this area has increased from an est. 20 to an est. 130, with exponential range expansion. Game populations have been re-established in Conservancies that have low densities of specific species or species that have gone locally extinct. This support has allowed for the re-establishment of a large number of species, including giraffe, red hartebeest, black faced impala and black rhino. Further, Conservancies, a large proportion of which are located adjacent or

[4] Game guard programs, precursors of the current model, were introduced in this area in the early 1980s.

close to protected areas, strengthen Namibia's protected area system by ensuring wildlife friendly environments adjacent to protected areas and through the creation of movement corridors between them.

Trophy hunting has been a central driver of this transformation. It is by far the largest generator of benefits from sustainable consumptive wildlife use, with 41 Conservancies hosting 40 trophy hunting concessions during 2011. Since registration of the first four communal conservancies in 1998, a total of 97 948 km^2 have been opened to trophy hunting concessions under community management. Benefits from consumptive use of wildlife (cash, employment, and in-kind [largely meat]) received by Conservancies and their members from 1998-2009 amounted to N$76.5 million (US$10.17 million) (NACSO Database, 2011). As the benefits from consumptive use have driven recovery of wildlife populations through reduction of poaching, these recoveries have in turn paved the way for non-consumptive tourism, more than doubling the returns from wildlife to communities. In 2011 more than 30 joint venture tourism lodges and 24 community campsites were functioning in communal Conservancies, generating Conservancy benefits (including cash, employment and in-kind benefits) of N$102.8 million (US$13.64 million) from 1998-2009. Tourism enterprises have proven to be strong, complementary additions to consumptive use options, with consumptive use (primarily trophy hunting) generating the majority of cash income to Conservancies (which can be put toward wildlife management activities and community development purposes), and tourism operations providing the greater individual employment benefits to Conservancy members. Benefits from consumptive use are critical because these can start to flow when wildlife populations are initially too low to support tourism, stimulating recoveries of wildlife to levels at which photographic tourism can become viable.

Community development activities paid for by benefit streams from sustainable use, among others, include improvements to schools or school facilities and equipment; improvements to rural health clinics; support to pensioners; scholarship funds; transport for the sick or injured; mitigation of human / wildlife conflict; and sponsoring of community sports teams. Finally, the hunting operations provide meat to community members (many very marginalized): meat provided from trophy hunting and own-use harvesting was valued at N$17,413,120 (US$2.29 million) between 1998 and 2009[5] (NACSO, 2010).

A number of cutting edge tools and practices have been developed by the Namibia CBNRM Programme to ensure sustainable hunting is playing a key conservation role, including:

- annual quota setting procedures for sustainable harvest offtake rates: jointly carried out by the MET, NGOs, and the Conservancies, and based upon annual game counts, hunting operator reports, and local knowledge of conservancy/MET/NGO staff;
- trophy hunting tender procedures for Conservancy hunting concessions: these aim to attain market values for game in a transparent manner, and strengthen relationships between the Conservancy committee and the hunting operator;
- trophy hunting contracts: through the Conservancy movement communities have been empowered to become meaningful partners in the development and support of hunting activities, although many remain on a steep learning curve; and
- Conservancy management plans and practices: **f**unds generated from wildlife use are used by conservancies to employ community game guards and implement game management and monitoring systems, allowing communities to proactively counter poaching threats and mitigate increasing incidents of human/wildlife conflict.

Sources:

[5] The value of distributed meat is calculated by using market values and average meat yields of game animals from which the meat was distributed, as recorded by conservancies in the Event Book.

NACSO. 2010. Namibia's communal conservancies: a review of progress 2009. NACSO, Windhoek, Namibia

Naidoo, R., Weaver, L. C., Stuart-Hill, G. & Tagg, J. (2011). Effect of biodiversity on economic benefits from communal lands in Namibia. *Journal of Applied Ecology* 48: 310-316.

Weaver, C., Hamunyela, E., Diggle, R., Matongo, G. & Pietersen T. (2011). The catalytic role and contributions of sustainable wildlife use to the Namibia CBNRM programme. In: Abensperg-Traun, M., Roe, D. & O'Criodain, C. eds. (2011). *CITES and CBNRM*.
Proceedings of an international symposium on "The relevance of CBNRM to the conservation and sustainable use of CITES-listed species in exporting countries", Vienna, Austria, 18-20 May 2011. IUCN and London, Gland, Switzerland & IIED, UK. Pp. 59-70

Case study 2: Conservation and trophy hunting in the Torghar Valley, Pakistan

Torghar (black mountains/hills in Pushtoo) is in the province of Balochistan in Pakistan. In the early 1980s, wild Straight-horned Markhor *Capra falconeri megaceros* and Afghan Urial *Ovis orientalis* were close to being extirpated from this region due to uncontrolled hunting and competition for grazing with domestic herds. Enforcement efforts against hunting were poor due to weak institutional capacity and lack of political will. In the mid-1980s, a tribal decree banning hunting was issued by a local leader, but could not be enforced. Local Jazalai (a Pathan tribe) leaders, with support from the United States Fish and Wildlife Service (USFWS), launched a community-based conservation programme in 1986, the Torghar Conservation Project (later managed by STEP, the Society for Torghar Environmental Protection). This project used limited and monitored trophy hunting, initially of Urial only and later also of Markhor, to provide revenue to fund the employment of local people as game guards and to provide community benefits. The hypothesis was that development of local livelihoods based on trophy hunting would change the attitude of local people toward wildlife, demonstrating that conservation could be an economically viable land use, and providing incentives for enforcement. In line with its commitment to conservation, the trophy hunting has been conservative, with 1-2 Markhor and 1-4 Urial taken per year.

After careful consideration, tribesmen accepted a ban on their traditional hunting in return for the economic benefits of the conservation programme. Illegal hunting virtually ceased. While exact population numbers cannot be ascertained in the difficult terrain, use of repeated standardized survey protocols have found that the Torghar populations of Markhor and Urial have steadily increased since the project started. Surveys at Torghar by USFWS-sponsored biologists found the estimated population of Markhor grew from less than 100 in 1990 to 2,541 in 2005, with estimated Urial populations increasing from 1173 in 1994 to 3,146 in 2005.

Over this period, the programme has continually faced a lack of regulatory support, including government reluctance to recognize local involvement in conservation, bans on hunting imposed by the national Conservation Council, and the listing of Markhor on Appendix I of CITES, making export of trophies to major market countries such as the United States problematic. Despite these obstacles the programme has grown, attracting further support from the United Nations Development Programme, WWF-Pakistan, the Global Environment Facility and others. While other means of raising revenue such as ecotourism based on photography have been considered, the region is remote and attracts few visitors.

TCP/STEP has also generated considerable benefits for the approx. 400 families of the local area. Revenues raised by trophy hunting and donor grants pay salaries for ca. 82 game guards, and have been used for community needs such as construction of water tanks, dams and irrigation channels (to provide water during droughts), supply of young fruit trees, a medical camp and emergency drought relief.

Sources:

Frisina, M. & Tareen, S.N. (2009). Exploitation prevents extinction: Case study of endangered Himalayan sheep and goats. In: Recreational Hunting, Conservation and Rural Livelihoods: Science and Practice (eds. B. Dickson, J. Hutton & W.M. Adams). 1st edition, Wiley-Blackwell, Oxford, UK. pp. 141-156.

Rosser, A.M., Tareen, N & Leader-Williams, N. (2005) Trophy hunting and the precautionary principle: a case study of the Torghar Hills population of straight-horned markhor. In: Biodiversity and the Precautionary Principle: risk and uncertainty in conservation and sustainable use (eds. R Cooney and B Dickson). Earthscan, London. pp. 55-72.

Valdez, R. 2008. Capra falconeri. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 27 March 2012.

Woodford M.H., Frisina M.R. & Awan G.A. (2004) The Torghar Conservation Project: Management of the Livestock, Suleiman Markhor (*Capra falconeri*) and Afghan Urial (*Ovis orientalis*) in the Torghar Hills, Pakistan. *Game and Wildlife Science* 21: 177-187.

Barry, Anna <anna_barry@fws.gov>

Facing Drought, Zimbabwe Says It Is Selling Off Wild Animals

2 messages

Kohn, Frank <frank_kohn@fws.gov> Thu, May 5, 2016 at 7:25 AM
To: FWHQ AIA-STAFF <fwhq_arl_aia-staff@fws.gov>

HTTP://WWW.NPR.ORG/SECTIONS/THETWO-WAY/2016/05/04/476749207/FACING-DROUGHT-ZIMBABWE-SAYS-IT-IS-SELLING-OFF-WILD-ANIMALS

Moore, Kathleen <kathleen_moore@fws.gov> Thu, May 5, 2016 at 9:06 AM
To: "Kohn, Frank" <frank_kohn@fws.gov>
Cc: FWHQ AIA-STAFF <fwhq_arl_aia-staff@fws.gov>

The apparent fall-out from Swaziland saying they have the same it would seem!

On Thu, May 5, 2016 at 7:25 AM, Kohn, Frank <frank_kohn@fws.gov> wrote:

> HTTP://WWW.NPR.ORG/SECTIONS/THETWO-WAY/2016/05/04/476749207/FACING-DROUGHT-ZIMBABWE-SAYS-IT-IS-SELLING-OFF-WILD-ANIMALS

--
Kathleen Moore
USFWS/Division of Management Authority
Branch of Permits, MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803
1-800-358-2104 (Phone)

Check out the new CITES species database at www.speciesplus.net to find out more information about how species are listed and protected under the Convention.

Barry, Anna <anna_barry@fws.gov>

Fwd: African Indaba April 2016, Volume 14-2

1 message

Vannorman, Tim <tim_vannorman@fws.gov> Thu, May 12, 2016 at 8:47 AM
To: FWHQ DMA-BOP-BIO'S <fwhq_dma_bop_bio@fws.gov>

I have not read this yet, but may be some information that would be useful for lions.

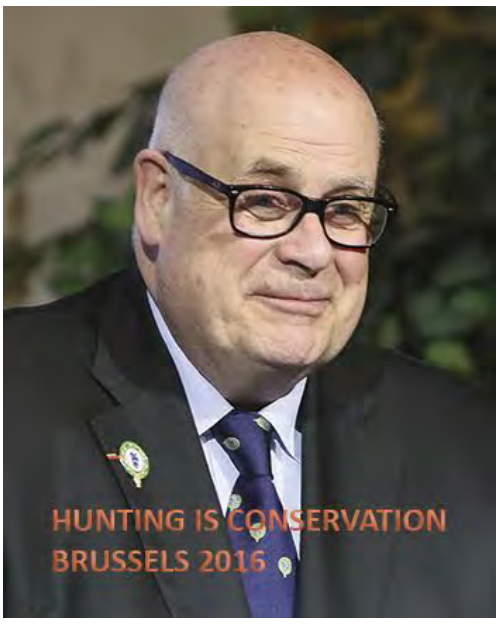
Tim

---------- Forwarded message ----------
From: African Indaba <indaba@cic-wildlife.org>
Date: Tue, Apr 19, 2016 at 2:47 AM
Subject: African Indaba April 2016, Volume 14-2
To: tim_vannorman@fws.gov

AFRICAN INDABA

DEDICATED TO THE PEOPLE
AND WILDLIFE OF AFRICA
Sponsored by the CIC

Welcome to April 2016 Issue of African Indaba



CIC Caprinae Atlas of the World

Contact CIC Headquarters
office@cic-wildlife.org,
Rowland Ward Publications
info@rowlandward.com,
Safari Press info@safaripress.com or
Gerhard@muskwa.co.za for ordering details.

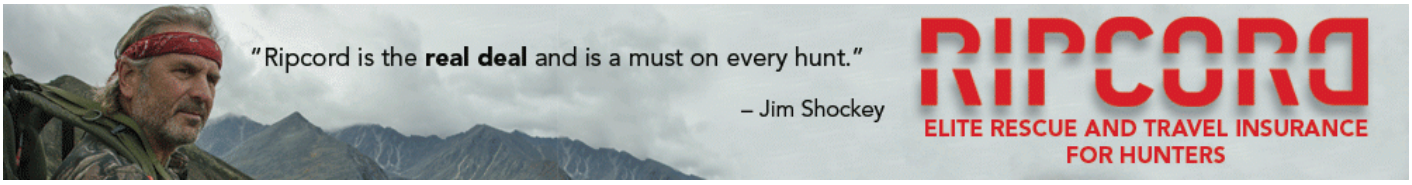
TROPHY HUNTING: informing responsible decision-making

On April 12th 2016 IUCN released a Briefing Paper aimed at informing discussions in the EU around import restrictions on hunting trophies. Trophy hunting is currently the subject of intense debate globally, with moves at various levels to end or restrict it. In the European Parliament, a group of Members have called for signing of a Declaration raising the possibility of restricting all import of trophies into the EU. This paper draws on a set of case studies to highlight that while there is considerable poor practice in trophy hunting and a strong need for reform, well managed trophy hunting can - and does -positively contribute to conservation and local livelihoods in the face of intense competing pressures on wildlife habitat and widespread poaching. You can download the Trophy Hunting Briefing Paper at the African Indaba Website or at the IUCN Website (subpage of the IUCN Sustainable Use and Livelihoods Specialist Group - a global expert network formed by IUCN as a joint initiative of the Species Survival Commission SSC and the Commission on Environmental, Economic and Social Policy CEESP).

Read our cutting edge hunting and conservation news from Africa online by clicking the individual articles below

1. Hunting is Conservation – Brussels 2016: Editorial by Bernard Lozé, CIC President >>
2. Prince William is Talking Sense – Trophy Hunting is Crucial to Conservation >>
3. Pro-Hunt Campaigning >>
4. European Sustainable Use Group ESUG >>
5. An Anti-Hunting Ideologue on a Flight of Fancy >>
6. Culling to Conserve: A Hard Truth for Lion Conservation >>
7. Zimbabwe Traditional Chiefs and EU Ambassador Van Damme in Wildlife Talks >>
8. Namibia: Significant Income Stream from Trophy Hunting Projected >>
9. US Court Overturns Bid to Stop Importation of Namibian Rhino Trophies >>
10. Working Together for Migratory Birds and People Across Africa and Eurasia >>
11. The Biggest Obstacles for Africa's Big Cats >>
12. News From and About Africa >>
13. Hunters and Anglers Pay for Conservation in USA >>
14. Decisions of the Scientific Review Group on Trade in Wild Fauna and Flora >>
15. Diana-Airguns Support CIC Anti Poaching Project >>
16. Rhino Poaching: What is the Solution? >>
17. Two "Famous" Lions Killed in Non-Hunting Kenya >>
18. Statement on Captive-Bred Lion Hunting and Associated Activities >>
19. Abstracts of Recently Published Wildlife Papers >>

To read and see the articles with photographs you can download a PDF file (0,8 MB) and print the April 2016 issue of African Indaba by clicking here.
Please forward this email to your friends and colleagues. Subscription to African Indaba is free of charge and everybody can subscribe online.
The current and all old issues of African Indaba are available for downloads in pdf format here.



African Indaba is mailed out by the CIC – International Council for Game and Wildlife Conservation and its Applied Science Division.
For more information about the CIC please go to www.cic-wildlife.org

Disclaimer: If you are not the intended recipient, you can unsubscribe here. This also applies if you want your address removed from the African Indaba Subscribers' list or if you feel that you did not give permission to receive African Indaba. All views and opinions expressed in this electronic message and its attachments do not necessarily reflect the views and opinions of the CIC – International Council for Game and Wildlife Conservation. The CIC, the publisher and the editors of African Indaba accept no liability whatsoever for any loss, damage or expense resulting directly or indirectly from the access of this email or any files, which are attached hereto.

International Council for Game and Wildlife Conservation
CIC Headquarters - H-2092 Budakeszi, PO Box 82, Hungary - Telephone: +36 23 453 830 - Fax: +36 23 453 832 - office@cic-wildlife.org

–
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

Study of the contribution of sustainable trophy hunting to the management and conservation of lion in Zimbabwe

Background

On the 23rd December 2015, the U.S. Fish and Wildlife Service (USFWLS), determined that the status of the lion subspecies from West Africa (*Panthera leo leo*) is endangered while the southern and eastern African subspecies (*P. l. melanochaita*) is threatened in terms of the Endangered Species Act of 1973, as amended (ESA)[1]. Consequently, the USFWLS published a rule under section 4(d) of the ESA that provides for conservation measures for *P. l. melanochaita*. This rule is effective from January 22, 2016 and is available on the Internet at http://www.regulations.gov.

In 2011, the USFWLS received a petition from several international animal welfare organisations requesting that the African lion subspecies be listed as endangered under the ESA. In 2012 the USFWLS published a ''positive'' 90-day finding confirming that it would initiate a status review of the African lion. In October 2014, the results of this review were published in the Federal Register concluding that the listing of the subspecies *Panthera leo leo* as a threatened species was warranted. Moreover, USFWLS proposed a rule under section 4(d) of the ESA to provide conservation measures for the African lion.

Following this announcement, USFWLS received additional comments from the public and peer reviewers that were taken into consideration to determine the final listing status of lion. This final rule incorporates changes based on the comments that were received as well as newly available scientific and commercial information that became available after the close of the comment period. In particular, USFWLS took into consideration additional information on the practices of trophy hunting that experts identified as undermining the sustainability of trophy hunting of lion populations. This prompted USFWLS to expand its assessment of the level of threat that trophy hunting presents to the species that resulted in further factors been take into consideration when making an enhancement finding for importation of sport-hunted trophies of *P. l. melanochaita.*

Information required to support Non-Detrimental Findings (NDF) under the 4(d) Rule for *Panthera leo melanochaita*

The purpose of the ESA is to provide a means whereby the ecosystems upon which endangered and/or threatened species depend may be conserved, to provide a programme for the conservation of such endangered and/or threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in the ESA. As a result, an import permit is now required under 50 CFR 17.32 for the

[1] The Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*), is a law that was passed in the USA to prevent extinction of species by providing measures to help alleviate the loss of species and their habitats. Before a plant or animal species can receive the protection provided by the Act, it must first be added to the Federal List of Endangered and Threatened Wildlife or the Federal List of Endangered and Threatened Plants in part 17 of title 50 of the Code of Federal Regulations (CFR). Section 4 of the Act and its implementing regulations at 50 CFR part 424 set forth the procedures for adding species to these lists.

importation of all *P. l. melanochaita* specimens. Therefore, through the promulgation of the 4(d) rule, all otherwise prohibited activities, including all imports of *P. l. melanochaita* specimens, require prior authorization or permits in terms of the ESA.

The regulations are covered under 50 CFR 17.32 which authorises the permit holder to carry out an otherwise prohibited activity for: scientific purposes, the enhancement of propagation or survival of the species, economic hardship, zoological exhibitions, educational purposes, or special purposes consistent with the purposes of the ESA. Applications for these activities are available from either *http://www.fws.gov/forms/3-200-20.pdf* or *http://www.fws.gov/forms/3-200-37.pdf.*

After extensively reviewing the available data regarding the biology and ecology of lion in Africa, and taking into consideration the benefits from sustainable hunting as well as the threats to continued survival of lion population in southern Africa, the USFWLS has identified the following factors that need to be provided in terms of the permitting regulations at 50 CFR 17.32. Specifically, the issuance criteria for threatened species permits are provided under 50 CFR 17.32(a)(2)), but do not specify what would constitute the enhancement of propagation or survival with regard to authorizing the import of parts or products of *P. l. melanochaita,* including sport-hunted trophies.

Therefore, when making a determination USFWLS will examine:

- The overall conservation and management of the subspecies in the country where the specimen originated;
- Whether that management of the subspecies addresses the threats to the subspecies (i.e., that it is based on sound scientific principles and that the management programme is actively addressing the current and longer term threats to the subspecies).
- Evaluate whether the import contributes to the overall conservation of the species by considering whether the biological, social, and economic aspects of a programme from which the specimen was obtained provide a net benefit to the subspecies and its ecosystem.

The Service will evaluate any application received that involves *P. l. melanochaita* in the context of enhancement of propagation or survival in accordance with its threatened species permitting regulations at 50 CFR 17.32, and issuance criteria for threatened species permits (50 CFR 17.32(a)(2)). These include, in addition to the general permitting criteria in 50 CFR 13.21(b):

(i) Whether the purpose for which the permit is required is adequate to justify removing from the wild or otherwise changing the status of the wildlife sought to be covered by the permit;
(ii) The probable direct and indirect effect that issuing the permit would have on the wild populations of the wildlife sought to be covered by the permit;
(iii) Whether the permit, if issued, would in any way, directly or indirectly, conflict with any known programme intended to enhance the survival probabilities of the population from which the wildlife sought to be covered by the permit was or would be removed;
(iv) Whether the purpose for which the permit is required would be likely to reduce the threat of extinction facing the species of wildlife sought to be covered by the permit;

2

(v) The opinions or views of scientists or other persons or organizations having expertise concerning the wildlife or other matters germane to the application; and
(vi) Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application.

In addition to these factors, particularly in relation to sport hunting, USFWLS will take into consideration the *IUCN Species Survival Commission (SSC) Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0* (IUCN SSC 2012), to assist them when making an enhancement finding for importation of sport-hunted trophies of *P. l. melanochaita.* This document sets out guidance on the use of trophy hunting as a tool for "*creating incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources*" (IUCN SSC 2012, p. 2) and recognizes that recreational hunting, particularly trophy hunting, can contribute to biodiversity conservation and more specifically, the conservation of the hunted species.

The SSC document lays out five guiding principles that, considered in conjunction with the USFWLS threatened species issuance criteria, will aid the Service when making an enhancement finding for importation of sport-hunted trophies of *P. l. melanochaita.* These are:

(a) *Biological sustainability:* The hunting programme cannot contribute to the long-term decline of the hunted species. It should not alter natural selection and ecological function of the hunted species or any other species that share the habitat. The programme should not inadvertently facilitate poaching or illegal trade in wildlife by acting as a cover for such illegal activities. The hunting programme should also not manipulate the ecosystem or its component elements in a way that alters the native biodiversity.

(b) *Net Conservation Benefit:* The biologically sustainable hunting programme should be based on laws, regulations, and scientifically based quotas, established with local input, that are transparent and periodically reviewed. The programme should produce income, employment, and other benefits to create incentives for reducing the pressure on the target species. The programme should create benefits for local residents to co-exist with the target species and other species. It is also imperative that the programme is part of a legally recognized governance system that supports conservation.

(c) *Socio-Economic-Cultural Benefit:* A well-managed hunting programme can serve as a conservation tool when it respects the local cultural values and practices. It should be accepted by most members of the community, involving and benefiting local residents in an equitable manner. The programme should also adopt business practices that promote long-term economic sustainability.

(d) *Adaptive Management: Planning, Monitoring, and Reporting:* Hunting can enhance the species when it is based on appropriate resource assessments and monitoring (*e.g.*, population counts, trend data), upon which specific science-based quotas and hunting programmes can be established. Resource assessments should be objective, well documented, and use the best science available. Adaptive management of quotas and programmes based on the results of resource assessments and monitoring is essential. The programme should monitor hunting activities to ensure that quotas and sex/age restrictions of harvested animals are met. The

3

programme should also generate reliable documentation of its biological sustainability and conservation benefits.

(e) *Accountable and Effective Governance:* A biologically sustainable trophy-hunting programme should be subject to a governance structure that clearly allocates management responsibilities. The programme should account for revenues in a transparent manner and distribute net revenues to conservation and community beneficiaries according to properly agreed decisions. All necessary steps to eliminate corruption should be taken and to ensure compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.

The Service's approach to enhancement findings for the importation of sport-hunted trophies of *P. l. melanochaita* is consistent with the purpose and intent of the Endangered Species Act. Before it will authorize the importation of a sport-hunted trophy, it must determine that the trophy hunting programme is managed to ensure the long-term survival of the species. In particular, the hunting programme should demonstrate that communities who share the same habitat and compete with humans living in these areas for space and resources benefit from the presence of wildlife.

Thus, when evaluating whether the importation of a trophy of *P. l melanochaita* would be authorized pursuant to 50 CFR 17.32, in accordance with the threatened species issuance criteria, USFWLS will examine how a country's management programme for lions addresses the following three main threats: Habitat loss, loss of prey base, and human-lion conflict.

Some of the factors taken into consideration include:

- Whether the programme is based on sound scientific information and identifies mechanisms that would arrest the loss of habitat or increase available habitat (i.e., by establishing protected areas and ensuring adequate protection from human encroachment).
- Whether the management programme actively address the loss of the lion's prey base by addressing poaching or unsustainable offtake within the country.
- A component of a management plan from which trophy imports would meet the issuance criteria would be whether there are government incentives in place that encourage habitat protection by private landowners and communities and incentives to local communities to reduce the incursion of livestock into protected areas or to actively manage livestock to reduce conflicts with lions.
- Examine if the hunting component of the management programme supports all of these efforts by looking at whether hunting concessions/tracts are managed to ensure the long-term survival of the lion, its prey base, and habitat.
- Examine if the trophy hunting provides financial assistance to the wildlife department to carry out elements of the management programme and if there is a compensation scheme or other incentives to benefit local communities that may be impacted by lion predation.
- Consider how a U.S. hunter's participation in the hunting programme contributes to the overall management of lions within a country.
- Management programmes for *P. l. melanochaita* would be expected to address, but are not limited to,
    - evaluating population levels and trends;
    - the biological needs of the species;

- quotas; management practices;
- legal protection;
- local community involvement; and
- use of hunting fees for conservation.

In evaluating these factors, USFWLS will work closely with the range country and interested parties to obtain the information. By allowing entry into the United States of *P. l. melanochaita* trophies from range countries that have science-based management programmes, it is anticipated that other range countries would be encouraged to adopt and financially support the sustainable management of lions that benefits both the species and local communities. In addition to addressing the biological needs of the subspecies, a scientifically based management programme would provide economic incentives for local communities to protect and expand *P. l. melanochaita* habitat.

Under this 4(d) rule any person wishing to conduct an otherwise prohibited activity, including all imports of *P. l. melanochaita* specimens, must first obtain a permit under 50 CFR 17.32. The onus is on individual requesting the import permit to provide all the information in their application showing that the activity meets the requirements for issuance criteria under 50 CFR 17.32.

Where it is not possible for the applicant to provide all of the necessary information needed by the USFWLS to make a positive determination under the ESA to authorize the activity, the Service will typically consult with the range country to the extent practicable and other interested parties to obtain necessary information.

The Service has the discretion to make the required findings on sport-hunted trophy imports of *P. l. melanochaita* on a country-wide basis, although individual import permits will be evaluated and issued or denied for each applicant. While the Service may make enhancement findings for sport-hunted trophy imports of *P. l. melanochaita* on a country-wide basis, the Service encourages the submission of information from individual applicants.

Steps taken to address the requirements of the 4(d) Rule for *Panthera leo melanochaita*

In 2006, the Zimbabwe Parks and Wildlife Management Authority (ZPWMA), with the help of IUCN, prepared the "**Conservation Strategy and Action Plan for the Lion (*Panthera leo*) in Zimbabwe".** Since then a number of detailed research programmes have been conducted in the Hwange National Park and surrounding protected areas as well as on private conservancies (Malilangwe, Bubye and Save). It has also introduced criteria to monitor the age of trophy hunted lions which in turn is used to assist with quota allocations using a points system.

More recently (2015) the ZPWMA prepared an initial report on the "**Conservation Status of the African Lion (*Panthera leo*) in Zimbabwe".** This report was submitted to the European Union and later to the USFWLS.

Scope of work

In conjunction with the Zimbabwe Parks and Wildlife Authority, Safari Operators Association (SOAZ), Zimbabwe Professional Hunters and Guides Association (ZPHGA) and the

CAMPFIRE Association, the consultant is expected to assess the requirements to fulfil the criteria called for under the 4(d) Ruling issued by the United Stated Fish and Wildlife Services. This will include, but is not limited to the following:

- Assess the overall legal and regulatory framework of the sport hunting sector, and indicate where these might be improved or better enforced.
- Assess the opportunities for improving the governance and transparency in the management of the lion hunting industry.
- Assess the opportunities in the non-government sector that could contribute to improving governance and management of wildlife and protected areas, with a special focus on community participation.
- Assess the reliability of data from the conservation and wildlife sector and indicate activities that may improve data collection for monitoring purposes.
- Assess the suitability of some of the policies and management practices developed in other countries in the region, and indicate opportunities for adapting these for the Zimbabwe setting.
- Identify the knowledge gaps required to complete the Zimbabwe NDF for lion in terms of the 50 CFR 17.32 Permit requirements
- Assist the ZPWMA to prepare the national NDF for lion in accordance with the requirements listed above.

Methodology

The assignment will be a combination of literature studies and limited field work. The consultant will work closely with the ZPWMA and ZPHGA to gather and analyse data related to the administration and management of lion conservation in the country. The consultant will liaise with relevant institutions on the government and non-government side, with selected researchers in national and international research entities with special expertise on the wildlife and conservation sector in Zimbabwe. Special attention is to be given to extracting key economic data from the safari hunting industry that clearly demonstrates its contribution to the conservation of lion in Zimbabwe. If necessary, the consultant will conduct a short field visit to at least one safari area, one CAMPFIRE Area and to a conservancy.

Time frame and reporting

The assignment will take place from 4th April till 27th May, 2016. The consultant will develop a draft report in conjunction with the ZPWMA and conduct a half-day workshop for the relevant stakeholders. The report will be in English, and will be of a maximum of 50 pages plus relevant annexes. The draft report should be submitted by 30th April, and a final report should be submitted one week after receiving written comments from the ZPHGA and ZPWMA.

Conservation Status of African Lion in Zimbabwe

3 messages

Barry, Anna <anna_barry@fws.gov> Thu, Jun 30, 2016 at 10:24 AM
To: snyasha@zimparks.co.zw
Cc: Tim Vannorman <tim_vannorman@fws.gov>

Dear Mr. Simukai Nyasha,

Again we wish to thank you for the information your office provided us regarding the status of lions in Zimbabwe. Tim asked me to contact you regarding a report mentioned in the "Study of the Contribution of Sustainable Trophy Hunting to the Management and Conservation of Lion in Zimbabwe" (see attached). In that document, it is mentioned that a report will be finalized during May 2016. If this report was prepared and finalized, we ask that you please send us a copy.

Thank you for all assistance in this matter.

Sincerely,

Anna Barry
Senior Biologist
USFWS/Division of Management Authority
Branch of Permits, MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803
1-800-358-2104, ext. 1976 or 703-358-1976
Fax: 703-358-2281
E-mail: Anna_Barry@fws.gov

Please be aware that we process application on a first come first serve basis and due to the number of applications we receive some delays are unavoidable.

Application Forms 3-200 (http://www.fws.gov/forms/display.cfm?number1=200) were revised and available May 2014. Please ensure the application that you complete expires 05/31/2017 (found on upper right hand corner of page 1) to avoid the application being returned. We do not accept applications via fax or e-mail.

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

Lion..pdf
238K

Simukai Nyasha <snyasha@zimparks.co.zw> Wed, Jul 6, 2016 at 5:11 AM
To: "Barry, Anna" <anna_barry@fws.gov>
Cc: Tim Vannorman <tim_vannorman@fws.gov>

Dear Anna Barry

Apologies for the late response, I was out of office. The study you are referring to is still underway. Basically the study is meant to to demonstrate that the lion population in Zimbabwe is being managed sustainably for benefit of both the species and local communities. We are hoping to conclude it before end of July. We will definitely sent you a copy once the study is finalised.

Regards

Simuk**ai Ny**asha

Interna ven er

Cell: +263-772 678 351

From: Barry, Anna [mailto:anna_barry@fws.gov]
Sent: Thursday, June 30, 2016 4:25 PM
To: snyasha@zimparks.co.zw
Cc: Tim Vannorman <tim_vannorman@fws.gov>
Subject: Conservation Status of African Lion in Zimbabwe

Dear Mr. Simukai Nyasha,

Again we wish to thank you for the information your office provided us regarding the status of lions in Zimbabwe. Tim asked me to contact you regarding a report mentioned in the "Study of the Contribution of Sustainable Trophy Hunting to the Management and Conservation of Lion in Zimbabwe" (see attached). In that document, it is mentioned that a report will be finalized during May 2016. If this report was prepared and finalized, we ask that you please send us a copy.

Thank you for all assistance in this matter.

Sincerely,

Anna Barry

Senior Biologist

USFWS/Division of Management Authority

Branch of Permits, MS: IA

5275 Leesburg Pike

Falls Church, VA 22041-3803

1-800-358-2104, ext. 1976 or 703-358-1976

Fax: 703-358-2281

E-mail: Anna_Barry@fws.gov

Please be aware that we process application on a first come first serve basis and due to the number of applications we receive some delays are unavoidable.

Application Forms 3-200 (http://www.fws.gov/forms/display.cfm?number1=200) were revised and available May 2014. Please ensure the application that you complete expires 05/31/2017 (found on upper right hand corner of page 1) to avoid the application being returned. We do not accept applications via fax or e-mail.

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

Barry, Anna <anna_barry@fws.gov> Thu, Jul 7, 2016 at 10:06 AM
To: Simukai Nyasha <snyasha@zimparks.co.zw>

Dear Simukai Nyasha,

Thank you for responding so quickly and we are looking forward to receiving the document.

Sincerely,

Anna Barry
Senior Biologist
USFWS/Division of Management Authority
Branch of Permits, MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803
1-800-358-2104, ext. 1976 or 703-358-1976
Fax: 703-358-2281
E-mail: Anna_Barry@fws.gov

Please be aware that we process application on a first come first serve basis and due to the number of applications we receive some delays are unavoidable.

Application Forms 3-200 (http://www.fws.gov/forms/display.cfm?number1=200) were revised and available May 2014. Please ensure the application that you complete expires 05/31/2017 (found on upper right hand corner of page 1) to avoid the application being returned. We do not accept applications via fax or e-mail.

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!



[Quoted text hidden]

Biological Conservation 201 (2016) 160–168

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/bioc

Aging traits and sustainable trophy hunting of African lions

Jennifer R.B. Miller [a,*], Guy Balme [a], Peter A. Lindsey [a,b], Andrew J. Loveridge [c], Matthew S. Becker [d,e], Colleen Begg [f], Henry Brink [g], Stephanie Dolrenry [h], Jane E. Hunt [c], Ingela Jansson [i], David W. Macdonald [c], Roseline L. Mandisodza-Chikerema [j], Alayne Oriol Cotterill [k], Craig Packer [l], Daniel Rosengren [m], Ken Stratford [n], Martina Trinkel [o], Paula A. White [p], Christiaan Winterbach [q], Hanlie E.K. Winterbach [q], Paul J. Funston [a]

[a] Panthera, 8 West 40th Street, 18th Floor, New York, NY 10018, USA
[b] Mammal Research Institute, Department of Zoology and Entomology, University of Pretoria, Pretoria, South Africa
[c] Wildlife Conservation Research Unit, Zoology Department, Oxford University, Tubney House, Abingdon OX135QL, UK
[d] Zambian Carnivore Programme, Box 80, Mfuwe, Eastern Province, Zambia
[e] Conservation Biology and Ecology Program, Department of Ecology, Montana State University, 310 Lewis Hall, Bozeman, MT 59717, USA
[f] Niassa Carnivore Project, The Ratel Trust, Cape Town, South Africa
[g] Selous Lion Project, PO Box 34514, Dar es Salaam, Tanzania
[h] Department of Biological Sciences, Conservation Conflict Research Institute, University of Cape Town, Rondebosch 7701, South Africa
[i] Department of Wildlife, Fish, and Environmental Studies, Swedish University of Agricultural Sciences, SE- 901 83 Umeå, Sweden
[j] Zimbabwe Parks and Wildlife Management Authority, PO Box CY140, Causeway, Harare, Zimbabwe
[k] Ewaso Lions, PO Box 14996, Nairobi 00800, Kenya
[l] Department of Ecology, Evolution & Behavior, University of Minnesota, 100 Ecology Building, 1987 Upper Buford Circle, St. Paul, MN 55108, USA
[m] Frankfurt Zoological Society, Bernhard-Grzimek-Allee 1, 60316 Frankfurt am Main, Germany
[n] Ongava Research Centre, Ongava Game Reserve, PO Box 58, Okaukeujo, Namibia
[o] School of Biological and Conservation Sciences, University of KwaZulu-Natal, Westville Campus, Private Bag 54001, Durban 4000, South Africa
[p] Center for Tropical Research, Institute of the Environment and Sustainability, University of California Los Angeles, 619 Charles E. Young Drive East, Los Angeles, CA 90095, USA
[q] Centre for Wildlife Management, University of Pretoria, Pretoria, South Africa

ARTICLE INFO

Article history:
Received 14 March 2016
Received in revised form 17 June 2016
Accepted 3 July 2016
Available online xxxx

Keywords:
Age-based hunting quota
Age determination
Minimum age threshold
Panthera leo
Pre-mortem aging
Sustainable harvest

ABSTRACT

Trophy hunting plays a significant role in wildlife conservation in some contexts in various parts of the world. Yet excessive hunting is contributing to species declines, especially for large carnivores. Simulation models suggest that sustainable hunting of African lions may be achieved by restricting offtakes to males old enough to have reared a cohort of offspring. We tested and expanded criteria for an age based approach for sustainably regulat ing lion hunting. Using photos of 228 known age males from ten sites across Africa, we measured change in ten phenotypic traits with age and found four age classes with distinct characteristics: 1 2.9 years, 3 4.9 years, 5 6.9 years, and ≥7 years. We tested the aging accuracy of professional hunters and inexperienced observers before and after training on aging. Before training, hunters accurately aged more lion photos (63%) than inexperienced observers (48%); after training, both groups improved (67 69%). Hunters overestimated 22% of lions <5 years as 5 6.9 years (unsustainable) but only 4% of lions <5 years as ≥7 years (sustainable). Due to the lower aging error for males ≥7 years, we recommend 7 years as a practical minimum age for hunting male lions. Results indicate that age based hunting is feasible for sustainably managing threatened and economically significant species such as the lion, but must be guided by rigorous training, strict monitoring of compliance and error, and conser vative quotas. Our study furthermore demonstrates methods for identifying traits to age individuals, information that is critical for estimating demographic parameters underlying management and conservation of age struc tured species.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

Trophy hunting can play a significant role in wildlife conservation by incentivising the conservation of animals and land in exchange for rec reational use. In Africa, hunting motivates the retention of vast blocks of state property for wildlife, generates over US$200 million annually across >20 countries, and encourages wildlife based land uses on large areas of community and private lands (Di Minin et al., 2015; Lindsey et al., 2007; Naidoo et al., 2016). However, poorly managed hunting can negatively affect animal populations by reducing genetic variation, increasing stress levels, changing animal behavior, and driv ing species decline (Aryal et al., 2015; Burke et al., 2008; Keehner et al., 2015; Packer et al., 2009; Rodríguez Muñoz et al., 2015). Excessive

* Corresponding author.
E-mail address: jmiller@panthera.org (J.R.B. Miller).

http://dx.doi.org/10.1016/j.biocon.2016.07.003
0006-3207/© 2016 Elsevier Ltd. All rights reserved.

trophy hunting has recently led to localized unsustainable exploitation of ecologically and economically important species, including elephants (Selier et al., 2014), leopards (Pitman et al., 2015), and lions (Bauer et al., 2015). The negative impacts of hunting in some areas contributed to 'Cecil gate' in 2015, prompting global public outcry and scrutiny over the use of trophy hunting as a management tool (Di Minin et al., 2015; Lindsey et al., 2016). In light of this recent media spotlight and increasing anthropogenic threats to species, science based techniques are urgently needed to guide the sustainable management of harvests if trophy hunting is to continue.

Most harvested species, particularly long lived large mammals, exhibit age and sex specific rates of survival and reproduction (Milner Gulland et al., 2007). Thus, age is a common metric used to guide the sustainable harvest and management of wildlife, including large carnivores, ungulates, and fish (Balme et al., 2012; Bender et al., 1994; Berkeley et al., 2004; Garel et al., 2006; Gipson et al., 2000; Hiller, 2014; Hoefs and Konig, 1984; Lundervold and Langvatn, 2003). Age based hunting addresses the age structured nature of populations by harvesting animals at certain age thresholds, which, in combination with conservative quotas, can help reduce negative demographic impacts (Whitman et al., 2004). The success of age based hunting depends on hunters' abilities to accurately age individuals, and requires traits that indicate relevant age thresholds and are easily discernible in the field. These indicators of age would be equally useful to enforcement authorities for ensuring that trophies meet permitted age thresholds. Because age structure is critical to understanding the dynamics of wildlife populations, determining precise indicators of age at biologically important life stages is also useful for wildlife research, management and conservation (Delahay et al., 2011; Van Horn et al., 2003). Here we investigate age determination and aging accuracy for African lions in an effort to test the feasibility of using age based trophy hunting regulations to manage and conserve threatened and economically significant species.

Lions are one of the most highly desired big game trophy species, and ensuring ecological and economic sustainability of lion hunting has been recently prioritised at national and international levels (Lindsey et al., 2013). Lion hunts attract some of the highest mean prices of all trophy species (US$24,000–125,000 per hunt) and produce 5–17% of national gross trophy hunting income in countries where lion hunting is allowed (Lindsey et al., 2012, 2007). Yet lion numbers are declining rapidly: the global population has decreased by as much as 42% over the past 21 years (3 generations) to 20,000–35,000 individuals (Bauer et al., 2015; Riggio et al., 2012). In many areas, excessive trophy harvests have contributed to declines in the southern and eastern African subspecies (Groom et al., 2014; Loveridge et al., 2007; Packer et al., 2011, 2009; Rosenblatt et al., 2014). Concerns over lion population decline led Australia and France in 2015–2016 to ban lion trophy imports and resulted in the United States uplisting some lion subspecies to 'Endangered' on the Endangered Species Act (Milman, 2015; U.S. Fish and Wildlife Service, 2015; Vaughan, 2015).

Modelling studies that have assessed the impact of age based trophy hunting on lion demography indicate that sustainable trophy hunting may be achieved by restricting offtakes to males old enough to have reared their first cohort of offspring, or ≥5 years of age (note that harvesting females is not sustainable; Edwards et al., 2014; Packer et al., 2009; Whitman et al., 2007, 2004). Following these guidelines, Tanzania, Zimbabwe and Niassa National Reserve in Mozambique began implementing age based hunting restrictions in 2007–2013. In these ongoing programmes, age restrictions are paired with quotas revised annually based on compliance with age limits, whereby operators that harvest males equal or older than 5–6 years are 'rewarded' the following year with an equal or higher quota, and operators harvesting males <4–5 years are 'punished' with reduced quotas (age limits vary between countries; Begg and Begg, 2012; Mandisodza et al., 2009; Wildlife Division, 2012). The implementation of age restrictions has resulted in reduced lion quotas and harvests in all three countries in which they have been implemented. Reduced harvests may be due to greater selectivity on the part of hunters, and/or due to the relatively low number of old male lions in hunted populations. Some professional hunters, safari operators, and conservationists have resisted the implementation of age restrictions, citing insufficient scientific evidence for which physical traits are the most reliable indicators of lion age, and disputing the practicality of accurately aging lions in the field.

Age based hunting systems require simple methods for aging quarry *pre mortem* in the field with high precision. In the case of lions, the harvest of younger males (<5 years) has a particularly significant impact due to the removal of individuals before they have raised a litter of cubs to independence and the associated risk of infanticide following the removal of pride males (Whitman et al., 2004). In the countries where age restrictions on lions are in place, lion ages are assessed *post mortem* based on teeth size, wear, and development (often using dental radiographs) and skull ossification (using weight and cranial sutures; Ferreira and Funston, 2010a; Smuts et al., 1978; Wildlife Division, 2012). The utility of various potential aging cues *pre mortem* is currently less clear. Only one trait has been suggested as a reliable *pre mortem* indicator of age: nose pigmentation, which grows darker as lions age (Whitman et al., 2004). However, the correlation between nose pigmentation and age has only been studied in the Serengeti population of lions and doubt has been raised as to whether the relationship holds across Africa (Lindsey et al., 2013). Furthermore, nose darkness can be challenging to assess in the field under varying light and visibility, especially from a distance.

A more practical and effective strategy for aging lions *pre mortem* would be to identify a suite of traits that that can be collectively referenced to accurately estimate a lion's age, as has been recently done for leopards (Balme et al., 2012). Because professional hunters often use camera trap photographs to identify animals suitable for trophy hunting, and wildlife managers and researchers use photographs to study individuals and monitor populations, characteristics that are easily identifiable from photographs would be especially useful in aging individuals. Previous studies have identified several candidate traits (Ferreira and Funston, 2010a). Males' manes grow with age, however length can be influenced by injury, testosterone, and nutrition (Smuts, 1980; West and Packer, 2002). Mane colour typically darkens with age but can vary with ambient temperature (West and Packer, 2002; West et al., 2006). Facial scarring and slack jowl also increase with age, with older individuals appearing pockmarked and loose jowled (Schaller, 1972; Smuts, 1980; West et al., 2006). In order for these traits to be used as reliable indicators of age, the relationship with age should ideally show low variation between individuals and across regions to establish consistent aging guidelines. Furthermore, practitioners should be able to easily grasp associations between traits and age to achieve high aging accuracy.

We aimed to identify distinct phenotypic traits for determining *pre mortem* age and to test the utility of these traits for accurately aging male lions. Using an extensive photo dataset of known age male lions from ten long term study sites across eastern and southern Africa, we examined associations between physical characteristics and age in a suite of traits between individual lions and across regions. Finally, we tested how accurately practitioners could age lions with varying levels of hunting experience as well as before and after training. We discuss the applicability of our results for use in the conservation and management of harvested large carnivores and their broader implications for the future conservation of lions and other threatened and economically significant species.

2. Methods

We collected 601 high resolution photographs (≥150 dpi) of 228 known age male lions (1–16 photos per individual and 92 individuals with >1 photo) from ten long term study sites across eastern and

southern Africa: the Okavango Delta region (n = 17) in Botswana; Kgalagadi Transfrontier Park (n = 3) in Botswana and South Africa; the Amboseli Tsavo ecosystem (n = 17) and Laikipia (n = 2) in Kenya; Niassa National Reserve (n = 14) in Mozambique; Etosha National Park (n = 3) in Namibia; Kruger National Park (n = 29) in South Africa; Serengeti National Park (n = 48), Selous Game Reserve (n = 11), and Ngorongoro Conservation Area (n = 21) in Tanzania; South Luangwa Valley (n = 19) in Zambia; and Hwange National Park (n = 44 individuals) in Zimbabwe. These sites represent a broad range in elevation (340 1820 m) and climate (arid, warm temperate, and equatorial zones; Fig. 1). Lion populations at these sites have been intensively studied for extended periods. Cubs were typically first seen at 3 8 weeks of age and subsequently identified from natural markings (e.g., whisker spots, ear notches, scars; Packer and Pusey, 1993) and/or through radio collaring. Dates of parturition were estimated from the mother's denning behavior and lactation stains and from physical development in comparison to other cubs of known birthdates (Pusey and Packer, 1994). Only photographs of individuals first viewed at <3 months of age were included to enable high precision in aging.

2.1. Aging traits

For each photo, author JRBM used sliding scales to score the characteristics of ten phenotypic traits (Table 1): mane development; mane colouration of the chest, neck, shoulder, and forehead; teeth colour and wear; facial scarring; slack jowl; and nose darkness. These traits were known indicators of age in different lion populations (Ferreira and Funston, 2010a; Smuts et al., 1978; West et al., 2006; Whitman and Packer, 2007). Traits were scored in a photo only when they were clearly visible (e.g. teeth traits were scored only in photos of yawning lions). Mane development and colour were assessed using single or paired photos that clearly displayed all upper body parts of the individual.

To test the repeatability of scoring, two naïve observers (graduate students unfamiliar with the study) scored a random subset of 14 50 photos per trait (Balme et al., 2012; Loehr et al., 2008). We compared scores given by students and JRBM using a repeated measures ANOVA with an error term of 'photo/observer' to test for differences between scores in each photo. Student scores were comparable to those given by JRBM, indicating high repeatability (mane development: $F_{2,64}$ =

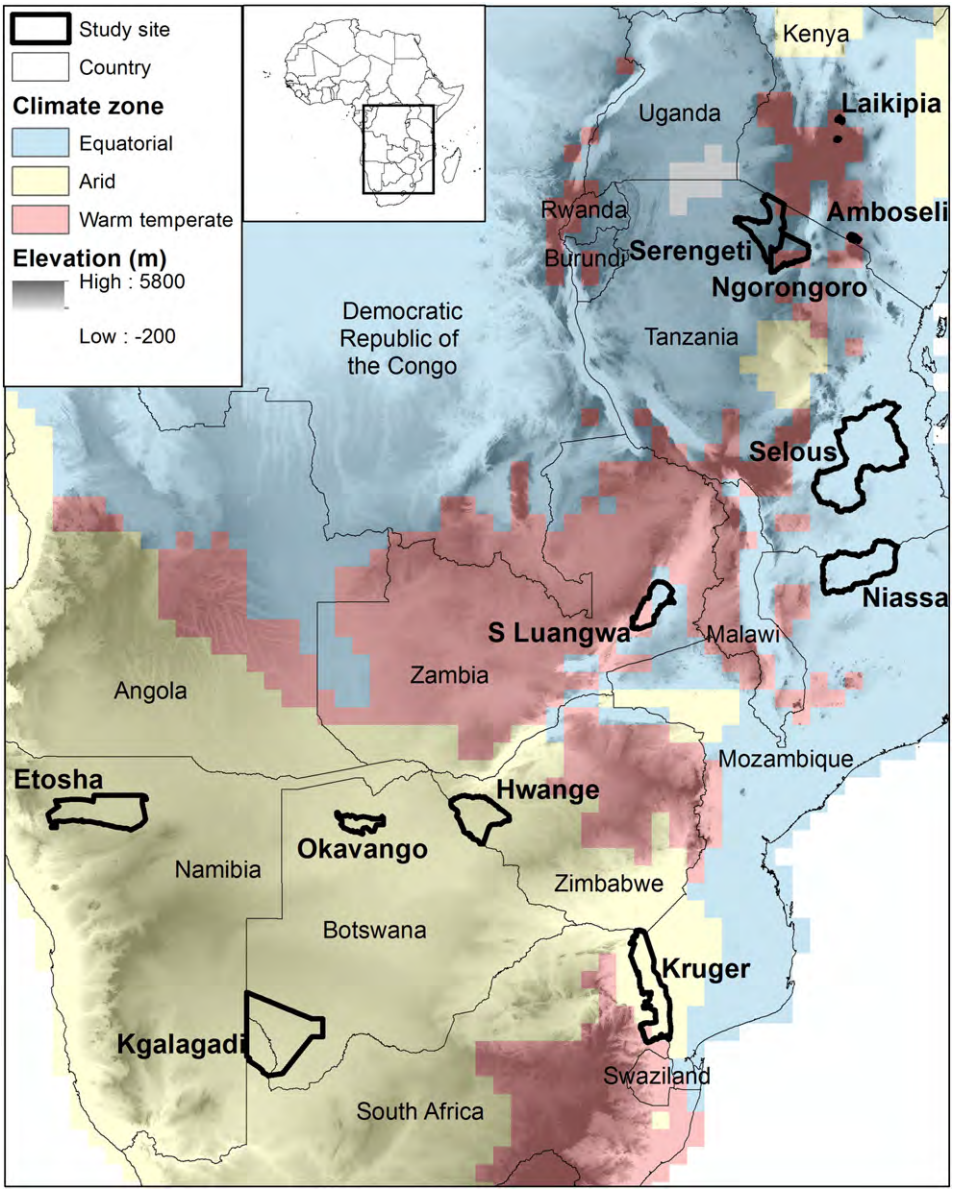


Fig. 1. Map of study sites in Africa with respect to climate zones and elevation.

Table 1
Score descriptions for the phenotypic traits assessed in known-age male lions.

Trait	Scoring code	Characteristics
Mane development	1	No or very short hair around face and on chest and neck
	2	Short hair around face and on chest and neck; Mohawk not visible
	3	Short Mohawk visible; bare patches between Mohawk and ears
	4	Long Mohawk with bare patches between Mohawk and ears; full around face and chest; incomplete on shoulder
	5	Fully developed, with forehead section fully filled between ears; some growth but mostly incomplete on shoulder
	6	Fully developed, with forehead section fully filled between ears; shoulders filled in
	7	Fully developed but thinning; the end of the hair looks fuzzy or frayed and/or the mane may thin or fall out in sections
Chest, neck, shoulder and forehead mane darkness (independent score for each)	1	Blonde
	2	Light brown
	3	Dark brown
	4	Black
Teeth colour	1	White
	2	Light yellow
	3	Dark yellow
Teeth wear	1	No wear (sharp)
	2	Slightly worn or chipped
	3	Heavily worn, very flat and very chipped
Facial scarring	1	Unscarred
	2	Lightly scarred or pocked
	3	Heavily scarred or pocked
Slack jowl	1	Absent: lower and upper lips tightly meet when mouth closed (not drooping)
	2	Present: lower lip obviously droops apart from top lip and downward when mouth closed
Nose darkness	0%	No black, all pink
	10%	Between 0 and 10% black
	20%	Between 10 and 20% black
	30%	Between 20 and 30% black
	40%	Between 30 and 40% black
	50%	Between 40 and 50% black
	60%	Between 50 and 60% black
	70%	Between 60 and 70% black
	80%	Between 70 and 80% black
	90%	Between 80 and 90% black
	100%	All black, no pink

2.352, $P = 0.103$; chest mane colour: $F_{2,64} = 0.267$, $P = 0.767$; neck mane colour: $F_{2,64} = 2.596$, $P = 0.082$; shoulder mane colour: $F_{2,64} = 0.195$, $P = 0.823$; forehead mane colour: $F_{2,64} = 0.209$, $P = 0.812$; slack jowl: $F_{2,60} = 1.000$, $P = 0.374$; teeth colour: $F_{2,26} = 1.560$, $P = 0.229$; teeth wear: $F_{2,26} = 1.368$, $P = 0.272$; facial scarring: $F_{2,56} = 1.314$, $P = 0.277$; nose darkness: $F_{2,96} = 2.731$, $P = 0.070$).

A previous study had found a correlation between nose darkness and age by digitally quantifying the proportion of black pigmentation pixels in the nose (Whitman et al. 2004). To test whether digital assessment differed from human scoring by eye, we additionally measured nose darkness with a similar digital method. Using Adobe Photoshop CS6 v.13.0.6, we clipped the fleshy part of the nose in each photo and set the colour value threshold to differentiate between the 'black' versus 'not black' (pink) portions of the nose. We then used the histogram tool to calculate the percentage of black nose pixels. To determine whether nose darkness differed by age between measurements made 'by eye' and digitally, we ran a Pearson correlation and tested whether values were comparable for each photo using a repeated measures ANOVA.

We examined the age associated with scores for each trait using ANOVA with Tukey post hoc tests to see which scores significantly differed by age range. To identify which characteristics within a trait could be used to determine age, we grouped together adjacent score categories when doing so produced significantly different age classes. For example, we initially measured nose darkness with 11 categories (0%, 10%, …90%, 100% black) but some of these categories (e.g. 0% and 10%) did not differ significantly in age. In these cases, non-significance indicated natural variation in the trait within an age and we grouped the adjacent score categories into a single group for analysis (e.g. 0–10%). To test how well each trait predicted age, we used linear mixed effects models to model 'age' by 'trait score' (fixed effect) with a random intercept effect of 'site' and 'individual' within each site ('site/individual' in the model) to account for pseudo-replication due to the availability of multiple photographs for some individuals and for the clustering of individuals with sites. We assessed model fit using the conditional R^2, a standard metric which describes the proportion of variance explained by both the fixed and random factors (Johnson, 2014). We additionally investigated how mane colouration changed with age by body part. We did this by running ANOVA tests on scores by age, with age grouped into 1-year age classes, and compared colouration scores by body part. All traits data were normally distributed.

We also explored whether trait development varied for lions in different geographical regions and climates. In particular, mane development and colour have been suggested to vary regionally and with temperature and humidity (West and Packer, 2002). We therefore tested how traits varied with elevation (data from the CGIAR-CSI SRTM; Jarvis et al., 2008) and climate zone (Koppen-Geiger Climate Classification, major zone; Kottek et al., 2006). Regional variable values were calculated as the mean of pixels within each study site boundary (data from The World Database on Protected Areas; IUCN and UNEP-WCMC, 2015) using zonal statistics in ArcGIS (Table A1). We added the interaction term 'trait score' * 'regional variable' to the previous linear mixed effects models and ran Chi-square tests to determine whether the regional variable significantly improved the model. Effects of regional variation were tested for all traits except slack jowl and facial scarring due to uneven sample sizes across regions. All statistical tests were run in R v.3.1.3 (R Development Core Team 2008).

2.2. Aging accuracy

A subset of known-age male lion photos was used to measure the effectiveness of training with phenotypic traits on improving accuracy in aging lions. We tested accuracy levels before and after training using a survey consisting of three sections: (1) a "pre-test", where participants aged individuals in 32 photos based on their baseline knowledge of lions; (2) a training, where participants reviewed brief educational materials on the traits for recognising lion age (based on the traits analysis); and (3) a "post-test", where participants aged individuals in 32 different photos. Participants were asked to assign the lions in photos to one of four age classes: (1) 1–2.9 years, (2) 3–4.9 years, (3) 5–6.9 years, and (4) ≥7 years. Because participants' ability to distinguish between the middle two age classes (3–4.9 years and 5–6.9 years) have the greatest implications for sustainable trophy hunting, to reduce variance we included in each section ten photos for each of the middle age classes and six photos for each the youngest and oldest age classes. Most traits were visible in all photos except for teeth colour and wear, which were not included in the survey assessment or training because photos with these traits excluded most other traits (e.g. featured only the mouth).

We conducted the anonymous survey online with two groups: professional hunters, who are responsible for determining which individual lions are suitable for clients to harvest, and inexperienced observers (college students), who offered a baseline for comparison against

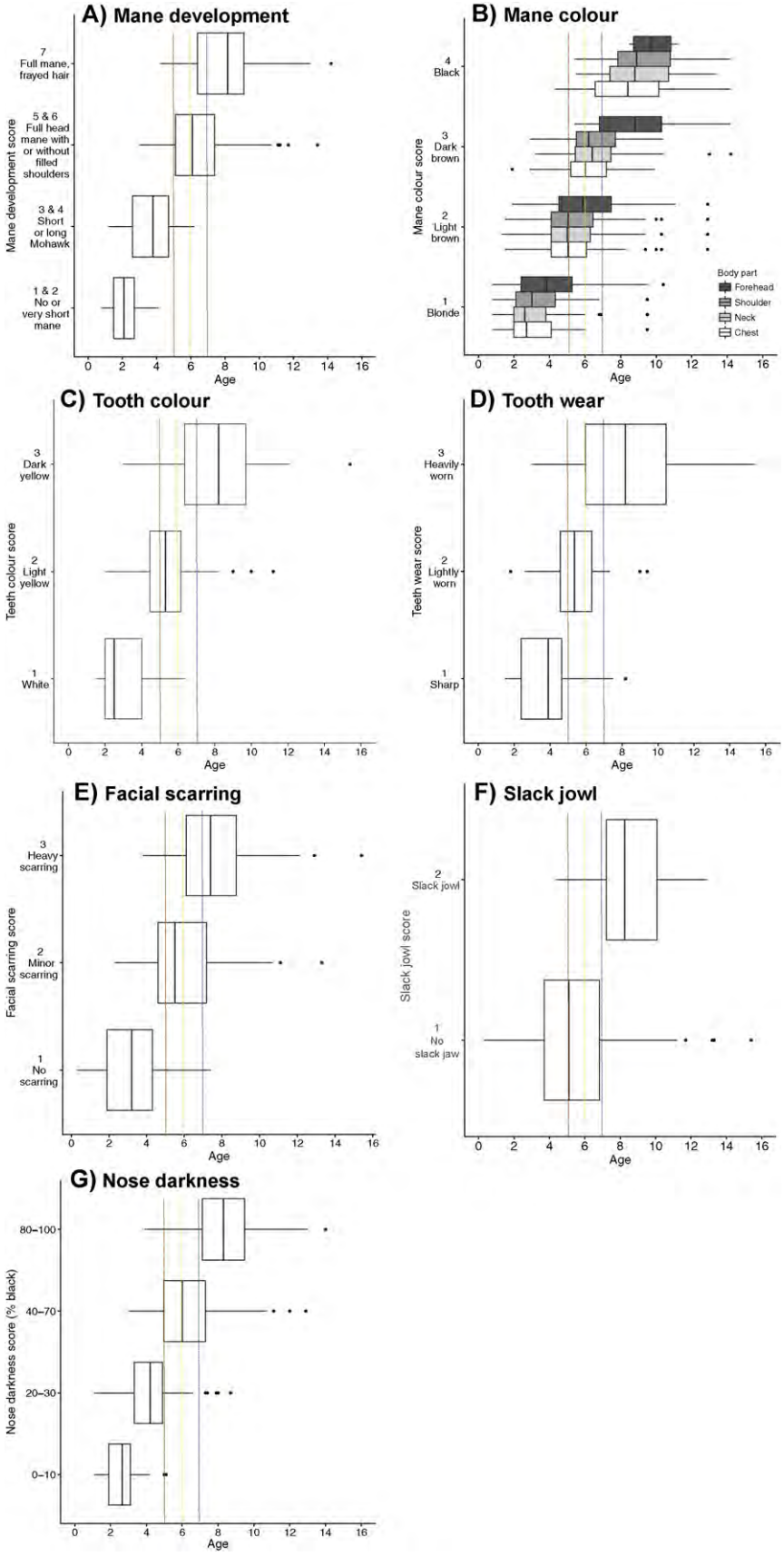


Fig. 2. Relationship between phenotypic traits and age in male lions in study sites across Africa for (A) mane development, (B) mane colour, (C) teeth colour, (D) teeth wear, (E) facial scarring, (F) slack jowl, and (G) nose darkness. Boxes indicate the lower, median and upper quartiles; horizontal lines represent the sample minimum and maximum; dots represent outliers. Vertical lines mark traits at 5 (orange), 6 (yellow), and 7 (blue) years of age. Data represents photographs of individual lions (see Methods for details). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

hunters. To explore how experience influenced participants' accuracy in aging, we asked both students and hunters how many hunts (any species) they had participated in and whether they had previously received education on aging lions. We additionally asked hunters how many years they had worked as professional hunters, how many lion hunts they had attended, and whether they had previously participated in a lion hunt that followed age restrictions. We included these data as predictor variables in multivariate linear regressions with a response variable of aging accuracy score for each participant group before and after training. We calculated each participant's aging accuracy score for the pre and post test sections as the percentage of correctly aged photos. We compared scores between sections and participants using unpaired and paired t tests with equal variances, respectively. We also examined which lion ages were most often categorised accurately by calculating the mean percentage of photos assigned to each of the four age classes and used ANOVA to compare differences by age class.

3. Results

3.1. Aging traits

For all ten phenotypic traits, age was strongly predicted by score (statistics below) and varied across scores (Fig. 2; mane development: $F_{6,210} = 37.17$, $P < 0.001$; chest mane colour: $F_{3,213} = 68.30$, $P < 0.001$; neck mane colour: $F_{3,213} = 55.19$, $P < 0.001$; shoulder mane colour: $F_{3,213} = 65.77$, $P < 0.001$; forehead mane colour: $F_{3,213} = 44.45$, $P < 0.001$; teeth colour: $F_{2,90} = 33.82$, $P < 0.001$; teeth wear: $F_{2,90} = 36.72$, $P < 0.001$; facial scarring: $F_{2,189} = 59.47$, $P < 0.001$; slack jowl: $F_{1,208} = 22.21$, $P < 0.001$; nose darkness [by eye]: $F_{10,306} = 41.17$, $P < 0.001$). Traits showed overlap in the ages associated with some scores, especially for mane development and nose darkness. Post hoc analyses revealed that compiling mane and nose darkness scores each into four categories of characteristics produced significantly distinct age classes between scores ($P < 0.006$ and $P < 0.0002$, respectively; Fig. 2A, Fig. 2G); all other traits showed significant differences in age between scores without grouping ($P < 0.01$; except mane forehead colour between dark brown and black, $P = 0.858$). Four age classes could be distinguished based on the revised grouping of trait characteristics: 1 2.9 years, 3 4.9 years, 5 6.9 years, and ≥7 years.

By age class, the majority of males (≥50%) 1 2.9 years of age were characterised by a smooth face (no facial scarring), tight jowl (no slack jowl), no mane or a small Mohawk, blonde hair colour on the chest, neck, shoulder, and forehead, sharp white teeth, and nose darkness of 0 30% black (Fig. 2). Most males 3 4.9 years showed a smooth face or light facial scarring, tight jowl, large Mohawk or full mane, blonde or light brown hair colour on the chest, neck, shoulder, and forehead, sharp or lightly worn light yellow teeth, and nose darkness of 20 60% black. Males 5 6.9 years predominantly showed light facial scarring, tight jowl, full mane, light or dark brown mane colour on the chest, neck, shoulder, and forehead, lightly or heavily worn light yellow teeth, and nose darkness of 40 70% black. Most males ≥7 years showed light or heavy facial scarring, full mane with or without fraying hair, black mane colour on the chest, neck, shoulder and forehead, lightly or heavily worn dark yellow teeth, nose darkness of 40 100% black, and a tight jowl. Jowl slackness was a unique identifying characteristic for the oldest age class: though only 24% of lions ≥7 years old showed slack jowls, 73% of individuals with slack jowls were ≥7 years old (Table A2).

Trait score, but not elevation or climate zone, was a significant predictor of ages associated with mane development (score: $t_{196} = 14.338$, $P < 0.001$, $R^2 = 0.73$; $P > 0.4$ for all Chi square tests with regional variables) and colour (chest: $t_{214} = 13.963$, $P < 0.001$, $R^2 = 0.74$; neck: $t_{216} = 12.386$, $P < 0.001$, $R^2 = 0.70$; shoulder: $t_{216} = 13.747$, $P < 0.001$, $R^2 = 0.73$; forehead: $t_{216} = 9.865$, $P < 0.001$, $R^2 = 0.55$; $P > 0.3$ for all Chi square tests), nose darkness ($t_{306} = 18.704$, $P < 0.001$, $R^2 = 0.78$; $P > 0.20$ for all Chi square tests), and teeth colour ($t_{76} = 7.749$, $P < 0.001$, $R^2 = 0.62$; $P > 0.07$ for all Chi square tests) and wear ($t_{77} = 7.765$, $P < 0.001$, $R^2 = 0.60$; $P > 0.4$ for all Chi square tests). Assessments of nose darkness made by eye and digital methods were statistically correlated ($r = 0.825$, $t_{315} = 25.938$, $P < 0.001$) and numerically equivalent ($F_{1,316} = 0.367$, $P = 0.545$; Fig. 3). Though not statistically significant, we observed differences in mane development by climate. Lion manes appear to grow more slowly and sparsely at sites in the equatorial climate zone (Selous and Niassa) than in warm temperate or arid climates, causing these individuals to resemble lions 2 3 years younger than same aged individuals in other sites (Fig. S1).

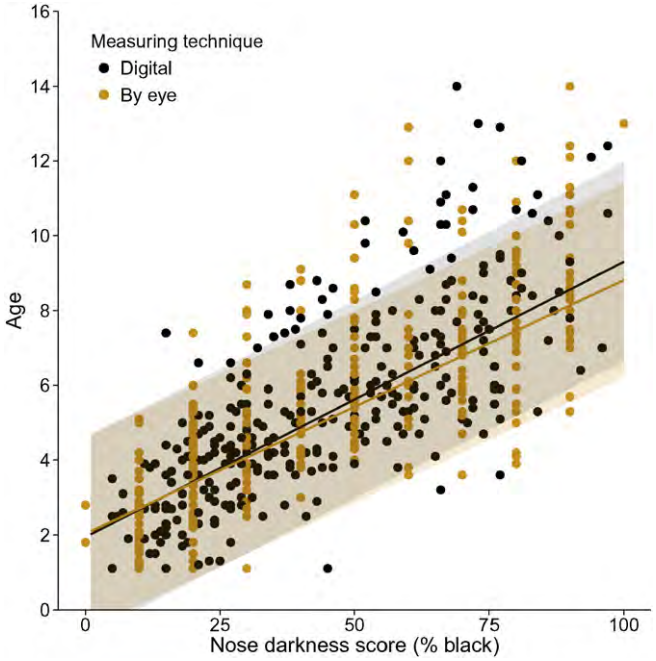


Fig. 3. Differences in nose darkness with age by measuring technique. Each point represents a different photograph of an individual lion; in some cases (64 out of n = 138 individuals), the same individual was measured at multiple ages. Lines represent linear mixed model predictions; shaded ribbons represent 95% prediction intervals (orange = by eye; grey = digital).

3.2. Aging accuracy

Fifty three professional hunters and 52 students completed the survey. Hunter participants averaged 16 years of professional hunting experience (range of 1 40 years) in numerous African countries, primarily Tanzania (45%), Zimbabwe (45%), South Africa (30%), Namibia (21%), Zambia (19%) and/or Mozambique (17%; note that most hunters worked in more than one country). Nearly all hunters (92%) had previously participated in a lion hunt, with 42% having attended >20 lion hunts, and 62% had attended lion hunts with age restrictions on harvested individuals. However, less than half (43%) had previously received education (participated in a training or read educational materials) on aging lions. The majority of students had never participated in a wildlife hunt (65%) and had never received education on aging lions (90%).

Professional hunters scored significantly higher than students before training (mean percent of correctly aged photos for hunters = 63 ± 2% [standard error], range of 38 78%; students = 48 ± 2%, range 22 78%; $t_{103} = -5.897$, $P < 0.001$) and similarly to students after training (hunters: 69 ± 1%, range 44 84%; students: 67 ± 2%, range 38 88%; $t_{103} = -0.783$, $P = 0.435$). Paired t tests revealed that both hunters and students scored higher after training ($t_{52} = -3.274$, $P = 0.002$ and $t_{51} = -8.129$, $P < 0.001$, respectively). Students improved significantly more than hunters ($t_{103} = 4.350$, $P < 0.001$), increasing their accuracy by an average of 19 ± 2 percentage points compared to 6 ± 2 for

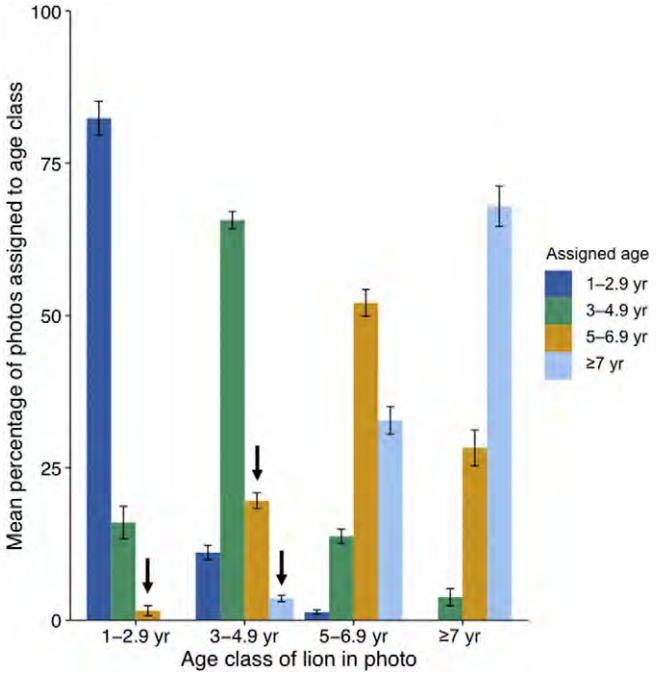


Fig. 4. Mean percentage of male lion photos assigned to different age classes by professional hunters compared to the actual age of the lion photo. Correctly aged lion photos are indicated where the assigned age (colour) matches the age class of the lion photo (x-axis). Arrows indicate lions <5 years that were overestimated as ≥5 years (unsustainable harvest). Bars indicate standard error (n = 53 participants).

hunters. Linear regression found no associations between aging accuracy and experience variables for either hunters or students before ($F_{8,44} = 1.282$, adjusted $R^2 = 0.042$, $P = 0.278$; $F_{4,47} = 3.197$, adjusted $R^2 = 0.147$, $P = 0.021$, respectively) or after training ($F_{8,44} = 1.539$, adjusted $R^2 = 0.077$, $P = 0.172$; $F_{4,47} = 2.532$, adjusted $R^2 = 0.107$, $P = 0.527$, respectively).

The percentage of lions accurately aged assigned by hunters after training significantly differed among all age classes except 3–4.9 years and ≥7 years ($F_{3,208} = 24.350$, $P < 0.001$; Tukey post hoc $P = 0.920$, $P < 0.001$ for all other pairs). Hunters most accurately aged 1–2.9 year old lions (82% correct) and least accurately aged 5–6.9 year old lions (52%); 3–4.9 year olds and ≥7 year olds were aged with 67% and 68% accuracy, respectively (Fig. 4). Hunters overestimated the age of 20% of 3–4.9 year olds and 2% of 1–2.9 year olds by miscategorising photos as 5–6.9 years, and 4% of 3–4.9 year olds as ≥7 years. Hunters underestimated the age of 15% of 5–6.9 year olds and 4% of ≥7 year olds by miscategorising photos as <5 years old.

4. Discussion

The ability to age individual animals in wildlife populations is necessary for informed wildlife management and conservation as well as sustainable, age-selective hunting of threatened, high-valued species. Our study revealed a suite of phenotypic traits in African lions that conspicuously change with age at biologically meaningful intervals. Most of these traits are consistent across regions, and can be used *pre mortem* to categorise individuals by age class with a moderate to high degree of accuracy. Most importantly, these traits do help in distinguishing the minimum age threshold of ≥5 years recommended for sustainable harvest of lions (Whitman et al., 2004). However, our results revealed that a large proportion (22%) of 'underage' lions (<5 years) were mistakenly overestimated to be 5–6.9 year olds, or suitable for hunting according to current age-based hunting systems in several African countries. This high error rate in critical age classes should be further investigated and suggests that an older minimum age threshold (e.g. ≥7 years) may be a more practical threshold for achieving sustainable harvests.

We found that that no single trait can be relied upon exclusively to precisely age lions; rather, multiple traits must be examined in combination to cross-validate an individual's age. For example, our findings corroborate previous evidence that nose darkness can be used for aging following the "50% rule" (lions with noses ≥50% black are on average ≥5 years; Whitman et al., 2004) by the human eye (in addition to digital measurement). Yet nose darkness showed such high variation around this age threshold (25% of lions with noses ≥50% black were <5 years old and 10% were <4 years old) such that nose darkness should not be used as alone to estimate age. Referring to nose darkness as well as mane development, facial scarring, and teeth colour and wear will account for age variation within each trait and improve the accuracy of age assessment. An exception is slack jowl, which was a strong indicator of older lions when present, although only one-third of lions ≥7 years old showed slack jowls. Due to large overlap in mane colour among ages, we did not find this trait to be useful for precisely determining age.

Based on synchronised development across the suite of phenotypic traits, we were able to categorise lions into four age classes that also corresponded to important biological stages of development: 1–2.9 years (dependent and non-reproductive), 3–4.9 years (independent and beginning to reproduce), 5–6.9 years (prime reproductive age), ≥7 years (final reproductive years and past prime, non-reproductive). For carnivores and lions in particular, precisely estimating an animal's age is necessary for assessing population demographic parameters, such as survival and reproduction, to manage and conserve species. Thus, in addition to assisting hunters, these classes may be especially informative to wildlife researchers and managers for assessing individual behavior and population structure.

Surprisingly, we did not find statistically significant regional variation in mane development or colour by age. This contrasts with previous studies that have documented shorter length, lower density, and slower growth rates as well as blonder colour in the manes of lions living at warmer and more humid climates (Kays and Patterson, 2002; Patterson et al., 2006; West and Packer, 2002; Fig. A1). We attribute this result to our small sample size of mane photos from sites in the equatorial climate zone (n = 6 compared to n = 103 from arid and n = 108 from warm temperate zones). If our sample size for this climate zone had been larger, we suspect that our results would have mirrored the findings of previous studies. Consequently, in sites where manes are short and sparse, such as Selous and Niassa, we recommend that other traits in addition to mane development be used for aging lions.

Accuracy survey results suggest that, with rigorous training, people with varying levels of experience can use phenotypic traits to accurately age lions. Both inexperienced observers and hunters improved their accuracy scores after training, with inexperienced observers scoring on par with hunters. The fact that both hunters and inexperienced observers scored similarly after training suggests a proficiency threshold, after which more intense training is necessary to improve; however, this threshold is likely test-specific (e.g. dependent on the number and quality of photos). Hunters improved only 6% after training, emphasizing a need for a more rigorous training than our survey provided. Considering that the online training was self-administered, computer-based, and brief (10 min), participants would likely further improve their accuracy through a more comprehensive, interactive, and field-based training. The need for adequate training cannot be stressed enough, as the success of age-based hunting is fundamentally dependent on hunters' abilities to accurately age. Until a rigorous training program which raises hunters' aging accuracy to acceptable levels (which must also be determined by management authorities) can be developed, quotas and minimum age thresholds must account for large margins of error. Our finding that previous experience with hunting or aging did not improve participants' lion aging abilities aligns with previous findings from a similar aging assessment of African leopards (Balme et al., 2012).

Hunters were least successful in aging lions in the 5 6.9 year age class, the most important age threshold for sustainable lion offtake. Hunters mis categorised and overestimated 24% of 3 4.9 year old lions to be of suitable hunting age (≥5 years), which in the field would have resulted in unsustainable harvest. Notably, hunters also underestimated 15% of photos of 5 6.9 year olds and 4% of ≥7 year olds as ages unsuitable for sustainable hunting, which could benefit lion conservation by allowing these males in their prime reproductive stage to sire additional offspring. The effects of such aging errors on lion demography and conservation have not been well studied (Whitman et al., 2007). Government agencies may wish to consider raising the minimum age threshold to ≥7 years as a more assured way of achieving sustainability by accounting for aging error. The traits that characterise ≥7 year old lions are more unique and distinct than those associated with younger age classes, and although some 5 6.9 year old lions were mis categorised as ≥7 year old and vice versa, very few 'underage' lions (<5 years) were mis categorised as ≥7 years (4%). This suggests that setting a minimum age threshold of 7 years would be more likely to achieve sustainable rates of hunting because individuals that are inaccurately aged would be mistaken as ≥5 years, the minimum age for sustainable offtake assuming no effect of aging error (Whitman et al., 2004). Lions ≥7 years old are also more likely to have successfully reproduced and raised at least one litter to maturity, thus reducing the impacts of infanticide (Bertram, 1975; Packer, 2001). Fi nally, this threshold is in line with emerging evidence that ≥7 years is a more sustainable minimum harvest age for lions in some parts of Afri ca (Creel et al., 2016). If 7 years were legally set as a minimum thresh old, a simple rule could be to restrict harvest to lions with slack jowls or to lions with majority black noses (>60% black), heavy facial scarring, and dark yellow and heavily worn teeth (an appearance which could also potentially be more desirable to hunters).

In the age based quota systems of Mozambique, Tanzania, and Zimbabwe, punishments and rewards based on trophy ages are decided through age validation using *post mortem* assessment con ducted by wildlife government authorities. Many of these assess ments are made based on photographs of the trophy head and side body that are required to be submitted with hunt return forms. The trait characteristics identified in our study (with the exception of slack jowl) could assist authorities in more precisely estimating ages and regulating harvests.

Our results indicate the importance of education and outreach for improving the aging skills of wildlife professionals. We recommend that hunting operators and authorities prioritise and consider requir ing trainings for professional hunters. Lion aging techniques could be included more widely in the curricula and final examination of hunting courses as a prerequisite for licensing, as is the case in Zimbabwe with lions, in the United States with mountain lions (http://cpw.state.co.us/thingstodo/Pages/LionExam.aspx, accessed February 2016), and is being developed in South Africa for leopards. Several lion aging guides have already been produced (Whitman and Packer, 2007; Whitman, 2010), and we reiterate the need for simple, user friendly resources and consistent messaging to improve the aging ability of wildlife profes sionals. The results of this study have been developed into hardcopy and digital resources which are freely accessible online (http://AgingTheAfricanLion.org) and are being actively shared with hunting operators and wildlife managers, researchers, and conservation practitioners.

The tractability of age based hunting systems has ramifications for international policy level decision making about lion conservation and the economic markets tied to the hunting industry. Age restrictions and adaptive quota systems that are transparent and properly imple mented may offer more realistic and attainable metrics for sustainability than wildlife population assessments (Creel et al., 2016; Whitman et al., 2004). We recommend that agency authorities in market countries, such as the U.S. Fish and Wildlife Service, consider the use of age restric tions and adaptive quota systems for making decisions about trophy imports. Until alternatives to trophy hunting can be found to support conservation (Lindsey et al., 2016), we recommend that these agencies work with range countries to develop and monitor age based hunting quotas that are adequately conservative to achieve desired conservation goals for each lion population.

The implications of our study also extend beyond hunting and lions. Age determination is a critical component of accurately estimating the demographic parameters (recruitment, survival, dis persal, population size) of wildlife populations for successful conser vation and management (Becker et al., 2013; Ferreira and Funston, 2010b; Skalski et al., 2005). Because tracking individual animals is rarely logistically or monetarily feasible, the ability to accurately and non invasively age from physical appearance may help to inter pret social interactions as well as population dynamics. The aging traits identified in our study could be used in numerous applications, including aging individuals involved in research (e.g. animals collared for telemetry or photographed in camera trap surveys), human wildlife conflict (e.g. captured problem animals), tourism and nature education (e.g. animals seen on safari or in documen taries), and in populations where close monitoring is required due to intense poaching or other pressures. Several of the lion aging traits identified by our study have been relevant for other species, such as African leopards (Balme et al., 2012), European badgers (Delahay et al., 2011), grey wolves (Gipson et al., 2000), and spotted hyenas (Van Horn et al., 2003), and we hope that our methodology will serve as a model for age determination in other species.

The recent illegal killing of 'Cecil the lion' placed an international spotlight on African trophy hunting that questioned the integrity of hunting practices and the future value of hunting for funding conserva tion (Di Minin et al., 2015; Lindsey et al., 2016). If lion trophy hunting is to continue, practices must at least adhere to science based regulations and achieve population sustainability. We present practical criteria to support an age based hunting system for lions that would reduce over harvest and that could potentially halt the decline of the species in hunted populations. This could benefit hunting operators and profes sional hunters at multiple scales by assisting compliance with recent in ternational regulations requiring hunting to have a net positive impact on lion populations, by securing the financial stability of trophy hunting (Lindsey et al., 2012) and by improving trophy quality (Whitman et al., 2004). Zimbabwe and Niassa National Reserve in Mozambique, which began implementing age based lion trophy hunting over the past few years, are reporting successes in the management of lion hunting that include increasing lion trophy age, hunt success, and population size. In demonstrating a reliable toolset for aging, we hope that this study fa cilitates continued and increasing positive outcomes in these countries as well as others that choose to sustainably manage wildlife for the long term.

Acknowledgements

We express our thanks to the hunters and students who participated in our survey and the professional hunters associations who worked to increase participation. Special thanks to N. Fordyce, M. Lewis, N. Okes, and S. Viljoen for assistance with the study. This manuscript benefited from feedback from members of the Cornell University Human Dimen sions Graduate Seminar and several anonymous reviewers. Finally, we wish to acknowledge the government agencies, hunting operators, and professional hunters that have embraced and encouraged age based hunting as a sustainable practice.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.biocon.2016.07.003.

References

Aryal, A., Dhakal, M., Panthi, S., Yadav, B., Shrestha, U., Bencini, R., Raubenheimer, D., Ji, W., 2015. Is trophy hunting of bharal (blue sheep) and Himalayan tahr contributing to their conservation in Nepal? Hystri http://dx.doi.org/10.4404/hystrix-26.2-11210.

Balme, G.A., Hunter, L.T.B., Braczkowski, A.R., 2012. Applicability of age-based hunting regulations for African leopards. PLoS One 7, 1–9. http://dx.doi.org/10.1371/journal.pone.0035209.

Bauer, H., Chapron, G., Nowell, K., Henschel, P., Funston, P.J., Hunter, L.T.B., Macdonald, D.W., Packer, C., 2015. Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas. Proc. Natl. Acad. Sci. 112, 14894–14899. http://dx.doi.org/10.1073/pnas.1500664112.

Becker, M.S., Watson, F.G.R., Droge, E., Leigh, K., Carlson, R.S., Carlson, A.A., 2013. Estimating past and future male loss in three Zambian lion populations. J. Wildl. Manag. 77, 128–142. http://dx.doi.org/10.1002/jwmg.446.

Begg, C.M., Begg, K.S., 2012. The status of lions and their threats in Niassa National Reserve, Mozambique. Technical Report Produced for SRN, Maputo.

Bender, L.C., Roloff, G.J., Haufler, J.B., 1994. Antler characteristics as an age discriminator in Michigan elk (*Cervus elaphus*). Am. Midl. Nat. 132, 401–404.

Berkeley, S.A., Hixon, M.A., Larson, R.J., Love, M.S., 2004. Fisheries sustainability via protection of age structure and spatial distribution of fish populations. Fisheries 29, 23–32. http://dx.doi.org/10.1577/1548-8446(2004)29[23:FSVPOA]2.0.CO;2.

Bertram, B., 1975. Social factors influencing reproduction in wild lions. J. Zool. 177, 463–482.

Burke, T., Page, B., van Dyk, G., Millspaugh, J., Slotow, R., 2008. Risk and ethical concerns of hunting male elephant: behavioural and physiological assays of the remaining elephants. PLoS One 3. http://dx.doi.org/10.1371/journal.pone.0002417.

Creel, S., M'Soka, J., Droge, E., Rosenblatt, E., Becker, M., Matandiko, W., Simpamba, T., 2016. Assessing the sustainability of African lion trophy hunting, with recommendations for policy. Ecol. Appl. http://dx.doi.org/10.1002/eap.1377.

Delahay, R.J., Walker, N., Gunn, M.R., Christie, C., Wilson, G.J., Cheeseman, C.L., Mcdonald, R.A., 2011. Using lifetime tooth-wear scores to predict age in wild Eurasian badgers: performance of a predictive model. J. Zool. 284, 183–191. http://dx.doi.org/10.1111/j.1469-7998.2011.00796.x.

Di Minin, E., Leader-Williams, N., Bradshaw, C.J.A., 2015. Banning trophy hunting will exacerbate biodiversity loss. Trends Ecol. Evol. 2037, 1–4. http://dx.doi.org/10.1016/j.tree.2015.12.006.

Edwards, C.T.T., Bunnefeld, N., Balme, G.A., Milner-Gulland, E.J., 2014. Data-poor management of African lion hunting using a relative index of abundance. Proc. Natl. Acad. Sci. 111, 539–543. http://dx.doi.org/10.1073/pnas.1219615110.

Ferreira, S.M., Funston, P.J., 2010a. Age assignment to individual African lions. S. Afr. J. Wildl. Res. 40, 1–9. http://dx.doi.org/10.3957/056.040.0103.

Ferreira, S.M., Funston, P.J., 2010b. Estimating lion population variables: prey and disease effects in Kruger National Park, South Africa. Wildl. Res. 37, 194–206. http://dx.doi.org/10.1071/WR09030.

Garel, M., Cugnasse, J.M., Hewison, A.M., Maillard, D., 2006. Errors in age determination of mouflon in the field. Wildl. Soc. Bull. 34, 300–306. http://dx.doi.org/10.2193/0091-7648(2006)34.

Gipson, P., Ballard, W., Nowak, R., Mech, L., 2000. Accuracy and precision of estimating age of gray wolves by tooth wear. J. Wildl. Manag. 64, 752–758.

Groom, R.J., Funston, P.J., Mandisodza, R., 2014. Surveys of lions *Panthera leo* in protected areas in Zimbabwe yield disturbing results: what is driving the population collapse? Oryx 48, 385–393. http://dx.doi.org/10.1017/S0030605312001457.

Hiller, T., 2014. Comparison of two age-estimation techniques for cougars. Northwest. Nat. 95, 77–82.

Hoefs, M., Konig, R., 1984. Reliability of aging old dall sheep ewes by the horn annulus technique. J. Wildl. Manag. 48, 980–982.

IUCN, UNEP-WCMC, 2015. The World Database on Protected Areas (WDPA). www.protectedplanet.net (accessed 10.1.15).

Jarvis, A., Reuter, H., Nelson, A., Guevara, E., 2008. Hole-filled SRTM for the Globe Version 4. CGIAR-CSI SRTM 90 m Database.

Johnson, P.C.D., 2014. Extension of Nakagawa & Schielzeth's R^2_{GLMM} to random slopes models. Methods Ecol. Evol. 5, 944–946. http://dx.doi.org/10.1111/2041-210X.12225.

Kays, R.W., Patterson, B.D., 2002. Mane variation in African lions and its social correlates. Can. J. Zool. 80, 471–478. http://dx.doi.org/10.1139/z02-024.

Keehner, J.R., Wielgus, R.B., Maletzke, B.T., Swanson, M.E., 2015. Effects of male targeted harvest regime on sexual segregation in mountain lion. Biol. Conserv. 192, 42–47. http://dx.doi.org/10.1016/j.biocon.2015.09.005.

Kottek, M., Grieser, J., Beck, C., Rudolf, B., Rubel, F., 2006. World map of the Köppen-Geiger climate classification updated. Meteorol. Z. 15, 259–263. http://dx.doi.org/10.1127/0941-2948/2006/0130.

Lindsey, P.A., Balme, G.A., Booth, V.R., Midlane, N., 2012. The significance of African lions for the financial viability of trophy hunting and the maintenance of wild land. PLoS One 7. http://dx.doi.org/10.1371/journal.pone.0029332.

Lindsey, P.A., Balme, G.A., Funston, P.J., Henschel, P., Hunter, L.T.B., 2016. Life after Cecil: channeling global outrage into funding for conservation in Africa. Conserv. Lett. 0, 1–5. doi:http://dx.doi.org/10.1007/s13398-014-0173-7.2

Lindsey, P.A., Balme, G.A., Funston, P.J., Henschel, P., Hunter, L.T.B., Madzikanda, H., Midlane, N., Nyirenda, V., 2013. The trophy hunting of African lions: scale, current management practices and factors undermining sustainability. PLoS One 8, 1–11. http://dx.doi.org/10.1371/journal.pone.0073808.

Lindsey, P.A., Roulet, P.A., Romañach, S.S., 2007. Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. Biol. Conserv. 134, 455–469. http://dx.doi.org/10.1016/j.biocon.2006.09.005.

Loehr, J., Carey, J., Ylönen, H., Suhonen, J., 2008. Coat darkness is associated with social dominance and mating behaviour in a mountain sheep hybrid lineage. Anim. Behav. 76, 1545–1553. http://dx.doi.org/10.1016/j.anbehav.2008.07.012.

Loveridge, A.J., Searle, A.W., Murindagomo, F., Macdonald, D.W., 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biol. Conserv. 134, 548–558. http://dx.doi.org/10.1016/j.biocon.2006.09.010.

Lundervold, M., Langvatn, R., 2003. A comparison of age estimation methods for the saiga antelope *Saiga tatarica*. Wildl. Biol. 9, 219–227.

Mandisodza, R., Lindsey, P.A., Funston, P.J., Loveridge, A.J., 2009. Lion Aging and Adaptive Quota Management: The Application of the Points System in Zimbabwe in 2014. Zimbabwe.

Milman, O., 2015. Australia bans hunting "trophies" from lions entering or leaving the country. Guard 12–13.

Milner-Gulland, E.J., Nilsen, E.B., Andreassen, H.P., 2007. Demographic side effects of selective hunting in ungulates and carnivores. Conserv. Biol. 21, 36–47.

Naidoo, R., Weaver, L.C., Diggle, R.W., Matongo, G., Stuart-Hill, G., Thouless, C., 2016. Complementary benefits of tourism and hunting to communal conservancies in Namibia. Conserv. Biol. 30, 628–638. http://dx.doi.org/10.1111/cobi.12643.

Packer, C., 2001. Infanticide is no fallacy. Am. Anthropol. 102, 829–857.

Packer, C., Brink, H., Kissui, B.M., Maliti, H., Kushnir, H., Caro, T., 2011. Effects of trophy hunting on lion and leopard populations in Tanzania. Conserv. Biol. 25, 142–153. http://dx.doi.org/10.1111/j.1523-1739.2010.01576.x.

Packer, C., Kosmala, M., Cooley, H.S., Brink, H., Pintea, L., Garshelis, D., Purchase, G., Strauss, M., Swanson, A., Balme, G.A., Hunter, L.T.B., Nowell, K., 2009. Sport hunting, predator control and conservation of large carnivores. PLoS One 4, e5941. http://dx.doi.org/10.1371/journal.pone.0005941.

Packer, C., Pusey, A.E., 1993. Should a lion change its spots? Nature http://dx.doi.org/10.1038/362595a0.

Patterson, B.D., Kays, R.W., Kasiki, S.M., Sebestyen, V.M., 2006. Developmental effects of climate on the lion's mane (*Panthera leo*). J. Mammal. 87, 193–200. http://dx.doi.org/10.1644/05-MAMM-A-226R2.1.

Pitman, R.T., Swanepoel, L.H., Hunter, L.T.B., Slotow, R., Balme, G.A., 2015. The importance of refugia, ecological traps and scale for large carnivore management. Biodivers. Conserv. http://dx.doi.org/10.1007/s10531-015-0921-9.

Pusey, A.E., Packer, C., 1994. Non-offspring nursing in social carnivores: minimizing the costs. Behav. Ecol. http://dx.doi.org/10.1093/beheco/5.4.362.

Development Core Team, R., 2008. R: A Language and Environment for Statistical Computing. Vienna, Austria.

Riggio, J., Jacobson, A., Dollar, L., Bauer, H., Becker, M.S., Dickman, A.J., Funston, P.J., Groom, R., Henschel, P., de Iongh, H., Lichtenfeld, L., Pimm, S., 2012. The size of savannah Africa: A lion's (*Panthera leo*) view. Biodivers. Conserv. 22, 17–35. http://dx.doi.org/10.1007/s10531-012-0381-4.

Rodríguez-Muñoz, R., del Valle, C.R., Bañuelos, M.J., Mirol, P., 2015. Revealing the consequences of male-biased trophy hunting on the maintenance of genetic variation. Conserv. Genet. 16, 1375–1394. http://dx.doi.org/10.1007/s10592-015-0747-8.

Rosenblatt, E., Becker, M.S., Creel, S., Droge, E., Mweetwa, T., Schuette, P.A., Watson, F., Merkle, J., Mwape, H., 2014. Detecting declines of apex carnivores and evaluating their causes: an example with Zambian lions. Biol. Conserv. 180, 176–186. http://dx.doi.org/10.1016/j.biocon.2014.10.006.

Schaller, G.B., 1972. The Serengeti Lion: A Study of Predator-prey Relations. University of Chicago Press, Chicago.

Selier, S.A.J., Page, B.R., Vanak, A.T., Slotow, R., 2014. Sustainability of elephant hunting across international borders in southern Africa: A case study of the greater Mapungubwe Transfrontier conservation area. J. Wildl. Manag. 78, 122–132. http://dx.doi.org/10.1002/jwmg.641.

Skalski, J., Ryding, K., Millspaugh, J., 2005. Wildlife Demography: Analysis of Sex, Age, and Count Data. Elsevier Inc., Burlington, MA.

Smuts, G.L., 1980. Comparative growth of wild male and female lions (panthera leo.pdf).

Smuts, G.L., Anderson, J.L., Austin, J., 1978. Age determination of the African lion. J. Zool. 185, 115–146.

U.S. Fish and Wildlife Service, 2015. Endangered and threatened wildlife and plants; listing two lion subspecies. Fed. Regist. 80, 80000–80056.

Van Horn, R.C., McElhinny, T.L., Holekamp, K.E., 2003. Age estimation and dispersal in the spotted hyena (*Crocuta crocuta*). J. Mammal. 84, 1019–1030. http://dx.doi.org/10.1644/BBa-023.

Vaughan, A., 2015. France Bans Imports of Lion Hunt Trophies Considers Stricter Controls on Other Species 1–2.

West, P.M., MacCormick, H., Hopcraft, G., Whitman, K.L., Ericson, M., Hordinsky, M., Packer, C., 2006. Wounding, mortality and mane morphology in African lions, *Panthera leo*. Anim. Behav. 71, 609–619. http://dx.doi.org/10.1016/j.anbehav.2005.06.009.

West, P.M., Packer, C., 2002. Sexual selection, temperature, and the lion's mane. Science 297, 1339–1343. http://dx.doi.org/10.1126/science.1073257.

Whitman, K.L., 2010. Pocket Guide to Aging Lions. Conservation Force.

Whitman, K.L., Packer, C., 2007. A Hunter's Guide to Aging Lions in Eastern and Southern Africa. Safari Press, Long Beach, California.

Whitman, K.L., Starfield, A.M., Quadling, H., Packer, C., 2007. Modeling the effects of trophy selection and environmental disturbance on a simulated population of African lions. Conserv. Biol. 21, 591–601. http://dx.doi.org/10.1111/j.1523-1739.2007.00700.x.

Whitman, K.L., Starfield, A.M., Quadling, H.S., Packer, C., 2004. Sustainable trophy hunting of African lions. Nature 428, 175–178. http://dx.doi.org/10.1038/nature02395.

Wildlife Division, 2012. Comment on ESA Status Review of the African Lion. Tanzania.

Received Date : 04-Mar-2016

Revised Date : 02-May-2016

Accepted Date : 12-May-2016

Article type : Articles

Assessing the sustainability of African lion trophy hunting, with recommendations for policy.

Scott Creel[1,2,*], Jassiel M'soka[3], Egil Dröge[1,2], Eli Rosenblatt[1,2], Matt Becker[1,2], Wigganson Matandiko[1,2] & Twakundine Simpamba[4]

1: Zambian Carnivore Programme, P.O. Box 80 Mfuwe, Eastern Province, ZAMBIA

2: Department of Ecology, Montana State University, Bozeman, Montana 59717 USA

3: Department of National Parks and Wildlife, South Luangwa National Park, P.O. Box 18, Mfuwe, ZAMBIA

4: Department of National Parks and Wildlife, Private Bag 1, Kafue Road, Chilanga, ZAMBIA

***Corresponding author**: screel@montana.edu, 406-994-7033

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1002/eap.1377
This article is protected by copyright. All rights reserved.

Accepted Article

ABSTRACT: While trophy hunting provides revenue for conservation, it must be carefully managed to avoid negative population impacts, particularly for long-lived species with low natural mortality rates. Trophy hunting has had negative effects on lion populations throughout Africa, and the species serves as an important case study to consider the balance of costs and benefits, and to consider the effectiveness of alternative strategies to conserve exploited species. Age-restricted harvesting is widely recommended to mitigate negative effects of lion hunting, but this recommendation was based on a population model parameterized with data from a well-protected and growing lion population. Here, we used demographic data from lions subject to more typical conditions, including source-sink dynamics between a protected National Park and adjacent hunting areas in Zambia's Luangwa Valley, to develop a stochastic population projection model and evaluate alternative harvest scenarios. Hunting resulted in population declines over a 25-year period for all continuous harvest strategies, with large declines for quotas greater than 1 lion/concession (~0.5 lion/1000 km^2) and hunting of males younger than 7 years. A strategy that combined periods of recovery, an age limit of ≥ 7 years and a maximum quota of ~0.5 lions shot per 1000 km^2 yielded a risk of extirpation < 10%. Our analysis incorporated the effects of human encroachment, poaching and prey depletion on survival, but assumed that these problems will not increase, which is unlikely. These results suggest conservative management of lion trophy hunting with a combination of regulations. To implement sustainable trophy hunting while maintaining revenue for conservation of hunting areas, our results suggest that hunting fees must increase as a consequence of diminished supply. These findings are broadly applicable to hunted lion populations throughout Africa, and to inform global efforts to conserve exploited carnivore populations.

Keywords: trophy hunting, extinction risk, population dynamics, carnivore, *Panthera leo*

This article is protected by copyright. All rights reserved.

Accepted Article

Large carnivores are declining globally (Estes et al. 2011), with important consequences for ecosystem structure and function (Pace et al. 1999; Scheffer et al. 2001; Terborgh & Estes 2013). These declines are well-exemplified by the lion (*Panthera leo*), Africa's largest carnivore, for which suitable habitat has declined by approximately 75% in recent decades (Riggio et al. 2013). Lion numbers have decreased in parallel with their habitat, and only 10 'stronghold' populations – stable, protected populations of more than 500 individuals – currently persist (Bauer & Van Der Merwe 2004; Packer et al. 2013; Riggio et al. 2013; Bauer et al. 2015; Riggio et al. 2016). As with many other apex carnivores, most large, free-ranging lion populations are limited by a combination of habitat loss, prey depletion, direct conflict and retaliatory killing, wire-snare poaching and trophy hunting (Yamazaki 1996; Ogada et al. 2003; Bauer & Van Der Merwe 2004; Loveridge et al. 2007; Packer et al. 2009; Packer et al. 2011; Becker et al. 2013; Becker et al. 2013; Rosenblatt et al. 2014).

For lions and all other exploited species, trophy hunting is unique because it is intentional and legal, and thus more easily controlled than other limiting factors (Creel et al. 2015). In 2015, the US Fish and Wildlife Service listed lions in Western and Central Africa as endangered and those in Eastern and Southern Africa as threatened under the Endangered Species Act. This listing decision found evidence for "practices that experts have identified as undermining the sustainability of trophy hunting" and included an explicit rule that body parts from lions killed in trophy hunts can only be imported from nations with "a scientifically sound management program that benefits the subspecies in the wild" (U.S.Fish and Wildlife Service 2015). Due to concern over population decline, poor recruitment and a decrease in the age of lions being shot in Game Management Areas adjacent to South Luangwa National Park, the Zambia Wildlife Authority implemented a moratorium on lion hunting for 2013-2015 (Rosenblatt et al. 2014). It

This article is protected by copyright. All rights reserved.

is unusual that a limiting factor can be switched off so directly (Rutledge et al. 2010; Creel et al. 2015), but hunting is also unusual because it provides revenue that can contribute to conservation, and from this economic perspective, lions are one the most important of Africa's hunted species (Creel & Creel 1997; Packer et al. 2011; Lindsey et al. 2013; U.S.Fish and Wildlife Service 2015). Well-regulated hunting has the potential to contribute to lion conservation, but data show that overharvesting has contributed to their current decline (Packer et al. 2011; Lindsey et al. 2013; Rosenblatt et al. 2014), and the ecological, cultural and economic importance of lions mandates careful attention to these issues (Creel et al. 2015).

Empirical Studies of Trophy Hunting Effects on Lions

Lions, like most large carnivores, have low adult mortality rates in the absence of human effects, making it unlikely that hunting simply substitutes for other causes of death (Rosenblatt et al. 2014; Creel et al. 2015), and data confirm that some lion populations are affected by overhunting. Loveridge et al. (2007) examined lions in Hwange National Park (Zimbabwe) in an area of 7129 km^2, of which 83% was within the National Park where hunting is not allowed, and 17% was within adjacent communal lands, safari areas and hunting concessions. Of 62 individuals marked on this site, trophy hunting accounted for 63% of 38 individuals who died or disappeared. The proportion of the population comprised of adults males declined from 26.3% to 13.7% during a period of 4 years over which the offtake of males doubled. Of marked, territorial males in this population, 72% were killed by trophy hunters, at a mean distance of 1.5 km from the park boundary. Thus in the Hwange region, sport hunting is largely based on source-sink harvesting of lions from the national park, and not on sustainable offtake of lions residing within the hunting areas themselves (a phenomenon that Loveridge termed the 'vacuum effect').

This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

Rosenblatt et al (2014) found similar results for lions on a 2775 km^2 study site centered on the Luangwa River (Zambia), including portions of South Luangwa National Park (SLNP, which does not allow hunting) and the adjacent Lupande and Lumimba Game Management Areas (GMAs, which allow hunting). Lupanda and Lumimba are considered 'prime' hunting areas by the Department of National Parks and Wildlife. This classification is currently applied to a small number of GMAs, all adjacent to the large, protected lion populations of SLNP and Kafue National Park. Using mark-recapture models fit to data from intensive monitoring of 210 individual lions in 18 prides and 14 male coalitions over 5 years, they found that trophy hunting was the most common cause of death, with 46 males harvested from a population showing indications of overharvest that included population decline, low recruitment, low sub-adult and adult male survival, depletion of adult males (prime-aged and old adult males never exceeded 6% of the population) and a senescing adult female population. The median age of harvested males was 4.86 years old, substantially below the minimum age of 6 suggested by Whitman et al (2004), and annual harvest rates ranged from 1.86 to 2.56 lions/1000 km^2, much higher than the baseline recommendation of 0.5 lions/1000 km^2 (Packer et al. 2011) and well above the higher value of 1 lion/1000 km^2 recently suggested for Tanzania's Selous Game Reserve (Packer et al. 2011). As in Hwange, harvest was heavily concentrated along the national park boundary (Rosenblatt et al. 2014) (see Results, Fig. 1).

In Tanzania's Selous Game Reserve, which holds the largest lion population on the continent (Creel & Creel 1997; Bauer & Van Der Merwe 2004; Creel et al. 2013), lions attained densities between 8 and 13 per 100 km^2, and on a focal study area of 2,600 km^2 in the Northern Sector of Selous, lions were killed at a rate of 2·7–4·3% of adult males annually between 1989 and 1994. This mortality was thought to be sustainable, while noting that lion quotas were substantially

This article is protected by copyright. All rights reserved.

higher, equal to 10—16% of the adult male population. Offtake of the full quota was thought to be unsustainable, and the percentage of quotas filled (both in Selous and nationwide) began declining in 1988 as quotas increased (Creel & Creel 1997). Packer et al. (2011) analyzed harvest records for all of Tanzania's hunting blocks, which cover more than 300,000 km^2 (approximately 100,000 km^2 in Game Reserves and 200,000 km^2 in less-protected Game Controlled Areas) and found that lion harvests declined by 50% between 1996 and 2008, with the greatest declines in the areas of heaviest harvest. Thus in Tanzania, estimated catch-per-unit-effort has been declining for several decades (Creel & Creel 1997; Packer et al. 2011).

In Zimbabwe's Gonarezhou National Park and Tuli Safari area, lion densities (as estimated from call-up surveys) were between 0% and 16% of those predicted on the basis of prey biomass, a pattern that was not observed for other large carnivores (Groom et al. 2014). Data on offtake of lions by trophy hunting and other potential limiting factors suggested that population collapse was due to direct human effects including "unsustainably high trophy hunting quotas" in conjunction high levels of legal control killing and illegal killing (Groom et al. 2014).

In the Bénoué Complex of Cameroon, track surveys conducted in three national parks and three hunting zones suggested that lion densities in hunting zones were only 31% of those in national parks (Croes et al. 2011). Lions attained only 27% of their estimated carrying capacity (based on prey density) in hunted areas, compared to 53% in national parks. In contrast, densities of leopards (*Panthera pardus*) and spotted hyenas (*Crocuta crocuta*) did not detectably differ between hunted areas and national parks. Relating these patterns to data on the number of lions shot and permits issued, Croes et al. (2011) concluded that in addition to other problems, "lions living in the hunting zones are strongly impacted through excessive trophy off-takes".

This article is protected by copyright. All rights reserved.

Accepted Article

In summary, empirical studies have detected low lion density and population declines associated with excessive trophy hunting, using a broad range of methods, at sites widely distributed across the lion's range.

Modelling Trophy Hunting Effects on Lions

A population model applied to data from lions in Serengeti National Park suggested that "hunting can be sustained simply by hunting males above a minimum age threshold" (Whitman et al. 2004; Whitman et al. 2007). Following this suggestion, age-limited harvesting has been implemented in several nations (e.g. Tanzania, Zambia and Mozambique) in an effort to make lion hunting more sustainable. Also based on this model, a minimum permitted age of 6 years has been widely adopted. When considering the generality of this strategy, one must recognize that the model was parameterized with data from a well-protected population experiencing strong, sustained growth as its prey base increased (Hanby et al. 1995; Packer et al. 1988): this limitation was carefully acknowledged by the original authors (Whitman et al. 2004). In contrast to patterns in Serengeti for the period modelled, the ungulate prey base supporting lions and other large carnivores is declining in most ecosystems (Bolger et al. 2008; Caro & Kerley 2008; Western et al. 2009), and many lion populations are thought to be declining as a result of prey depletion and related problems (Bauer et al. 2015; Riggio et al. 2016). Moreover, the structure of the underlying population model (Quadling & Starfield 2002; Whitman et al. 2004) was highly complex and process-based, requiring detailed data such as the likelihood of death in territorial disputes between males of specific ages and resident/nomad status, the likelihood of females locating open territories as a function of distance, and differences in the likelihood that dispersing males will join single males, groups of nomads or pride-holding males. The lack of such data has limited application since the model's development (by Starfield more than 30 years

This article is protected by copyright. All rights reserved.

Accepted Article

ago) to a single population in Serengeti National Park (Whitman et al. 2004), with some important parameters roughly estimated even in that application (for examples, see the supplementary data of Whitman et al. 2004). To address uncertainty about the sustainability of current lion hunting policies and to evaluate age restrictions in areas more representative of harvested lion populations, we developed a simpler model to assess the sustainability of lion hunting, using Leslie matrix projection. We then applied the model to data typical of current conditions for many lion populations, with exposure to effects of human encroachment, snaring and prey depletion, and source-sink dynamics in which lions moving from a fully protected area are regularly exposed to mortality from hunting (Loveridge et al. 2007; Becker et al. 2013; Watson et al. 2013; Rosenblatt et al. 2014; Watson et al. 2015). We used population and harvest projections over 25 years to examine the sustainability of a range of potential policies including age-restricted harvest, quotas and recovery periods, separately and in combination. Our results strongly suggest that a combination of all of these strategies will be needed to avoid population declines due to overharvest, with appreciable risk of local extirpation.

A similar model parameterized with data from Serengeti was recently used to examine regulation of hunting with data only on the number of days required to kill a lion (Edwards et al. 2014). As Edwards et al. (2014) note, the value of this approach is that it can be applied even if data on population size, structure and growth rate are limited. On the other hand, indirect approaches depend on a strong and constant relationship between population size and the indirect measure of choice. In this case, the model assumed that the number of days required to shoot a lion (μ) relates inversely to population size in a constant manner, $\mu = {}^{1}/_{cN}$, where N is population size and c is a constant describing hunting effort and effectiveness. Thus, the model's results depend on an assumption that hunting effort and methods do not change as the targeted population

This article is protected by copyright. All rights reserved.

Accepted Article

decreases, which we do not consider realistic for lions. Even if constant effort and methods could be mandated and enforced, this approach relies on the additional assumption that μ has a strong relationship with population density, which to our knowledge is not supported by data from lions (see Results, Fig. 2), perhaps because a 'day of hunting' can mean many different things. For example, the use of baits (ungulate carcasses) to attract lions is still common practice. If multiple baits are dragged and hung in areas of known use (for example, watering points with good stalking cover), the likelihood of attracting a lion is likely to be decoupled from changes in population size until they become extreme. Similar concerns arise for the regulation of hunting with most large carnivores, for which population monitoring is generally difficult, limiting direct data on population size and trends.

METHODS

We modelled lion dynamics without harvest and with a range of harvest scenarios. The online supplement describes the model's structure, parameterization and validation in detail. Our basic approach was to begin with a population of defined size (180 individuals), with a sex ratio and age-distribution based on SLNP and the adjacent Lupande and Lumimba GMAs. These starting conditions are typical of many of Africa's most important lion hunting areas, with a single population that occupies a National Park in which lions cannot be hunted and adjacent areas in which hunting is allowed (see Results, Fig. 1). Recent population trends for lions in SLNP have included a decrease in population size and age-sex trends indicative of excessive trophy hunting (Rosenblatt et al. 2014). Many lion populations now show trends and constraints comparable to those of Luangwa valley lions. With these starting conditions, we projected population dynamics 25 years into the future, without hunting and with a range of hunting scenarios described just below. For all cases, we used stochastic Leslie matrix projection, with linear

This article is protected by copyright. All rights reserved.

density dependence and separate projection matrices for males and females (because they differ in patterns of age-specific survival and reproduction).

Effects of Trophy Hunting

We modelled the effects of three methods that are currently proposed or used to regulate lion hunting, separately and in combination: (a) block quotas, (b) age-restriction, and (c) recovery periods with no hunting. SLNP is bordered by four hunting blocks (Upper and Lower Lupande GMA, Lumimba GMA and Nyampala GMA), ranging in size from 1,296 km^2 to 4,392 km^2. Recent and proposed regulations allow either one or two males to be harvested in each of these blocks, so we modelled block quotas of one or two. SLNP is the primary source for lions shot in Upper and Lower Lupande and Lumimba (see Results, Fig. 1), but the ranging patterns of lions shot in Nyampala have not been described. Lions shot in Nyampala are likely to originate from SLNP, but if they do not, then results midway between those shown for block quotas of 1 and 2 would best represent block quotas of 2 for the other three blocks (see Results, Figs. 3 & 4). Current or proposed policies in Zambia, Tanzania, Mozambique and elsewhere incorporate a minimum age for males that can be shot, though there is currently little direct guidance about the appropriate age threshold for a population facing the conditions typical for most lions. Simulations based on data from the well-protected and growing lion population in Serengeti N.P. suggested a threshold of six years, but applicability of this threshold to other populations has not been tested. Thus, we modelled scenarios that varied the minimum allowable age from 4 to 8 years. Finally, the Zambian government recently closed trophy hunting for three years to allow a period of recovery in both population size and age structure. Thus, we modelled scenarios with continuous harvest, with 2 year recovery periods between hunted periods of 4 years ('4 on/2 off') and with alternating 3 year periods of hunting and population recovery ('3 on/3 off'). We

This article is protected by copyright. All rights reserved.

present results for combinations of block quota (one or two), recovery periods (continuous harvest, 4 on/2 off, 3 on/3 off) and minimum age (4 – 8 years).

Direct hunting mortality. We incorporated direct mortality of males due to trophy hunting by checking within each group at each time step for males above the minimum allowable age, and removing them until the quota was filled. For scenarios other than continuous harvest, no males were removed by hunting in years designated for recovery.

Super-additive effects of hunting mortality on recruitment of cubs. The social disruption created by increased mortality due to hunting often reduces reproduction in social carnivores (Whitman et al. 2007; Rutledge et al. 2010; Creel et al. 2015). For lions, an increase in male turnover increases the frequency of infanticide by males that inherit prides, reducing recruitment (Whitman et al. 2004; Whitman et al. 2007). To incorporate super-additive effects on recruitment in a simple manner that is amenable to comparison with empirical data, we assumed that effects on recruitment will be stronger when the minimum age of males that can be shot is lower, because increased social disruption should increase the frequency of turnover. We then defined the reduction in fecundity due to hunting within the age classes exposed to this effect. As described in detail in the online supplemental materials, we examined three cases: one with no effect on fecundity due to male losses, one with strong effects on fecundity (reduction of 32% - 55% with stronger effects when a wider age range is hunted) and one intermediate case. These cases span the plausible range for the strength of super-additive effects in lions (Fig. S4), and we show results for all three cases for each harvest regulation scenario that we modelled.

This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

Model Outputs

For each scenario, we ran 500 stochastic simulations over 25 years, from which we report mean population size, the proportion of populations that were extirpated, and the total number of lions taken by trophy hunters. These data allow comparison of risks for different scenarios, and allow comparison of risks to financial benefit from license sales in a manner that could readily be used to adjust license fees.

RESULTS AND DISCUSSION

Lions are often hunted in areas adjacent to a fully-protected source population (Loveridge et al. 2007; Rosenblatt et al. 2014), so a population model parameterized with data from such conditions if of general interest. From 2008 to 2012 in the Luangwa valley, 22 kill sites recorded by the Department of National Parks and Wildlife show that lions were killed a median of 997 meters (SE = 463 meters) from SLNP, well within the normal ranges of lions that occupy the primary photo-tourism area of SLNP along the Luangwa River (Fig. 1, lion locations from Rosenblatt et al. 2014). The observed distribution of distances between kill sites and the National Park boundary did not overlap with a distribution of random locations within the GMA ($P < 0.001$, bootstrap randomization test). In short, the Luangwa valley holds a single lion population with individuals regularly moving between SLNP (where they are fully protected and support photo-tourism) and the adjacent GMAs where they are exposed to hunting.

We did not model the sustainability of hunting regulations based on indirect measures such as the number of days required to kill a lion. Data from the Luangwa valley (2003 - 2012) show that these indirect measures provide a weak signal-to-noise ratio (Fig. 2). Neither the number of days hunted nor reported measures of trophy quality showed any tendency to decline over a

This article is protected by copyright. All rights reserved.

Accepted Article

period for which capture-recapture estimates of population size revealed a significant decline, which (together with changes in age-structure) was deemed serious enough to provoke a complete hunting closure in 2013 (Rosenblatt et al. 2014). More specifically, a GLM (family = poisson, link = log) relating the number of days required to kill a lion to time had a slope indistinguishable from zero ($b = 0.005 \pm 0.018$ SE, $z = 0.28$, $P = 0.78$).

The baseline model (a scenario with no hunting and other limiting effects at 2008-2012 levels), yielded a deterministic growth rate (λ) of 1.022, stable stochastic dynamics and no risk of extirpation over 25 years (Fig. S3). Because the initial conditions were for a population well below carrying capacity with $\lambda > 1$, populations in the baseline model increased over roughly 6-7 until reaching equilibrium. All scenarios with hunting produced some degree of population decline and local extirpation probabilities greater than zero, though some combinations of strategies yielded relatively stable dynamics and low probability of extirpation over 25 years.

Age-Restricted Harvesting

Our results (Fig. 3) strongly support the prior inference that restricting harvest to males above a certain age increases the sustainability of lion hunting (Whitman et al. 2004; Whitman et al. 2007a; Whitman and Packer 2007). However, our results do not support the suggestion that restriction of hunting to males of age six or older will reliably yield sustainable offtake in the absence of other restrictions, with the conditions typified by Luangwa valley lions. As Figure 3 shows, with age restriction and no other limits on offtake, the probability of extirpation was essentially certain if males as young as 4 years were allowed to be hunted (as has recently been the case in SLNP, where the median age of 12 known individuals shot by hunters between 2008 and 2012 was 4.86 years) (Rosenblatt et al. 2014). The probability of extirpation dropped

This article is protected by copyright. All rights reserved.

Accepted Article

monotonically as the minimum age was raised, but fell consistently below 50% only with a minimum age of 7, and remained at 5% - 11% with a minimum age of 8. The results suggest that: (*a*) age-restriction is an important element of sustainable hunting for lions, (*b*) a minimum age of 7-8 is necessary to yield a reasonably low risk of extirpation even in the near future, and (*c*) age-restrictions must be combined with other regulations to assure sustainability. Like the baseline model (Fig. S3), all of the scenarios with hunting simulated an initial population well below carrying capacity with $\lambda = 1.022$, which allowed population growth for the first few years of simulation (Fig. 3), but this transient period of growth would not be expected with less favorable starting conditions for the simulation.

Lions can be aged using characteristics such as nose pigmentation, mane development and tooth condition (Whitman et al. 2007), but even careful application of these methods will yield some errors in age estimates. Our results can be used to examine the consequences of errors in aging, by recognizing that true age is being modelled. For example, if errors in age estimation cause half of the lions shot to be 5, even though regulations stipulate a minimum age of 6, then results intermediate to those for ages 5 and 6 would describe the predicted effect on population dynamics. We note that errors in aging are likely to be reduced by application of a minimum age of 7 or 8, because age-specific variation is greater at younger ages, when traits are changing more rapidly (Whitman and Packer 2007).

Block Quotas and Recovery Periods

Given the relatively high risk of extirpation from age restricted harvesting, particularly with the commonly-used threshold of six years, we examined scenarios with two restrictions applied in conjunction with age limits: maximum block quotas and recovery periods. A block quota of 2

This article is protected by copyright. All rights reserved.

Accepted Article

examines a situation in which total harvest (maximum of 8 individuals killed/year) is slightly lower than reported harvests ($\bar{\bar{X}} = 8.8$ individuals killed/year) from 2008-2012 and a block quota of 1 examines the consequences of halving this rate. Recent observations suggest that South Luangwa lion dynamics have responded to a moratorium on hunting that began in 2013, so we also modelled recovery periods of 2 or 3 years out of each 6 year period. Results for these scenarios (Figs. 4 & 5) show that block quotas and recovery periods both considerably increased the sustainability of hunting, and that combining a block quota of one with a recovery period was the only scenario that consistently yielded a risk of extirpation below 20%. This scenario yields maximum annual mortality due to hunting of substantially less than 0.5 lions/1000 km^2 (see 'Number of Males Shot', below), which has been proposed as a reasonable threshold for sustainability (Packer et al. 2011). The value of 0.5 lions/1000 km^2 is a valuable general guideline, but it was based on estimates of population growth rates taken from coarse estimates of population size, which is notoriously difficult to estimate for lions without intensive monitoring (Creel et al. 2013; Rosenblatt et al. 2014; Riggio et al. 2016).

As expected, scenarios that included recovery periods and block quotas were less sensitive to effects of minimum hunted age than more liberal scenarios (Figs. 4 & 5). This result provides potentially useful guidance by identifying regulations that are expected to be sustainable in the face of uncertainty in the aging of lions or difficulty in enforcing age restrictions. Strategies that incorporate recovery periods and block quotas can promote sustainability despite problems with accurate aging or enforcement of age restriction. This combination of strategies is also inherently safer than harvesting solely on the basis of age with a 'points system' that reduces quotas if under-aged lions are shot, because such systems adjust quotas after the effects of killing under-aged males have already occurred.

This article is protected by copyright. All rights reserved.

Finally, because very few males reach old age classes under most harvest scenarios (as in empirical data for SLNP), differences in outcomes for age thresholds of 7 and 8 years were somewhat unpredictable unless aggregated across a very large number of model iterations. This result is logically realistic: a change in policy that affects a small number of individuals in a stochastic process will have rather stochastic outcomes.

Number of Males Shot

Figure 6 shows the number of males legally shot in each year for each of the harvest scenarios described above. These data reinforce the conclusion that a combination of strategies is needed to promote sustainability, because a clear decline over time in the number of harvestable males is apparent for most scenarios. This decrease in the availability of prime-aged males is minimized by the combination of a block quota of one, a 3 on/3 off cycle of hunting and recovery, and a minimum hunted age of 7 or 8 years. While this scenario yields the lowest risk of extirpation, even this combination is predicted to produce a decline in harvestable males with the baseline conditions of this model, even with no super-additive effects on reproduction. Moreover, the survival rates in our base simulations include effects from poaching and human encroachment at their current levels, and then assume that these problems will not worsen, which is not necessarily correct (Becker et al. 2013; Watson et al. 2013; Rosenblatt et al. 2014; Watson et al. 2015). If other negative effects on lions are not controlled, it is unlikely that trophy hunting at any level will be sustainable.

Implications for Sustainable License Fees

Figure 7 shows the mean number of males killed by trophy hunters over 25 years for each of the policy scenarios discussed above. The number of harvested males ranged from a maximum of

This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

37 to a minimum of 7. As Figure 7 shows, many scenarios yield similar total offtake over a span of 25 years, parallel to results above showing that many scenarios yield similar risks of extirpation. This result is important because it implies that, among alternatives with similar expected outcomes, the one that is most easily and effectively enforced should be favored. Figure 7 can also be used to assess what changes might reasonably be made to lion hunting fees to promote sustainability, while maintaining current revenue for conservation. Forty-four males, or a mean of 8.8 males/year, were taken from this population by trophy hunters between 2008 and 2012, which yielded population decline, poor recruitment, a population with few old males, and a decrease in the age of harvested males (Rosenblatt et al. 2014). Figure 7 suggests that scenarios yielding sustainable offtake would require offtake to decline by roughly an order of magnitude. Thus, a clear policy recommendation is that the fee for lion hunting should be increased comparably, if it is expected to yield ecologically and economically sustainable trophy hunting. Such changes might usefully be paired with longer leases on hunting concessions (so that hunting operators could plan for required periods of recovery) and staged fees so that the full amount is only charged if a lion is shot.

The economics of supply and demand imply that any scarce and declining resource will become more expensive. If treated simply as a commodity (an approach that is questionable on many fronts), lions have declined dramatically over recent decades (Bauer & Van Der Merwe 2004; Packer et al. 2011; Riggio et al. 2013). Declines have been larger in the areas with heavier hunting, and hunting was the strongest predictor of population declines for lions in Tanzanian protected areas (Packer et al. 2011). Our results strongly suggest that lion hunting fees have been too low to promote truly sustainable hunting. Throughout their range, the conservation of free-ranging lion populations has been demonstrably constrained by budgets that do not provide

This article is protected by copyright. All rights reserved.

sufficient protection (Packer et al. 2011; Creel et al. 2013). Thus, any policy change that reduced funding for necessary conservation actions such as patrolling and snare removal would be expected to have negative effects on lion populations, by exacerbating widespread and accelerating problems such as wildlife depletion due to snaring and encroachment by local people (Watson et al. 2013; Watson et al. 2015). At the same time, substantial recent data demonstrate that trophy hunting at unsustainable levels has contributed to lion population declines (Loveridge et al. 2007; Packer et al. 2009, 2011; Rosenblatt et al. 2014). Collectively, these results suggest the following:

1. For trophy hunting to be sustainable under the conditions that most lions now experience, modifications to policy must reduce total mortality.

2. Age-restricted harvesting is effective to increase the sustainability of trophy hunting, but is probably not sufficient to yield sustainability by itself. The widely-suggested minimum huntable age of 6 years (Whitman et al. 2004; Whitman et al. 2007) was based on data from a growing lion population in Serengeti, with more favorable conditions for lions than now exist for most populations that support trophy hunting. Our results suggest that a minimum age of 7 - 8 is substantially more effective for the conditions typified by Luangwa lions, and should be combined with other policies to limit total mortality.

3. The acceptable risk of local extirpation will have to be confronted. Our results show that a risk of extirpation that might be considered acceptable (e.g. <10%) is likely to be accomplished only with a combination of methods. This inference is generalizable to other exploited species.

4. Policies that combine age-restriction, conservative block quotas and recovery periods are more likely to promote sustainable harvest, particularly with uncertainty about field estimates of age or

This article is protected by copyright. All rights reserved.

Accepted Article

difficulties with enforcement of regulations. A general lesson from this result is that policies that incorporate a combination of strategies to limit negative effects of hunting on population dynamics provide a margin of safety.

5. As lion populations (and particularly prime aged males) decrease, the price of licenses must increase to halt declines linked to overharvesting, to accurately reflect a decrease of supply (in the economic sense), and to ensure that hunting contributes to effective conservation of areas in which hunting is allowed. The values of lions that are not directly linked to short-term economics (e.g. ecological and cultural importance as well as value to non-consumptive tourism) should not be ignored and where lion are hunted in protected area complexes, efforts should focus on restoring and increasing lion populations and habitat for GMAs now classified as secondary or understocked, rather than finding means to increase offtake on prime hunting blocks. More broadly, low hunting license fees for carnivores promote aggressive offtake of these rare and ecologically important species (Creel et al. 2015: *e.g.*, a wolf license for out-of-state hunters in Idaho costs only $32, with individuals allowed to take up to five, while licenses for deer and elk, which outnumber wolves by several orders of magnitude, cost $302 and $417).

6. The data used to parameterize our model includes impacts on survival from poaching and human encroachment at their current levels, thus assuming these activities will not worsen, which is unlikely given burgeoning human pressures across Africa's remaining lion populations. If the current acceleration of other negative effects on lions is not addressed and controlled, then it is unlikely that trophy hunting at any level will be sustainable. These conclusions are likely to generalize to other African large carnivores, particularly the leopard.

This article is protected by copyright. All rights reserved.

Accepted Article

Acknowledgements: We thank the Zambia Department of National Parks and Wildlife for permission to conduct this research, and for their support and cooperation. This work was supported by grants from the National Science Foundation (IOS 1145749), WWF-Netherlands, Mfuwe Lodge/Bushcamp Company, Painted Dog Conservation Inc., and the National Geographic Society Big Cats Initiative.

SUPPORTING INFORMATION

Supplemental online material includes a detailed description of the lion population model's structure, parameterization and validation.

DATA AVAILABILITY

Data associated with this paper have been deposited in Dryad: http://dx.doi.org/10.5061/dryad.mc2p8.

LITERATURE CITED

Bauer H, Van Der Merwe S. 2004. Inventory of free-ranging lions Panthera leo in Africa. Oryx **38**: 26-31.

Bauer H Chapron G, Nowell K, Henschel P, Funston P, Hunter LT, Macdonald DW, Packer C. 2015. Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas. Proceedings of the National Academy of Sciences **112**: 14894-14899.

This article is protected by copyright. All rights reserved.

Accepted Article

Becker MS, McRobb R, Watson F, Droge E, Kanyembo B, Murdoch J, Kakumbi C. 2013a. Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. Biological Conservation **158**: 26-36.

Becker MS, Watson FG, Droge E, Leigh K, Carlson RS, Carlson AA. 2013. Estimating past and future male loss in three Zambian lion populations. Journal of Wildlife Management **77**: 128-142.

Bolger DT, Newmark WD, Morrison TA, Doak DF. 2008. The need for integrative approaches to understand and conserve migratory ungulates. Ecology Letters **11**: 63-77.

Caro T, Kerley GIH. 2008. Decline of large mammals in the Katavi-Rukwa ecosystem of western Tanzania. African Zoology **43**: 99-116.

Creel S, et al. 2013. Conserving large populations of lions: the argument for fences has holes. Ecology Letters **16**: 1413-1414e3.

Creel S, Creel NM. 1997. Lion density and population structure in the Selous Game Reserve: Evaluation of hunting quotas and offtake. African Journal of Ecology **35**: 83-93.

Creel S et al. 2015. Questionable policy for large carnivore hunting. Science **350**: 1473-1475.

Croes BM, Funston PJ, Rasmussen G, Buij R, Saleh A, Tumenta PN, De Iongh HH. The impact of trophy hunting on lions (*Panthera leo*) and other large carnivores in the Bénoué Complex, northern Cameroon. Biological Conservation. **144**: 3064-3072.

This article is protected by copyright. All rights reserved.

Accepted Article

Edwards CT, Bunnefeld N, Balme GA, Milner-Gulland EJ. 2014. Data-poor management of African lion hunting using a relative index of abundance. Proceedings of the National Academy of Sciences **111**: 539-543.

Estes JA et al. 2011.Trophic downgrading of planet earth. Science **333**: 301-306.

Groom RJ, Funston PJ, Mandisodza R. Surveys of lions Panthera leo in protected areas in Zimbabwe yield disturbing results: what is driving the population collapse?. Oryx **48**:385-393.

Hanby JP, Bygott JD, Packer C. 1995. Ecology, demography and behavior of lions in two contrasting habitats: Ngorongoro Crater and the Serengeti Plains. Pages 315-331 in Sinclair ARE, Arcese P, editors. Serengeti II. University of Chicago Press, Chicago.

Lindsey PA, Balme GA, Funston P, Henschel P, Hunter L, et al. (2013) The trophy hunting of African lions: Scale, current management practices and factors undermining sustainability. PLoS ONE 8(9): e73808. doi:10.1371/journal.pone.0073808

Loveridge AJ, Searle AW, Murindagomo F, Macdonald DW. 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation **134**: 548-558.

Midlane, N. 2014. The Conservation Status and Dynamics of a Protected African Lion Panthera Leo Population in Kafue National Park, Zambia. Ph. D. thesis, University of Cape Town, Cape Town.

Ogada MO, Woodroffe R, Oguge NO, Frank LG. 2003. Limiting depredation by African carnivores: the role of livestock husbandry. Conservation Biology **17**: 1521-1530.

This article is protected by copyright. All rights reserved.

Pace ML, Cole JJ, Carpenter SR, Kitchell JF. 1999. Trophic cascades revealed in diverse ecosystems. Trends in Ecology and Evolultion **14**: 483-488.

Packer C, Herbst L, Pusey AE, Bygott JD, Hanby JP, Cairns SJ, Borgerhoff Mulder M. 1988. Reproductive success in lions. Pages 363-383 in Clutton-Brock TH, editor. Reproductive Success. University of Chicago Press, Chicago.

Packer C, Brink H, Kissui BM, Maliti H, Kushnir H, Caro T. 2011. Effects of trophy hunting on lion and leopard populations in Tanzania. Conservation Biology **25**: 142-153.

Packer C, Kosmala M, Cooley HS, Brink H, Pintea L, Garshelis D, Purchase G, Strauss M, Swanson A, Balme G, Hunter L. 2009. Sport hunting, predator control and conservation of large carnivores. PloS One **4**: e5941.

Packer C et al. 2013. Conserving large carnivores: dollars and fence. Ecology Letters, **16**: 635-641.

Quadling HS, Starfield AM. 2002. Exploiting object-orientated programming structures in the quest for an individual-based lion population model with an attractive user interface: Starfield Festschrift. South African Journal of Science **98**: 449-454.

Riggio J Caro T, Dollar L, Durant SM, Jacobson AP, Kiffner C, Pimm SL, van Aarde RJ. 2016. Lion populations may be declining in Africa but not as Bauer et al. suggest. Proceedings of the National Academy of Sciences **113**: E107-E108

Riggio J et al. 2013. The size of savannah Africa: a lion's (Panthera leo) view. Biodiversity and Conservation **22**: 17-35.

This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

Rosenblatt E, Becker MS, Creel S, Droge E, Mweetwa T, Schuette PA, Watson F, Merkle J, Mwape H. 2014. Detecting declines of apex carnivores and evaluating their causes: An example with Zambian lions. Biological Conservation **180**: 176-186.

Rutledge LY, Patterson BR, Mills KJ, Loveless KM, Murray DL, White BN. 2010. Protection from harvesting restores the natural social structure of eastern wolf packs. Biological Conservation **143**: 332-339.

Scheffer M, Carpenter S, Foley JA, Folke C, Walker B. 2001. Catastrophic shifts in ecosystems. Nature **413**: 591-596.

Terborgh J, Estes JA. 2013. Trophic Cascades: Predators, Prey, and the Changing Dynamics of Nature. Island Press, Washington.

U.S.Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Listing Two Lion Subspecies. Federal Register **80**: 80000-80056.

Watson F, Becker MS, McRobb R, Kanyembo B. 2013. Spatial patterns of wire-snare poaching: Implications for community conservation in buffer zones around National Parks. Biological Conservation **168**: 1-9.

Watson FG, Becker MS, Milanzi J, Nyirenda M. 2015. Human encroachment into protected area networks in Zambia: Implications for large carnivore conservation. Regional Environmental Change **15**: 415-429.

Western D, Russell S, Cuthill I. 2009. The status of wildlife in protected areas compared to non-protected areas of Kenya. PloS One **4**: e6140.

This article is protected by copyright. All rights reserved.

Accepted Article

Whitman K, Starfield AM, Quadling HS, Packer C. 2004. Sustainable trophy hunting of African lions. Nature **428**: 175-178.

Whitman KL, Packer C. 2007. A Hunter's Guide to Aging Lions in Eastern and Southern Africa. Safari Press, Huntington Beach.

Whitman KL, Starfield AM, Quadling HS, Packer C. 2007. Modeling the effects of trophy selection and environmental disturbance on a simulated population of African lions. Conservation Biology **21**: 591-601.

Yamazaki K. 1996. Social variation of lions in a male-depopulated area in Zambia. Journal of Wildlife Management **60**: 490-497.

FIGURE LEGENDS

Figure 1. Ranging patterns of lions in the Luangwa Valley from 2008 to 2012 and the reported locations of 21 lions shot by trophy hunters in the same years. One recorded kill site (not shown) in the western portion South Luangwa National Park was probably recorded incorrectly. No location was reported for 22 of 44 lions shot in this period. Lion kill sites are from Department of National Parks and Wildlife records, and lion ranging patterns are shown by radio-locations of resident females (Rosenblatt et al. 2014).

Figure 2. Indirect measures of population status showed high variability and no tendency to decline over a period of 10 years for which direct data revealed population decline, depletion of males in prime age-classes, poor recruitment and a decrease in the median age of harvested males to less than 5 years (Rosenblatt et al. 2014). Data are from Department of National Parks

This article is protected by copyright. All rights reserved.

Accepted Article

and Wildlife records; recorded measurements that are not plausible were not deleted, because our intention was to evaluate the signal-to-noise ratio of such data. Error bands show 95% confidence intervals.

Figure 3. With harvesting in every year, (***top***) population size is expected to decline appreciably, so that (***bottom***) the probability of local extinction within 25 years is also appreciable. For each minimum permitted age, the three curves show models with no effect on cub recruitment, moderate effects, and strong effects.

Figure 4. Mean population size for population projections over 25 years with variation in the minimum male age permitted for hunting. For each minimum age, population means are shown for three scenarios: no effect of male loss on reproduction, moderate effects and strong effects. (***Left***) Maximum block quota of one male shot per year. (***Right***) Maximum block quota of 2 males shot per year. (***Top***) Hunting cycle of 4 years on and 2 years off. (***Bottom***) Hunting cycle of 3 years on and 3 years off.

Figure 5. The proportion of simulated populations that went to local extinction over 25 years with variation in the minimum male age permitted for hunting. For each minimum age, extinction probabilities are shown three scenarios: no effect of male loss on reproduction, moderate effects and strong effects. (***Left***) Maximum block quota of one male shot per year. (***Right***) Maximum block quota of 2 males shot per year. (***Top***) Hunting cycle of 4 years on and 2 years off. (***Bottom***) Hunting cycle of 3 years on and 3 years off.

This article is protected by copyright. All rights reserved.

Figure 6. Differences between hunting scenarios in the number of males legally harvested in each year. As population size and age structure changed through time, harvest rates declined for all scenarios, with the smallest decline for a maximum block quota of one, minimum permitted age of 7 or 8, and recovery periods of 3 years between 3 year periods of hunting.

Figure 7. The total number of adult males shot over 25 years, for scenarios varying the minimum age permitted, the duration of cycles between hunting and population recovery, and block quotas of one or two.

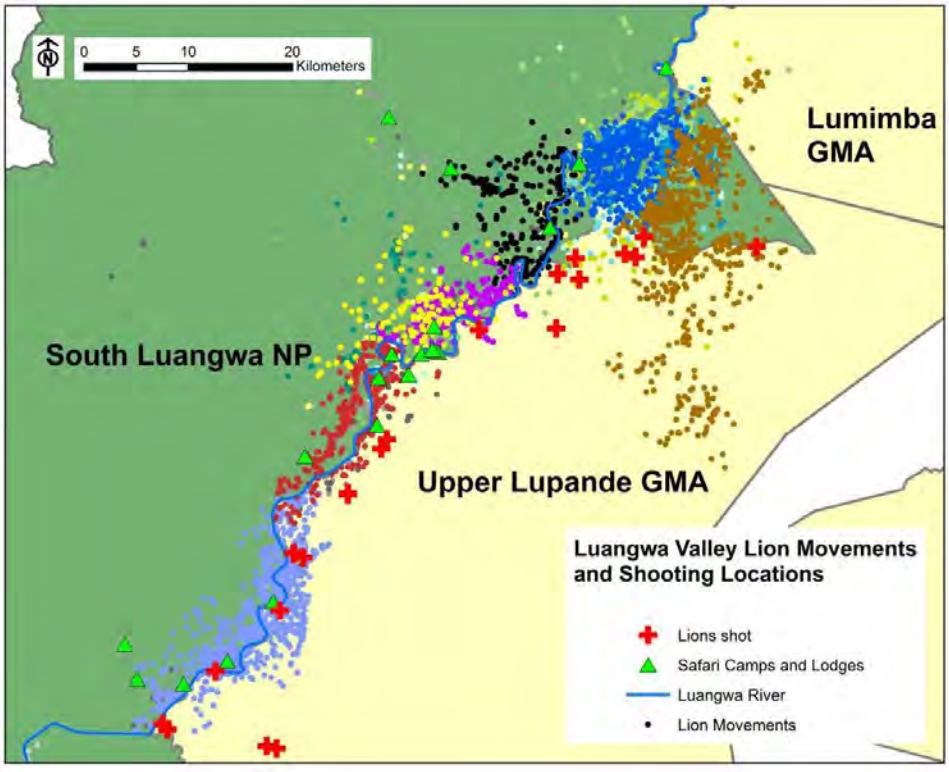


Figure 1.

This article is protected by copyright. All rights reserved.

Accepted Article

Accepted Article

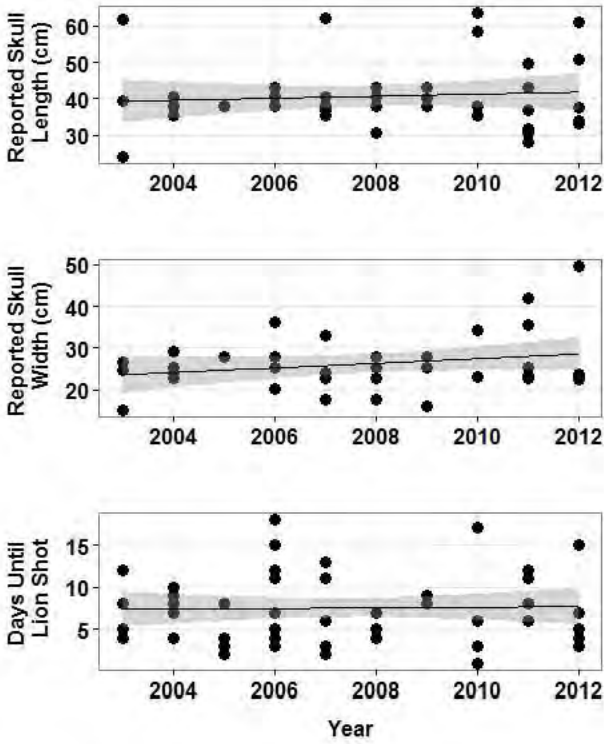


Figure 2.

This article is protected by copyright. All rights reserved.

Accepted Article

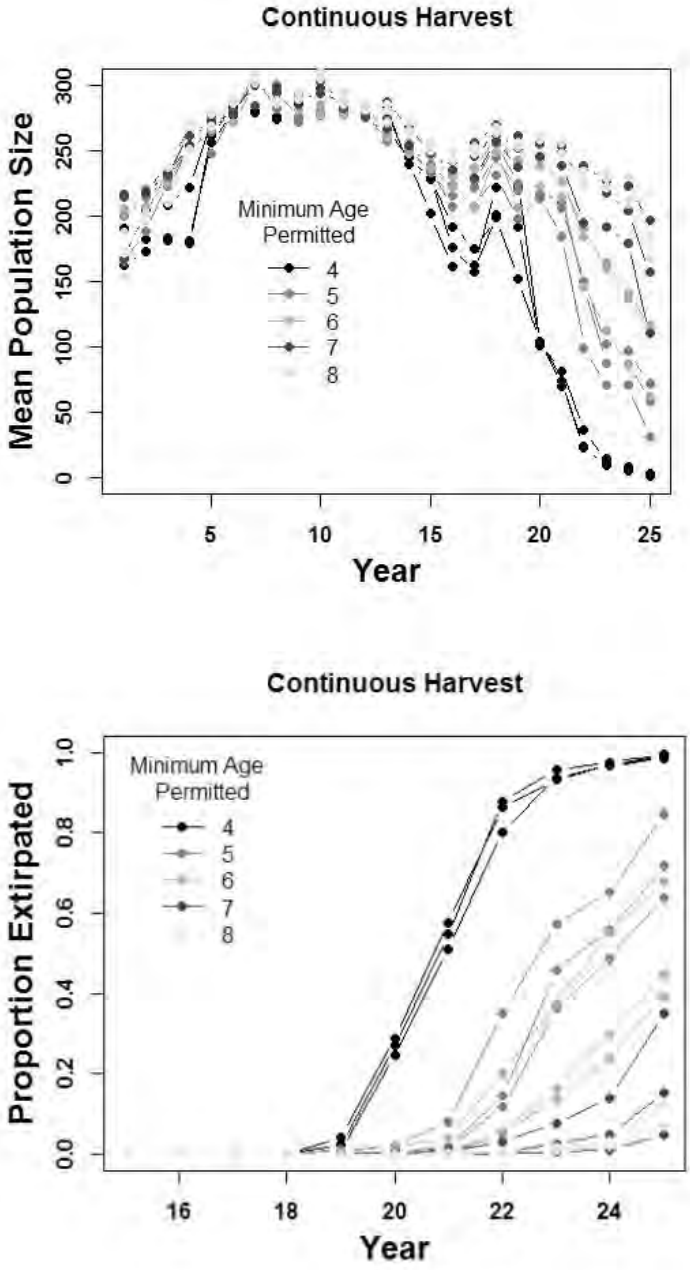


Figure 3.

This article is protected by copyright. All rights reserved.

Accepted Article

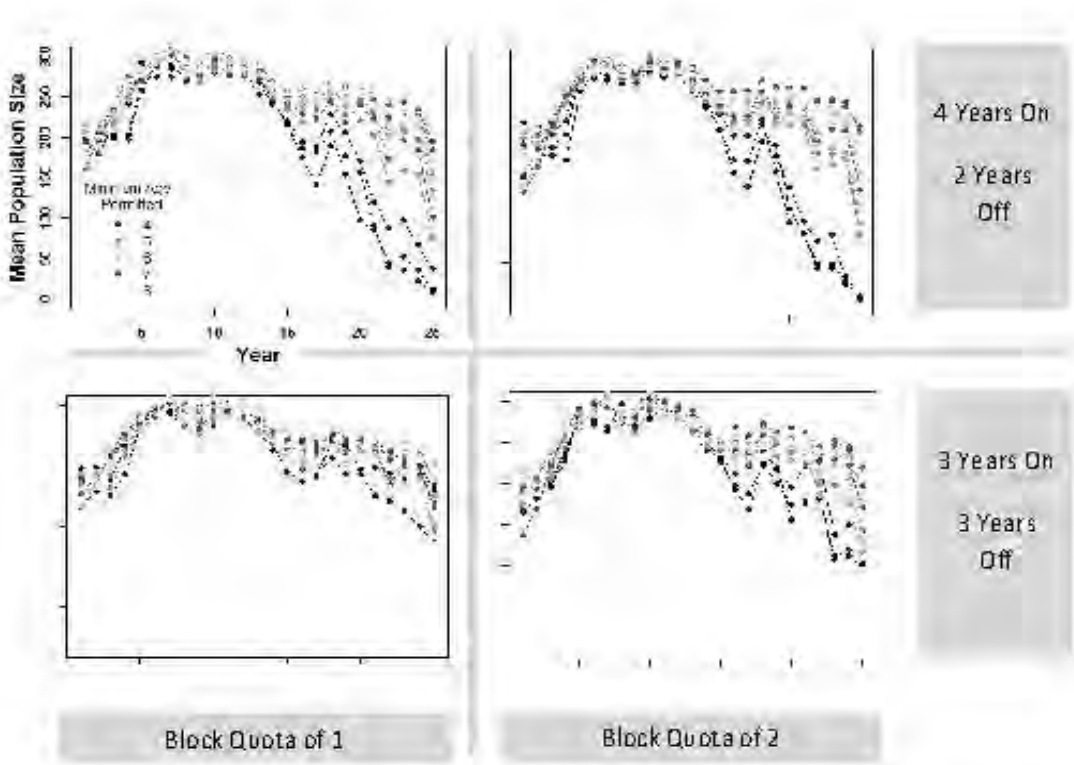


Figure 4.

This article is protected by copyright. All rights reserved.

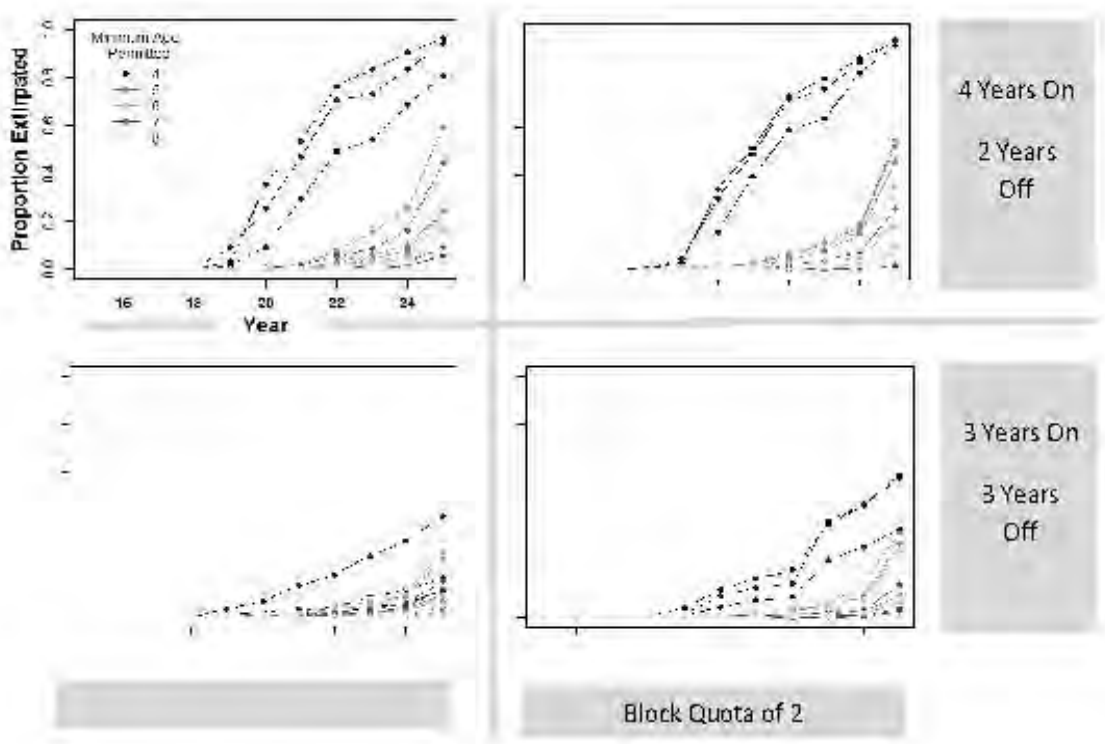


Figure 5.

Accepted Article

This article is protected by copyright. All rights reserved.

Accepted Article

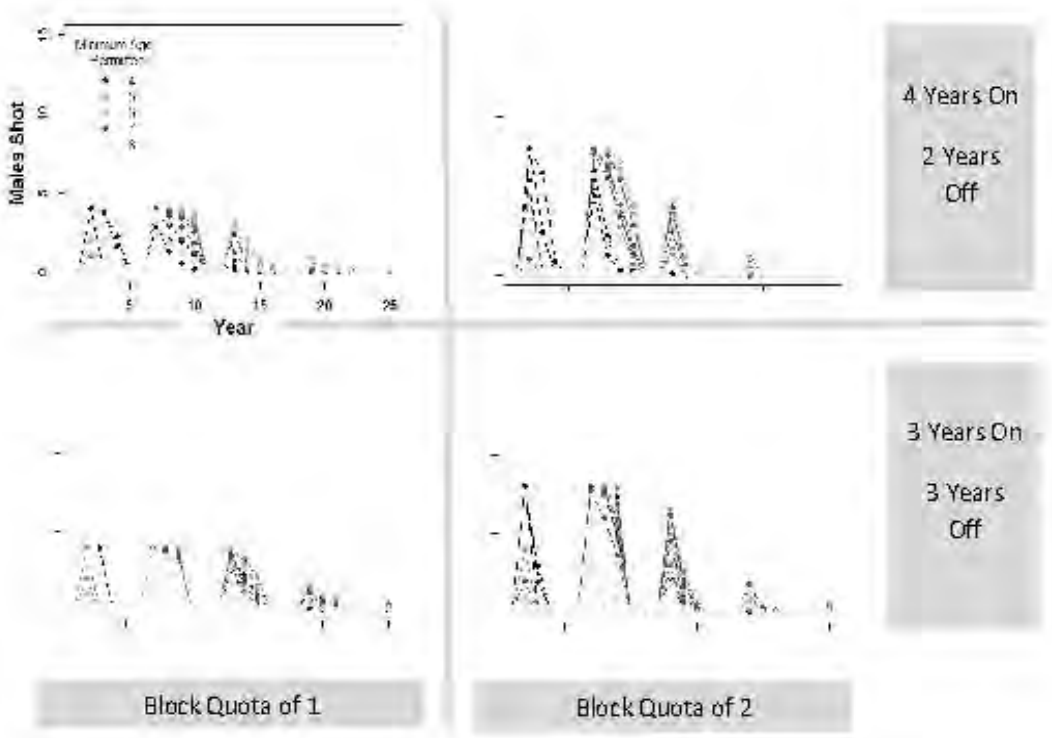


Figure 6.

This article is protected by copyright. All rights reserved.

Accepted Article

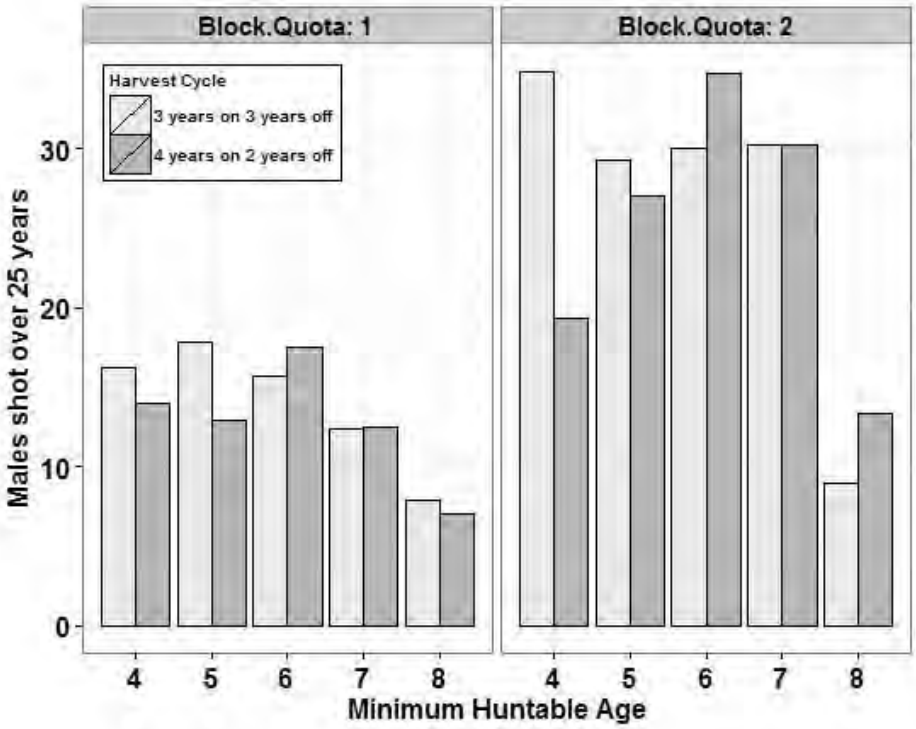


Figure 7.

This article is protected by copyright. All rights reserved.

Fwd: PDFs of your two new lion papers please!

2 messages

Gadd, Michelle <michelle_gadd@fws.gov> Wed, Aug 10, 2016 at 2:05 PM
To: Darcy Vargas <darcy_vargas@fws.gov>, Anna Barry <anna_barry@fws.gov>, Mike Moore <mike_moore@fws.gov>, Tim Vannorman <tim_vannorman@fws.gov>, Sandra Farkas <sandra_farkas@fws.gov>, Kathleen Moore <kathleen_moore@fws.gov>, Emma Nelson <emma_nelson@fws.gov>

Please find attached some great new papers co-authored by our colleague Matt Becker from Montana, working in Zambia. Please let me know if you would like an email introduction to Matt directly - he runs the Zambia Carnivore Project which has done impressive research on large felids, canids and hyaenids in various land uses in Zambia and he also has mentored a number of Zambian carnivore biologists who are now going for their doctorates and veterinary degrees. This project also shares an airplane with an AFE-sponsored elephant project in South Luangwa. thanks, mg

---------- Forwarded message ----------
From: Matthew S. Becker <matt@zambiacarnivores.org>
Date: Tue, Jul 26, 2016 at 11:07 AM
Subject: RE: PDFs of your two new lion papers please!
To: Michelle Gadd <michelle_gadd@fws.gov>

Hi Michelle, Please find attached! All the best, M

Creel et al 2016
Miller et al 2016

--
Michelle Gadd, Ph.D.
Program Officer, African Elephant and African Rhino Programs
Division of International Conservation
U.S. Fish and Wildlife Service
5275 Leesburg Pike, MS: IA
Falls Church, VA 22041-3803
michelle_gadd@fws.gov

2 attachments

Creel_et_al-2016-Ecological_Applications.pdf
710K

Miller et al 2016 - Biol Cons - Aging traits and sustainable trophy hunting of African lions.pdf
1067K

Barry, Anna <anna_barry@fws.gov> Thu, Aug 11, 2016 at 10:10 AM
To: "Gadd, Michelle" <michelle_gadd@fws.gov>

Thanks Michelle!

Anna

[Quoted text hidden]

Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas

Hans Bauer[a,1], Guillaume Chapron[b], Kristin Nowell[c], Philipp Henschel[d], Paul Funston[d], Luke T. B. Hunter[d], David W. Macdonald[a], and Craig Packer[a,e]

[a]Wildlife Conservation Research Unit, Zoology, University of Oxford Recanati-Kaplan Centre, Tubney OX13 5QL, United Kingdom; [b]Grimsö Wildlife Research Station, Department of Ecology, Swedish University of Agricultural Sciences, 73091 Riddarhyttan, Sweden; [c]World Conservation Union, Cat Action Trust, Cape Neddick, ME 03902; [d]Panthera, New York, NY 10018; and [e]Department of Ecology, Evolution and Behavior, University of Minnesota, St. Paul, MN 55408

Edited by Chris Carbone, Zoological Society of London, London, United Kingdom, and accepted by the Editorial Board September 27, 2015 (received for review January 12, 2015)

We compiled all credible repeated lion surveys and present time series data for 47 lion (*Panthera leo*) populations. We used a Bayesian state space model to estimate growth rate-λ for each population and summed these into three regional sets to provide conservation-relevant estimates of trends since 1990. We found a striking geographical pattern: African lion populations are declining everywhere, except in four southern countries (Botswana, Namibia, South Africa, and Zimbabwe). Population models indicate a 67% chance that lions in West and Central Africa decline by one-half, while estimating a 37% chance that lions in East Africa also decline by one-half over two decades. We recommend separate regional assessments of the lion in the World Conservation Union (IUCN) Red List of Threatened Species: already recognized as critically endangered in West Africa, our analysis supports listing as regionally endangered in Central and East Africa and least concern in southern Africa. Almost all lion populations that historically exceeded ∼500 individuals are declining, but lion conservation is successful in southern Africa, in part because of the proliferation of reintroduced lions in small, fenced, intensively managed, and funded reserves. If management budgets for wild lands cannot keep pace with mounting levels of threat, the species may rely increasingly on these southern African areas and may no longer be a flagship species of the once vast natural ecosystems across the rest of the continent.

lion | *Panthera leo* | Africa | population decline

Large carnivores are generally declining worldwide (1), but trends vary according to geography (2) and the severity of threats posed to humans (3). The African lion (*Panthera leo*) exemplifies the challenges of carnivore conservation: widespread habitat loss (4), extensive prey base depletion (5 7), indiscrimi nate retaliatory or preemptive killing to protect humans and their livestock (8 10), poorly regulated sport hunting (11 18), and demand for traditional African and Chinese medicines (19). Although lions are relatively well studied compared with most large felids, regional scale population estimates remain scant across much of its range (20), and population surveys are gen erally repeated at irregular intervals because of the inherent difficulty of counting lions (21, 22) and shortage of funds for systematic surveys. No reliable data are available for Angola, Central African Republic, Somalia, South Sudan, and Ethiopia. Furthermore, systematic surveys are absent from large areas of potential lion habitat in countries with a rich tradition of wildlife research, such as Zambia and Tanzania.

With widespread declines in many reserves (23) and rapid deterioration of the lion's status in a substantial portion of the species' range (24), there is growing concern that lion numbers may be declining rapidly, leading to the lion's consideration for listing as threatened or endangered on the US Endangered Species Act. The lion is currently listed as vulnerable on the World Conservation Union (IUCN) Red List and would be considered endangered if numbers were to decline by at least 50% over three lion generations (LGs) (25). Here, we use a comprehensive dataset of repeated counts to assess lion status, calculate growth rate per population, and estimate broader trends per geographic region. We show that lion populations are rapidly disappearing from large parts of Africa, signaling a major trophic downgrading of savannah ecosystems.

Results

We present time series data for 47 of 67 areas (4) where lions are still known to occur (Fig. 1), with the most recent estimates to taling 8,221 lions (Dataset S1); note that this subsample only excludes areas where the available data are speculative. Almost all lion populations that historically exceeded ∼500 individuals are declining (Figs. 2 4). All West Central African populations other than Pendjari ($\lambda = 1.07 \pm 0.13$) are declining (Fig. 2), with lions in Comoé and Mole now likely extinct. A similar pattern is found in East Africa (Fig. 3), with Serengeti ($\lambda = 1.02 \pm 0.02$) being the only large population surveyed that is not decreasing, whereas data from Katavi indicate a dramatic decline ($\lambda = 0.67 \pm 0.11$). Southern African populations do not indicate such a drastic and widespread decline (Fig. 4), but one of the largest (Okavango; $\lambda = 0.97 \pm 0.1$) is, nevertheless, declining. Fenced populations reveal a completely different pattern: none have experienced a sharp decline, and many small fenced populations are increasing (Figs. 3 and 4). Data and model inferences for 47 populations included in our study are given in Figs. S1 S4. When summing posterior densities of growth rates into regional groups, we found that West Central African populations were sharply declining ($\lambda = 0.90 \pm 0.22$) and that East African populations were also declining, albeit less sharply ($\lambda = 0.99 \pm 0.14$). In contrast, southern African

Significance

At a regional scale, lion populations in West, Central, and East Africa are likely to suffer a projected 50% decline over the next two decades, whereas lion populations are only increasing in southern Africa. Many lion populations are either now gone or expected to disappear within the next few decades to the extent that the intensively managed populations in southern Africa may soon supersede the iconic savannah landscapes in East Africa as the most successful sites for lion conservation. The rapid disappearance of lions suggests a major trophic downgrading of African ecosystems with the lion no longer playing a pivotal role as apex predator.

Author contributions: H.B., G.C., K.N., P.H., P.F., and C.P. designed research; H.B., G.C., K.N., P.H., P.F., L.T.B.H., D.W.M., and C.P. performed research; G.C. and C.P. contributed new reagents/analytic tools; H.B., G.C., K.N., P.H., P.F., and C.P. analyzed data; and H.B., G.C., K.N., P.H., P.F., L.T.B.H., D.W.M., and C.P. wrote the paper.

The authors declare no conflict of interest.

This article is a PNAS Direct Submission. C.C. is a guest editor invited by the Editorial Board.

[1]To whom correspondence should be addressed. Email: hans.bauer@zoo.ox.ac.uk.

This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1500664112/-/DCSupplemental.

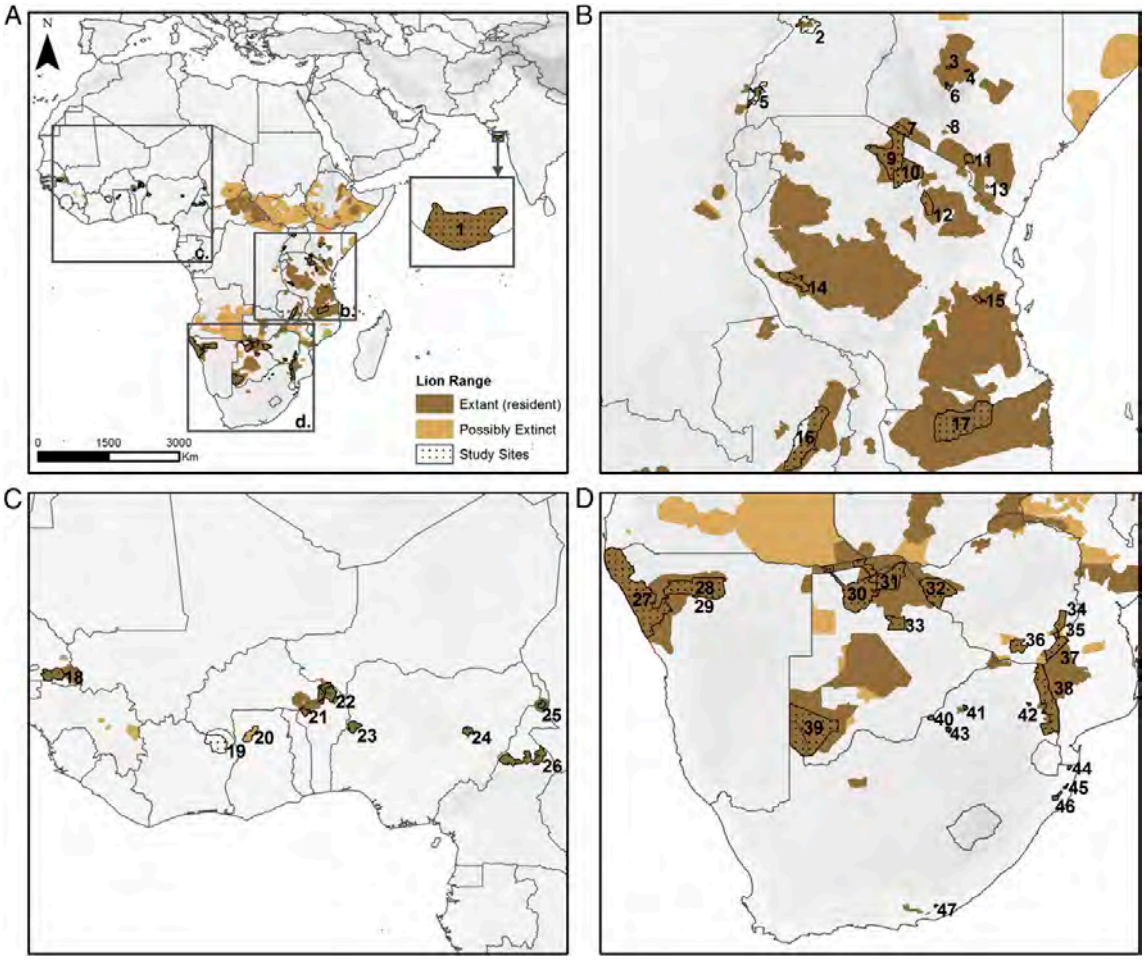


Fig. 1. Distribution map of monitored lion populations; zooming levels: (*A*) species wide, (*B*) East Africa, (*C*) West Central Africa, (*D*) southern Africa. 1, Gir; 2, Murchison Falls; 3, Laikipia; 4, Samburu; 5, Queen Elizabeth National Park; 6, Ol Pejeta Conservancy; 7, Masai Mara; 8, Nairobi; 9, Serengeti; 10, Ngorongoro; 11, Mbirikani; 12, Tarangire; 13, Taita Hills; 14, Katavi; 15, Matambwe; 16, Luangwa; 17, Niassa; 18, Niokolo Koba; 19, Comoe National Park; 20, Mole; 21, Pendjari; 22, W; 23, Kainji Lake; 24, Yankari; 25, Waza; 26, Benoue; 27, Kunene; 28, Etosha; 29, Ongava; 30, Okavango Delta; 31, Chobe Kwando; 32, Hwange; 33, Makgadikgadi Pans; 34, Save Conservancy; 35, Malilangwe Conservancy; 36, Bubye Conservancy; 37, Gonarezhou; 38, Kruger National Park; 39, Kgalagadi; 40, Madikwe Nature Reserve; 41, Welgevonden; 42, Makalali; 43, Pilanesberg National Park; 44, Tembe Elephant Park; 45, Phinda; 46, Hluhluwe iMfolozi; and 47, Kwandwe.

populations were increasing ($\lambda = 1.09 \pm 0.15$), as the majority were in fenced reserves showing strongest increases ($\lambda = 1.10 \pm 0.14$). Nationally, South Africa was the only African country with growth in every population, all of which were fenced; most were rees tablished over the past two decades and quickly reached saturation. The Asian population, representing a single contiguous population surviving in the Indian state of Gujarat, has stabilized inside the Gir Reserve (Fig. 2) and expanded in the surrounding countryside (26). Niassa Reserve in Mozambique also increased but is considered as a separate case (Fig. 2) (see below).

When population trends were assumed to remain unchanged in the future and, ignoring process error, were projected over a multiyear timescale (Table 1), we found that four of seven sur viving West Central African populations were extremely likely to decline by more than one half in two decades ($p^{20}_{0.5} > 0.7$) (Table 1). In East Africa, 6 of 14 surviving populations were very likely to decline by more than one third in two decades ($p^{20}_{0.33} > 0.5$) (Table 1). In southern Africa, the second largest population (Okavango) was also likely to decline by one third in two decades ($p^{20}_{0.33} > 0.5$) (Table 1). When considering projected growth rates summed by regional groups, we found that the West Central African group was likely to drop by one third in 5 y ($p^{5}_{0.33} = 0.56$) and very likely to drop by one half in 20 y ($p^{20}_{0.5} = 0.67$), whereas East African populations also had a bleak future, with $p^{20}_{0.33} = 0.45$ and $p^{30}_{0.5} = 0.43$, respectively. When applying IUCN thresholds, the West Central African group had a probability of projected decline of more than one half in three LGs of $p^{3LG}_{0.5} = 0.67$, and the East African group had a probability of declining by more than one half in three LGs of $p^{3LG}_{0.5} = 0.37$.

Discussion

These growth rate estimates represent the best available knowledge of the global trends of lion populations. However, we acknowl edge that they are intrinsically imprecise. In some sites, census

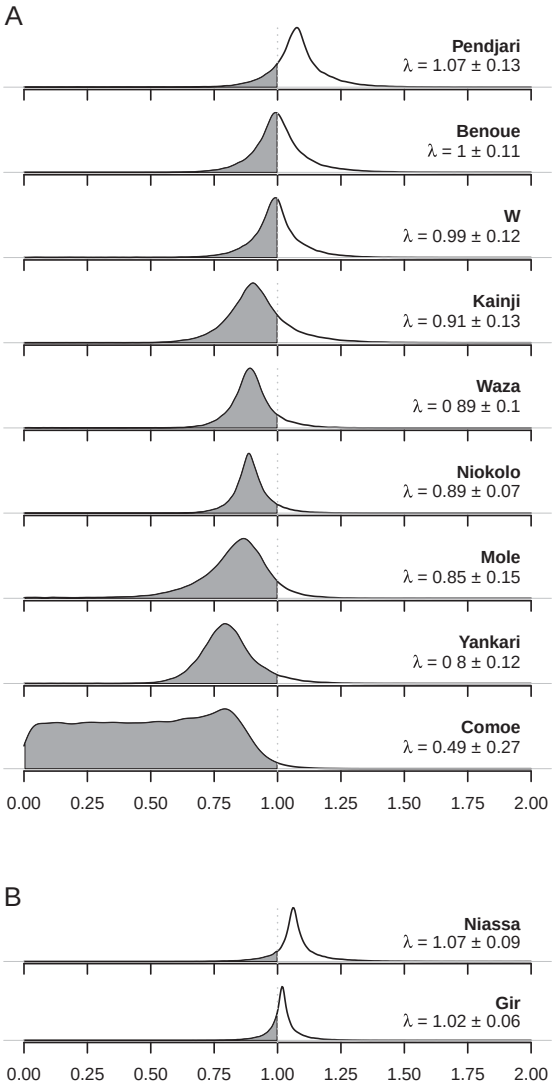


Fig. 2. Posterior densities of growth rates for (*A*) West Central Africa lion populations and (*B*) special cases. The gray areas under the curves indicate the probabilities of decline. Values shown are medians ± SDs of growth rate estimates.

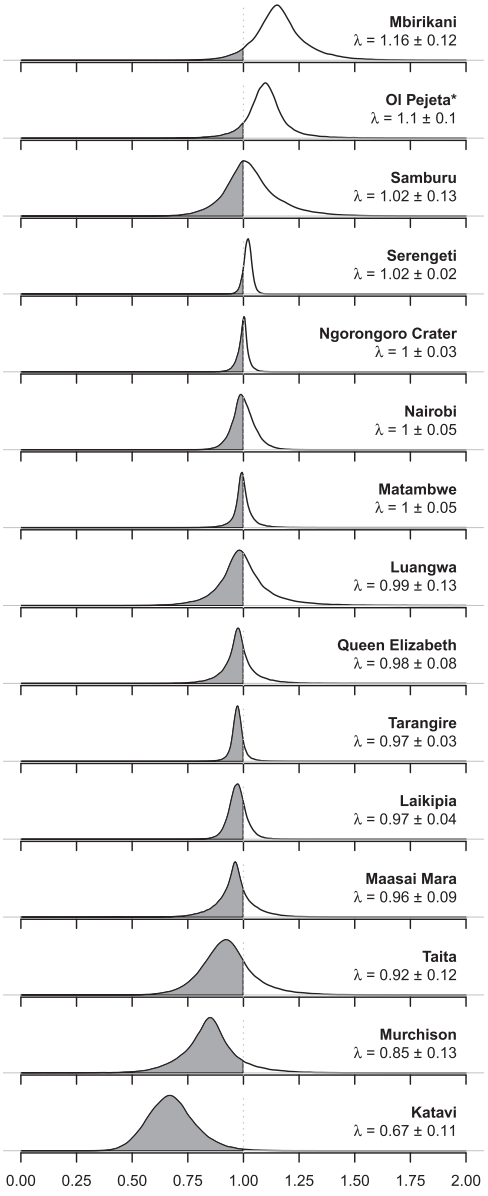


Fig. 3. Posterior densities of growth rates for East Africa lion populations. The gray areas under the curves indicate the probabilities of decline. Values shown are medians ± SDs of growth rate estimates. *Fenced populations.

methodology varied between years, although we limited our sample to counts that were consistently based on the most reliable survey techniques, and thus, the regional scale declines are unlikely to be an artifact of methodological shortcomings. If there is an overall bias in our results, it is probably toward optimism: our sample populations were all monitored in areas with at least partial protection, and research sites are known to be generally avoided by poachers and encroachers (27). Concomitantly, a clear pattern emerged that the most severely declining populations were the least well monitored (Fig. S5). In fact, it seems likely that unmonitored unfenced populations across much of Africa will have suffered even greater rates of decline than reported here, because lack of monitoring generally reflects a lack of conservation effort. The deteriorating conservation status of lions across much of the continent is further emphasized by the apparent extirpation of lions in 12 African countries, with possible recent extirpation in another 4 countries (25).

Niassa (Mozambique) was treated as an outlier because of the exceptional postwar situation, with the return of rule of law coinciding with increased scavenging opportunities resulting from high

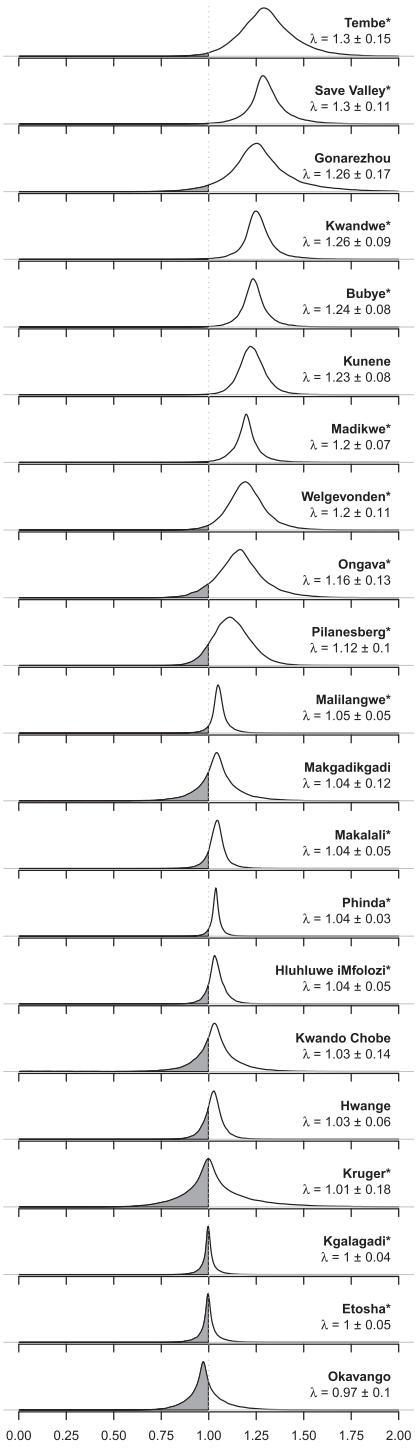


Fig. 4. Posterior densities of growth rates for southern Africa lion populations. The gray areas under the curves indicate the probabilities of decline. Values shown are medians ± SDs of growth rate estimates. *Fenced populations.

levels of elephant poaching. Human population density is relatively high in Mozambique, and therefore, unless management is further strengthened, this lion population may also experience declining prey abundance in the near future, which is common in most of Africa.

The striking contrast between countries in southern Africa and the rest of the continent is congruent with differences in human population density, which has been shown to be an important explanatory variable for population status (23). Another important determinant is prey abundance (28, 29), which is increasingly under threat from an unsustainable and increasingly commercialized bushmeat trade (6). Lion trends are consistent with time series data on their main prey species: whereas herbivore population sizes increased by 24% in southern Africa, herbivore numbers declined by 52% in East Africa and 85% in West Central Africa between 1970 and 2005 (5). Another important determinant is management budgets and capacity to protect parks, all of which are higher in the well maintained populations in southern Africa (23). Packer et al. (23) showed that management budget and the presence of wildlife proof fencing were the two most important determinants of short term lion population trends across Africa. Although the results presented in Figs. 3 and 4 are consistent with the benefits of fencing, we cannot present a formal analysis because of the negative relationship between data availability and rates of population decline (Fig. S5) and the lack of data on management budget for many of 47 sites in this analysis.

Nevertheless, our results clearly confirm widespread declines in West Central Africa and support the regionally critically endangered listing for West Africa (24). Moreover, they suggest that the lion is regionally endangered in East Africa, where lions have traditionally been abundant across large ecologically intact mosaics of landscapes (4). The rapid disappearance of lions from recently identified strongholds (4) also signals a major trophic downgrading of African ecosystems, with the lion no longer playing its ecological role as apex predator (30). The decline of lions was first apparent in West Central Africa (24) and is now apparent in East Africa. This decline is consistent with a broader pattern of defaunation (31), with multiple megafauna species experiencing massive declines (32).

Our results indicate that greatly increased intervention efforts are required to maintain viable and ecologically effective populations in most large "lion conservation units" (33, 34). Effective lion conservation requires management capacity and sizeable budgets (23), but most African reserves operate on low levels of funding and management capacity (23). Declining populations require immediate increases in financial support and improved governance and management capacity to reverse current trends, and cost effective monitoring will be essential in all of the important remaining lion populations. Accurate estimates of short to medium term changes require frequent counts, because time series data consisting of only two to three surveys can inevitably only provide very weak information on long term trends (Figs. S1 S4). These results emphasize the importance of consistent, rigorous large scale surveys conducted by independent agencies, particularly in countries like Tanzania, which has previously been assumed to hold a significant proportion of Africa's remaining lion populations.

Fenced reserves in Kenya and southern Africa are very effective, but these reserves include many small populations that require metapopulation management, euthanasia, and contraception and only make limited contributions to ecosystem functionality and conservation outcomes (23, 35, 36). Effective management of lions in large landscapes is also possible (9, 37) but has rarely been implemented at sufficiently large scale, except in southern Africa (21). Unless political and funding commitments are scaled up to address mounting levels of threat (23), lions may disappear from most of Africa.

Table 1. Cumulative probabilities of projected lion population decline by one-third (33%) and one-half (50%) in periods of 5, 10, 20, and 30 y and three LGs defined according to the IUCN

Population	Size	$p^{5}_{0\,33}$	$p^{5}_{0\,5}$	$p^{10}_{0\,33}$	$p^{10}_{0\,5}$	$p^{20}_{0\,33}$	$p^{20}_{0\,5}$	$p^{30}_{0\,33}$	$p^{30}_{0\,5}$	$p^{3LG}_{0\,33}$	$p^{3LG}_{0\,5}$
Western-Central											
Yankari	11	0.87	0.76	0.91	0.88	0.93	0.92	0.94	0.93	0.93	0.92
Niokolo	16	0.72	0.33	0.85	0.76	0.89	0.86	0.9	0.89	0.89	0.87
Waza	17	0.68	0.35	0.82	0.72	0.87	0.84	0.88	0.86	0.87	0.84
Kainji	32	0.56	0.33	0.69	0.6	0.75	0.71	0.76	0.74	0.75	0.71
W	64	0.2	0.1	0.34	0.23	0.44	0.36	0.48	0.42	0.45	0.37
Benoue	200	0.17	0.08	0.3	0.2	0.39	0.32	0.42	0.37	0.39	0.33
Eastern											
Taita	15	0.5	0.3	0.65	0.54	0.72	0.67	0.74	0.71	0.72	0.68
Samburu	26	0.15	0.07	0.25	0.17	0.32	0.27	0.35	0.31	0.33	0.28
Nairobi	30	0.06	0.01	0.19	0.08	0.34	0.23	0.4	0.31	0.35	0.24
Laikipia	60	0.1	0.01	0.37	0.15	0.59	0.43	0.66	0.56	0.6	0.45
Luangwa	94	0.21	0.1	0.36	0.24	0.45	0.38	0.49	0.44	0.46	0.39
Matambwe	112	0.03	0.01	0.12	0.05	0.26	0.14	0.36	0.23	0.28	0.15
Murchison	132	0.78	0.6	0.86	0.81	0.88	0.86	0.89	0.88	0.88	0.87
Queen Elizabeth	144	0.16	0.06	0.36	0.2	0.54	0.4	0.6	0.51	0.55	0.41
Tarangire	157	0.04	0.01	0.28	0.06	0.63	0.36	0.73	0.58	0.65	0.39
Maasai Mara	286	0.26	0.1	0.5	0.31	0.65	0.54	0.69	0.63	0.66	0.56
Southern											
Kgalagadi*	115	0.03	0.01	0.11	0.04	0.21	0.13	0.28	0.19	0.22	0.13
Kwando Chobe	285	0.11	0.06	0.19	0.13	0.25	0.2	0.27	0.23	0.25	0.21
Makgadikgadi	327	0.1	0.05	0.16	0.12	0.21	0.17	0.23	0.2	0.21	0.18
Etosha*	457	0.05	0.01	0.14	0.07	0.26	0.16	0.33	0.23	0.26	0.17
Okavango	1107	0.2	0.09	0.38	0.24	0.55	0.42	0.59	0.52	0.55	0.44
Kruger*	1672	0.2	0.12	0.3	0.22	0.37	0.31	0.39	0.35	0.37	0.32

Population sizes show most recent estimates of lion numbers. Extinct populations or populations unlikely to decline are not shown.
*Fenced population.

Materials and Methods

We compiled and analyzed data from 47 lion populations representing the best available knowledge of the species from the past two decades (23, 25) (Dataset S1). Population estimates were obtained by diverse methods, including total count, individual identifications, total or sample inventory using calling stations, radio telemetry, photo databases, transects, spoor counts, and density estimates based on direct observations corrected for patrol effort (20, 22, 24, 38). We excluded population estimates that were based on extrapolation of lion densities in adjacent areas and unpublished guesstimates by experts. There is a wide discrepancy between populations regarding the intensity of monitoring: some have only been monitored two times during the period of our study, others have been monitored more regularly, and a few are monitored annually.

We used a Bayesian state space model to estimate the growth rate-λ of each population (39). Theoretically, a hierarchical approach could be used to explain the growth rate of each population with hyperparameters (40, 41) describing, for example, broad geographic location (southern, East, or West Central Africa), human population density, whether the reserve is fenced, conservation efforts, or governance scores (23). What is often referred to as "borrowing strength" by modeling parameters in the data model as random variables at the group level drawn from a hyper-distribution would allow a more informative posterior parameter estimate than a separate analysis of each dataset (42–44). However this approach was ill suited for this analysis, because populations were not exchangeable since populations with small amounts of data were not random draws from the overall distribution of lambda (Fig. S1): growing populations are well-monitored, whereas declining populations are often poorly monitored. Two-thirds of the populations that are missing more than one-half of the data are declining, whereas two-thirds of the populations missing less than one-half of the data are increasing. Thus, a posthoc analysis confirmed that posterior median estimates of population growth rates were positively correlated with the number of years of data in each time series ($P < 0.05$). A hierarchical approach would, therefore, bias the posterior estimates of growth rate toward the information-rich growing populations and thus, provide spurious inferences about overall population dynamics, because the model would attempt to fit the data from the declining populations by increasing individual random effects without capturing any biological mechanisms.

Our process model assumes that true population size at time t (N_t) follows a log-normal distribution of the deterministic prediction of the median population size at time t (μ_t) with a stochastic process error on the log scale-σ_{proc}. The deterministic prediction results from exponential growth with rate-λ:

$$\begin{cases} \mu_t & \log(\lambda \cdot N_{t\ 1}) \\ N_t \sim \text{lognormal}(\mu_t, \sigma_{\text{proc}}) \end{cases}.$$

We link this process model to census data with an observation model, where the count of lions at time t ($Nobs_t$) is Poisson-distributed, with mean-ψ_t itself drawn from a Gamma-distribution with mean equal to the prediction of the process model and an SD for observation error σ_{Nobs}. This hierarchical formulation allows the uncertainty in the data to exceed the variance of the Poisson parameter-ψ_t (45):

$$\begin{cases} \alpha_t & \dfrac{N_t^2}{\sigma^2_{Nobs}} \\ \beta_t & \dfrac{N_t}{\sigma^2_{Nobs}} \\ \psi_t \sim \Gamma(\alpha_t, \beta_t) \\ Nobs_t \sim \text{Poisson}(\psi_t) \end{cases}.$$

For each population, we ran six Monte Carlo Markov Chains (100,000 iterations thinning by 10 after adapting and updating for 50,000 iterations) with JAGS (46) and R (47) and checked convergence (48).

Forty-seven unweighted posterior density distributions of growth rate (one per population) were summed across three sets to provide geographic conservation-relevant estimates of demographic trends. The four African regions defined by the IUCN regional lion conservation strategies (33, 34) constituted three sets after we lumped West and Central Africa because of similar genetic characteristics and conservation threats.

We estimated the projected probability of decline over T years by 33% [$p^{T}_{0\,33}$ $P(\lambda^{T} < 0.67)$] and 50% [$p^{T}_{0\,5}$ $P(\lambda^{T} < 0.5)$] for each population (without making inferences on true population size N), with T equal to 5, 10, 20, or 30 y. Because the IUCN Red List mandates an appraisal of species' population trends over the longer time period of three generation lengths (GLs) or 10 y (49), we also calculated $p^{T}_{0\,33}$ and $p^{T}_{0\,50}$, where T $3 \times$ GL. GL 7 is defined by GL $R_{\text{span}} \times Z +$ age of first reproduction, where age of first

reproduction is 3.5 y (50), R_{span} 12 [the number of years that females are reproductive (50)], and Z 0.29 [a constant calculated as the slope of the linear regression between GL and R_{span} for 221 mammalian species (51)] as recommended by the IUCN. Two populations are presented separately from any grouping: the Gir populations in India and Niassa Reserve in Mozambique, which is considered an outlier (*Discussion*).

ACKNOWLEDGMENTS. We acknowledge the contribution of E. Sogbohossou, M. Hoffmann, C. Breitenmoser-Wursten, U. Breitenmoser, M. Becker, B. Croes, S. Dell, M. Dricuru, R. Groom, A. Loveridge, S. Miller, L. Petracca, A. Battistoni, H. Robinson, T. Tende, P. Trethowan, P. Tumenta, M. Venktraman, P. White, L. Bertola, C. Winterbach, C. Hilton-Taylor, H. Andrén, and F. Chiozza. The maps benefited from the Geographical Information System expertise of Michelle Moeller.

1. Ripple WJ, et al. (2014) Status and ecological effects of the world's largest carnivores. *Science* 343(6167):1241484.
2. Chapron G, et al. (2014) Recovery of large carnivores in Europe's modern human-dominated landscapes. *Science* 346(6216):1517–1519.
3. Gompper ME, Belant JL, Kays R (2015) Carnivore coexistence: America's recovery. *Science* 347(6220):382–383.
4. Riggio J, et al. (2013) The size of savannah Africa: A lion's (Panthera leo) view. *Biodivers Conserv* 22(1):17–35.
5. Craigie ID, et al. (2010) Large mammal population declines in Africa's protected areas. *Biol Conserv* 143(9):2221–2228.
6. Lindsey PA, et al. (2013) The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. *Biol Conserv* 160:80–96.
7. Lindsey PA, et al. (2013) The trophy hunting of African lions: Scale, current management practices and factors undermining sustainability. *PLoS One* 8(9):e73808.
8. Bauer H, de Iongh H, Sogbohossou E (2010) Assessment and mitigation of human-lion conflict in West and Central Africa. *Mammalia* 74(4):363–367.
9. Hazzah L, et al. (2014) Efficacy of two lion conservation programs in Maasailand, Kenya. *Conserv Biol* 28(3):851–860.
10. Ikanda D, Packer C (2008) Ritual vs. retaliatory killing of African lions in the Ngorongoro Conservation Area, Tanzania. *Endanger Species Res* 6:67–74.
11. Becker M, et al. (2013) Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. *Biol Conserv* 158:26–36.
12. Croes BM, et al. (2011) The impact of trophy hunting on lions (Panthera leo) and other large carnivores in the Bénoué Complex, northern Cameroon. *Biol Conserv* 144(12): 3064–3072.
13. Groom RJ, Funston PJ, Mandisodza R (2014) Surveys of lions Panthera leo in protected areas in Zimbabwe yield disturbing results: What is driving the population collapse? *Oryx* 48(03):385–393.
14. Loveridge AJ, Searle AW, Murindagomo F, Macdonald DW (2007) The impact of sport-hunting on the population dynamics of an African lion population in a protected area. *Biol Conserv* 134(4):548–558.
15. Packer C, et al. (2011) Effects of trophy hunting on lion and leopard populations in Tanzania. *Conserv Biol* 25(1):142–153.
16. Packer C, et al. (2009) Sport hunting, predator control and conservation of large carnivores. *PLoS One* 4(6):e5941.
17. Rosenblatt E, et al. (2014) Detecting declines of apex carnivores and evaluating their causes: An example with Zambian lions. *Biol Conserv* 180:76–186.
18. Sogbohossou EA, et al. (2014) Social structure of lions (Panthera leo) is affected by management in Pendjari Biosphere Reserve, Benin. *PLoS One* 9(1):e84674.
19. Williams VL (2015) Traditional medicines: Tiger-bone trade could threaten lions. *Nature* 523(7560):290.
20. Bauer H, Van Der Merwe S (2004) Inventory of free-ranging lions Panthera leo in Africa. *Oryx* 38(01):26–31.
21. Ferreira SM, Funston PJ (2010) Estimating lion population variables: Prey and disease effects in Kruger National Park, South Africa. *Wildl Res* 37(3):194–206.
22. Funston PJ, et al. (2010) Substrate and species constraints on the use of track incidences to estimate African large carnivore abundance. *J Zool* 281(1):56–65.
23. Packer C, et al. (2013) Conserving large carnivores: Dollars and fence. *Ecol Lett* 16(5): 635–641.
24. Henschel P, et al. (2014) The lion in West Africa is critically endangered. *PLoS One* 9(1): e83500.
25. Bauer H, Packer C, Funston P, Henschel P, Nowell K (2015) *Panthera leo in the 2015 IUCN Red List of Threatened Species.* Avaliable at www.iucnredlist.org/details/15951/0. Accessed October 8, 2015.
26. Meena V, Macdonald DW, Montgomery RA (2014) Managing success: Asiatic lion conservation, interface problems and peoples' perceptions in the Gir Protected Area. *Biol Conserv* 174:120–126.
27. Laurance WF (2013) Does research help to safeguard protected areas? *Trends Ecol Evol* 28(5):261–266.
28. Hayward MW, O'Brien J, Kerley GIH (2007) Carrying capacity of large African predators: Predictions and tests. *Biol Conserv* 139(1):219–229.
29. Van Orsdol KG, Hanby JP, Bygott JD (1985) Ecological correlates of lion social organization (Panthers, leo). *J Zool* 206(1):97–112.
30. Estes JA, et al. (2011) Trophic downgrading of planet Earth. *Science* 333(6040): 301–306.
31. Dirzo R, et al. (2014) Defaunation in the Anthropocene. *Science* 345(6195):401–406.
32. Ripple WJ, et al. (2015) Collapse of the world's largest herbivores. *Sci Adv* 1(4): e1400103.
33. IUCN (2006) *Conservation Strategy for the Lion in East and Southern Africa* (IUCN SSC Cat Specialist Group, Pretoria, South Africa).
34. IUCN (2006) *Conservation Strategy for the Lion in West and Central Africa* (IUCN SSC Cat Specialist Group, Yaounde, Cameroon).
35. Miller SM, et al. (2013) Management of reintroduced lions in small, fenced reserves in South Africa: An assessment and guidelines. *S Afr J Wildl Res* 43(2):138–154.
36. Slotow R, Hunter LTB (2009) Reintroduction decisions taken at the incorrect social scale devalue their conservation contribution: The African lion in South Africa. *Reintroduction of Top-Order Predators* (Wiley-Blackwell, New York), pp 43–71.
37. Lichtenfeld LL, Trout C, Kisimir EL (2014) Evidence-based conservation: Predator-proof bomas protect livestock and lions. *Biodivers Conserv* 24(3):1–9.
38. Durant SM, et al. (2011) Long-term trends in carnivore abundance using distance sampling in Serengeti National Park, Tanzania. *J Appl Ecol* 48(6):1490–1500.
39. McCarthy MA (2007) *Bayesian Methods for Ecology* (Cambridge Univ Press, Cambridge, United Kingdom).
40. Clark JS (2007) *Models for Ecological Data: An Introduction* (Princeton Univ Press, Princeton).
41. Royle JA, Dorazio RM (2008) *Hierarchical Modeling and Inference in Ecology: The Analysis of Data from Populations, Metapopulations and Communities* (Academic, London).
42. Morris CN, Normand SL (1992) Hierarchical models for combining information and for meta-analyses. *Bayesian Stat* 4:321–344.
43. Riebler A, Held L, Rue H (2012) Estimation and extrapolation of time trends in registry data—borrowing strength from related populations. *Ann Appl Stat* 6(1):304–333.
44. Gopalaswamy AM, et al. (2012) Density estimation in tiger populations: Combining information for strong inference. *Ecology* 93(7):1741–1751.
45. Liberg O, et al. (2012) Shoot, shovel and shut up: Cryptic poaching slows restoration of a large carnivore in Europe. *Proc R Soc Lond B Biol Sci* 279(1730):910–915.
46. Plummer M (2003) JAGS: A program for analysis of Bayesian graphical models using Gibbs sampling. *Proceedings of the 3rd International Workshop on Distributed Statistical Computing*, eds Hornik K, Leisch F, Zeileis A (Vienna). Available at www.ci.tuwien.ac.at/Conferences/DSC-2003/Proceedings/Plummer.pdf. Accessed October 8, 2015.
47. R Development Core Team (2015) *R: A Language and Environment for Statistical Computing* (R Foundation for Statistical Computing, Vienna).
48. Gelman A, Rubin DB (1992) Inference from iterative simulation using multiple sequences. *Stat Sci* 7(4):457–472.
49. IUCN SSC (2012) *IUCN Red List Categories and Criteria: Version 3.1* (IUCN Species Survival Commission, Gland, Switzerland), 2nd Ed.
50. Packer C, Tatar M, Collins A (1998) Reproductive cessation in female mammals. *Nature* 392(6678):807–811.
51. Pacifici M, et al. (2013) Generation length for mammals. *Nat Conserv* 5:89–94.

Supporting Information

Bauer et al. 10.1073/pnas.1500664112

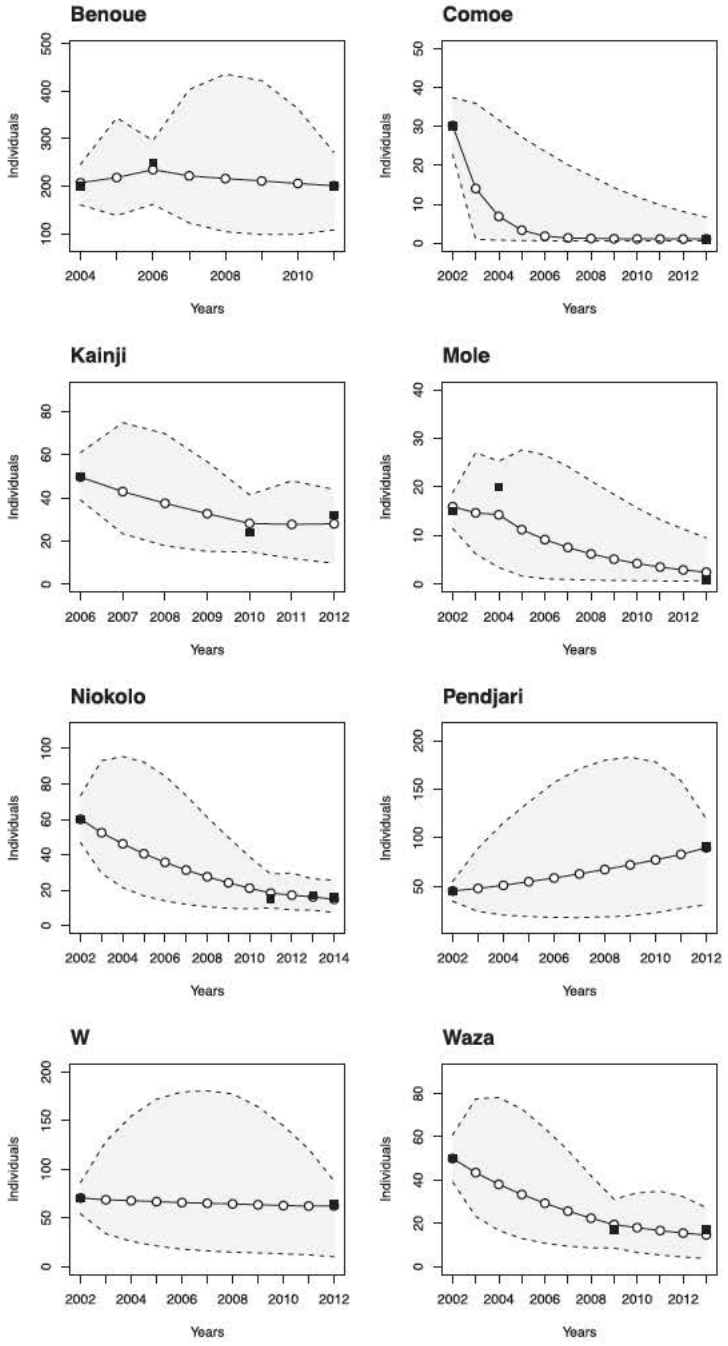


Fig. S1. (Continued)

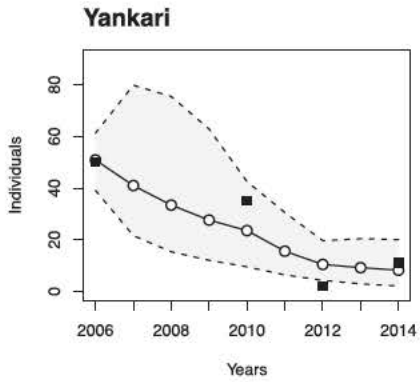


Fig. S1. West Central African populations: model fitted to time series (black squares are data, white circles are medians of the model-inferred true population sizes μ_b and gray areas between dashes lines are 95% credible intervals).

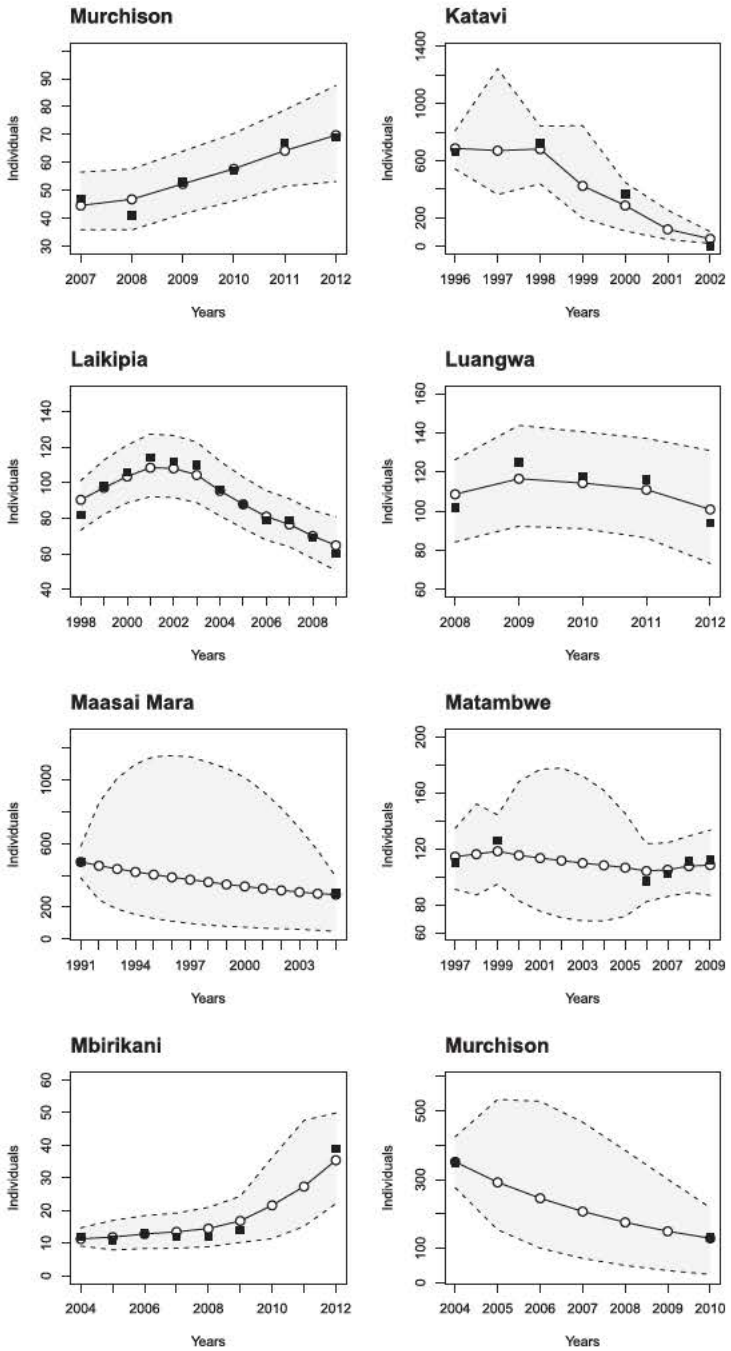


Fig. S2. (Continued)

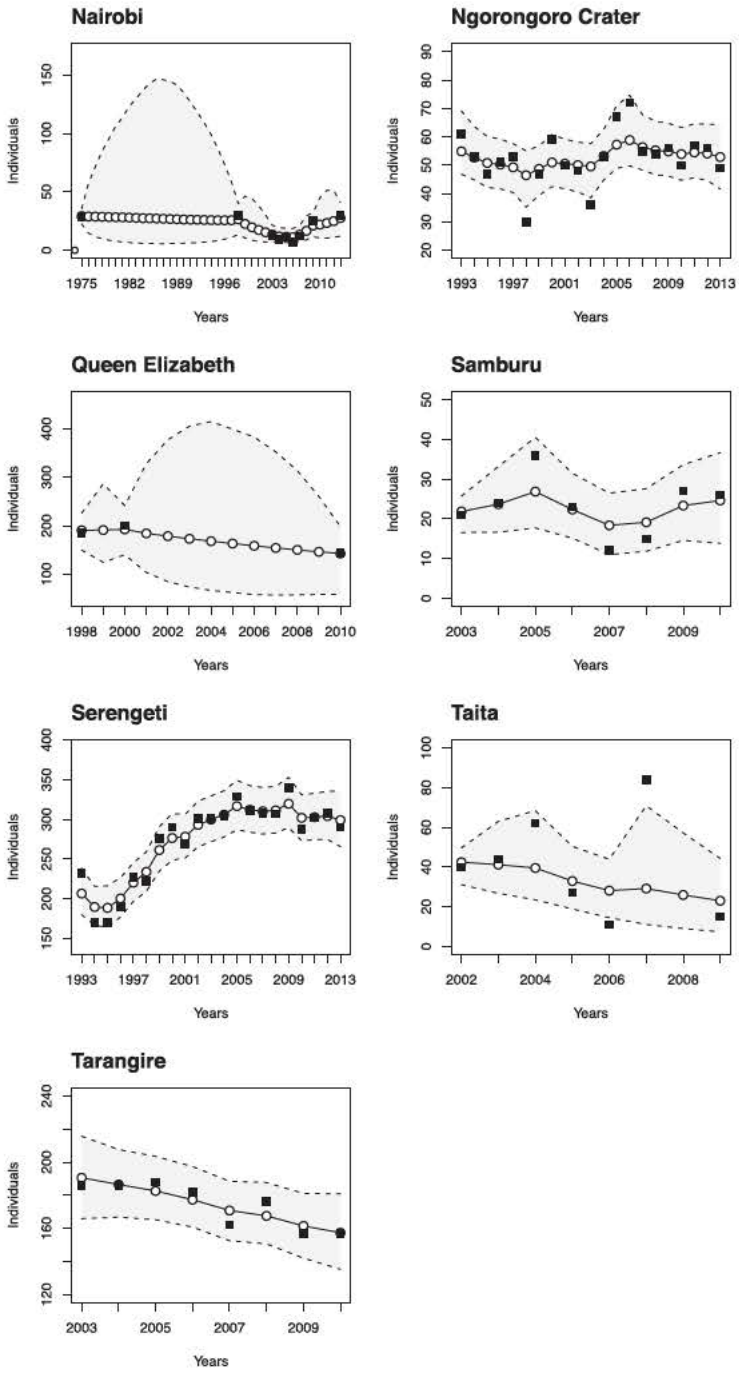


Fig. S2. East African populations: model fitted to time series (black squares are data, white circles are medians of the model-inferred true population sizes μ_t, and gray areas between dashes lines are 95% credible intervals). *Fenced populations.

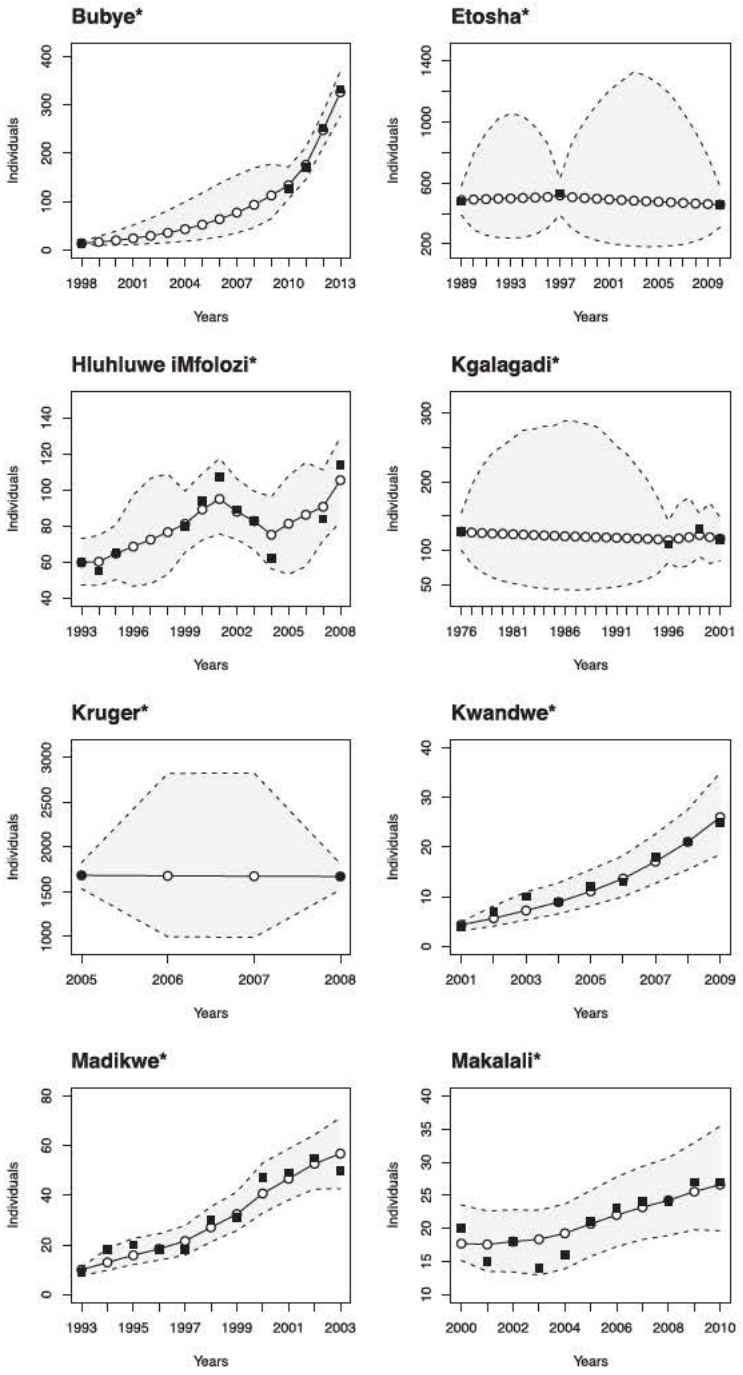


Fig. S3. (Continued)

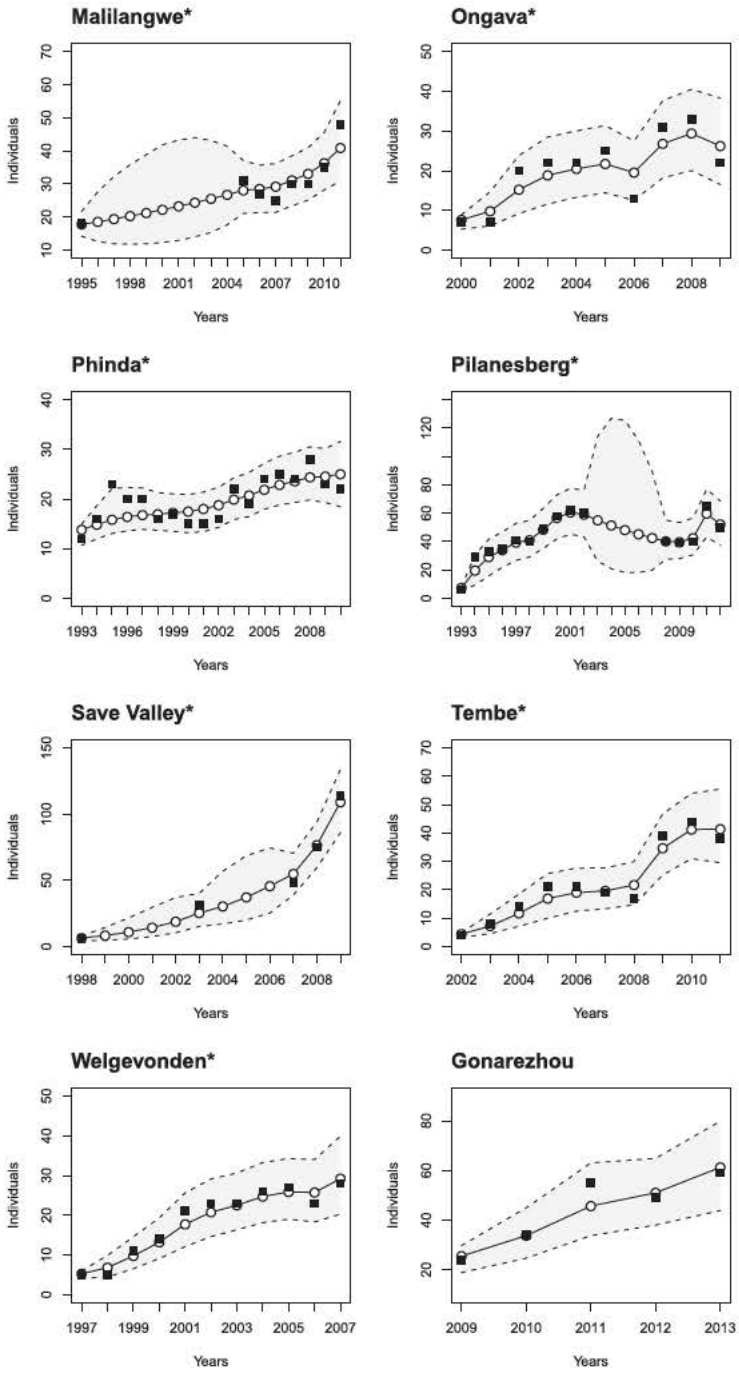


Fig. S3. (Continued)

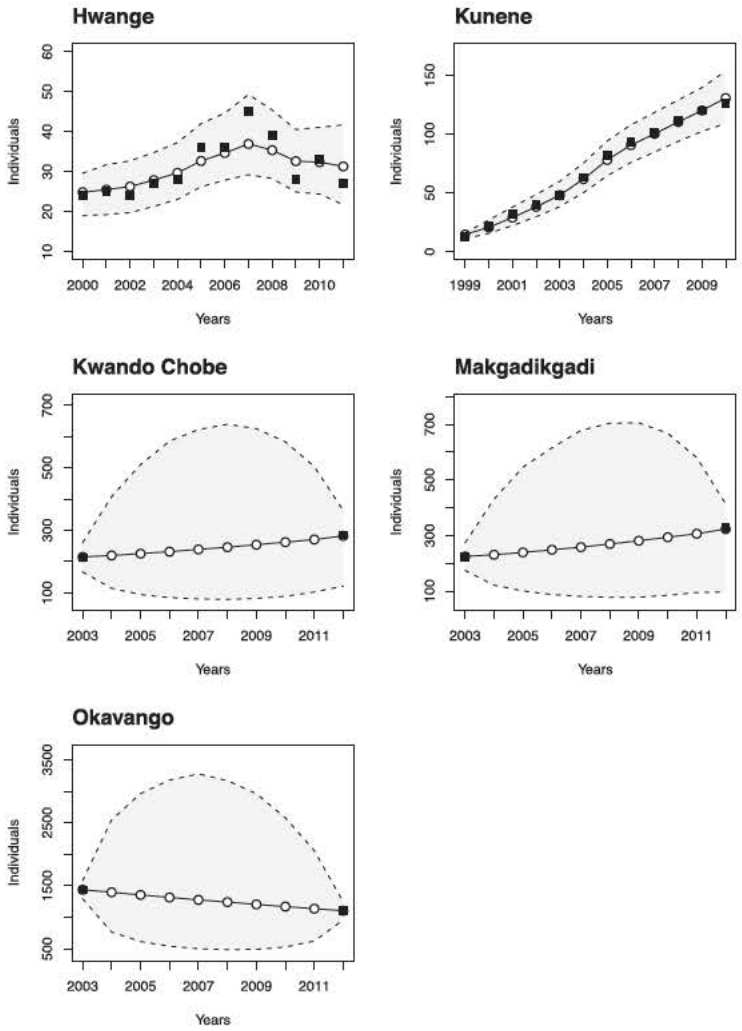


Fig. S3. Southern African populations: model fitted to time series (black squares are data, white circles are medians of the model-inferred true population sizes μ_b and gray areas between dashes lines are 95% credible intervals). *Fenced populations.

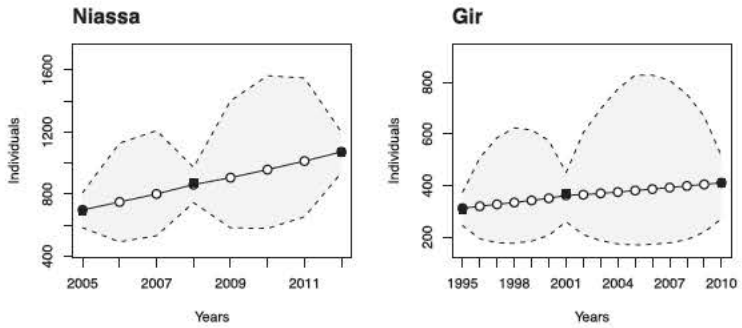


Fig. S4. Other populations: model fitted to time series (black squares are data, white circles are medians of the model-inferred true population sizes μ_b and gray areas between dashes lines are 95% credible intervals).

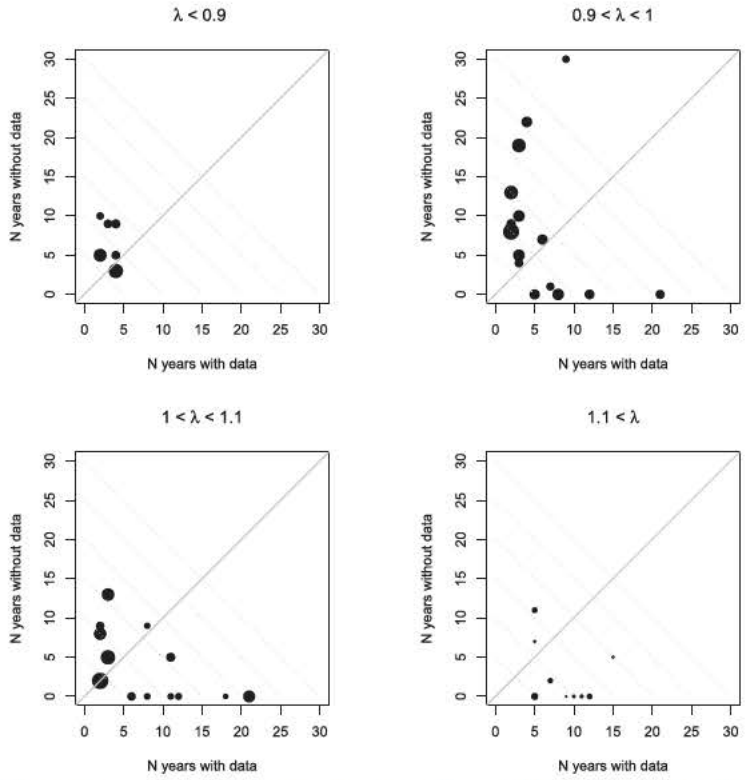


Fig. S5. Patterns of information in the time series data. Each site is represented by the number of years with and without data in its time series, and each point is scaled according to population size. Populations are grouped according to our modeled growth rate estimates. The area above the solid diagonal line indicates populations with times series that lack data for more than one-half of the years. The area below the solid diagonal lines indicates populations with data from more than one-half of the years in the time series. Dotted diagonal lines indicate the overall span of each time series. For example, a 10-y time series (including years with missing data) is indicated by the line having 10 as *x* and *y* intercepts.

Dataset S1. Monitoring data for 47 lion populations (23)

Dataset S1

ECOLOGY LETTERS

Ecology Letters, (2013) doi: 10.1111/ele.12091

LETTER

Conserving large carnivores: dollars and fence

C. Packer,[1]* A. Loveridge,[2] S. Canney,[3] T. Caro,[4] S.T. Garnett,[5] M. Pfeifer,[6] K.K. Zander,[5] A. Swanson,[1] D. MacNulty,[7] G. Balme,[8,9] H. Bauer,[10] C.M. Begg,[11] K.S. Begg,[11] S. Bhalla,[12] C. Bissett,[13] T. Bodasing,[14] H. Brink,[15] A. Burger,[16] A.C. Burton,[17] B. Clegg,[18] S. Dell,[19] A. Delsink,[20] T. Dickerson,[21] S.M. Dloniak,[22] D. Druce,[14,20] L. Frank,[23] P. Funston,[24] N. Gichohi,[25] R. Groom,[26] C. Hanekom,[14] B. Heath,[27] L. Hunter,[8] H.H. Delongh,[28,29] C J. Joubert,[30] S.M. Kasiki,[31] B. Kissui,[32] W. Knocker,[33] B. Leathem,[34] P.A. Lindsey,[8,35] S.D. Maclennan,[10] J.W. McNutt,[36] S.M. Miller,[24] S. Naylor,[21] P. Nel,[19] C. Ng'weno,[25] K. Nicholls,[37] J.O. Ogutu,[38] E. Okot-Omoya,[39] B.D. Patterson,[40] A. Plumptre,[39] J. Salerno,[41] K. Skinner,[42] R. Slotow,[20] E.A. Sogbohossou,[43] K.J. Stratford,[44] C. Winterbach,[45] H. Winterbach[45] and S. Polasky[1,46]

Abstract

Conservationists often advocate for landscape approaches to wildlife management while others argue for physical separation between protected species and human communities, but direct empirical comparisons of these alternatives are scarce. We relate African lion population densities and population trends to contrasting management practices across 42 sites in 11 countries. Lion populations in fenced reserves are significantly closer to their estimated carrying capacities than unfenced populations. Whereas fenced reserves can maintain lions at 80% of their potential densities on annual management budgets of \$500 km^{-2}, unfenced populations require budgets in excess of \$2000 km^{-2} to attain half their potential densities. Lions in fenced reserves are primarily limited by density dependence, but lions in unfenced reserves are highly sensitive to human population densities in surrounding communities, and unfenced populations are frequently subjected to density independent factors. Nearly half the unfenced lion populations may decline to near extinction over the next 20 40 years.

Keywords

Carnivores, carrying capacity, density dependence, exponential growth, landscape conservation, spatial separation.

Ecology Letters (2013)

[1]*Department of Ecology, Evolution and Behavior, University of Minnesota, St. Paul, MN, 55408, USA*
[2]*Recanati Kaplan Centre/WildCRU, Department of Zoology, University of Oxford, Tubney, OX13 5QL, UK*
[3]*Spatial Ecology & Epidemiology Group, Department of Zoology, University of Oxford, Oxford, OX1 3PS, UK*
[4]*Department of Wildlife, Fish & Conservation Biology, University of California, Davis, CA, 95616, USA*
[5]*Research Institute for the Environment & Livelihoods, Charles Darwin University, Casuarina, NT, 0909, Australia*
[6]*Department of Ecology & Evolution, Imperial College London, London, UK*
[7]*Department of Wildland Resources & Ecology Center, Utah State University, Logan, UT, 84322, USA*
[8]*Panthera, New York, NY, 10018, USA*
[9]*Department of Zoology, University of Cape Town, Rondebosch, 7701, South Africa*
[10]*Wildlife Conservation Research Unit, University of Oxford, Tubney, OX13 5QL, UK*
[11]*Niassa Carnivore Project, Ratel Trust, Cape Town, South Africa*
[12]*Ewaso Lions Project, P.O. Box 14996, Nairobi, 00800, Kenya*
[13]*Wildlife & Reserve Management Research Group, Department of Zoology & Entomology, Rhodes University, Grahamstown, South Africa*
[14]*Ezemvelo KZN Wildlife, KwaZulu Natal, South Africa*
[15]*Durrell Institute of Conservation and Ecology, University of Kent, Kent, CT2 7NR, UK*
[16]*Welgevonden Game Reserve, Bulge River, South Africa*
[17]*Alberta Biodiversity Monitoring Institute, University of Alberta, Edmonton, AB, T6G 2E9, Canada*
[18]*Malilangwe Wildlife Reserve, P. Bag 7085, Chiredzi, Zimbabwe*
[19]*NorthWest Parks and Tourism Board, Mafikeng, South Africa*
[20]*School of Life Sciences, University of KwaZulu Natal, KwaZulu Natal, South Africa*
[21]*Phinda Private Game Reserve, Hluhluwe, South Africa*
[22]*Department of Zoology, Michigan State University, East Lansing, MI, 48824, USA*
[23]*Living with Lions, Museum of Vertebrate Zoology, University of California, Berkeley, CA, 94720, USA*
[24]*Department of Nature Conservation, Tshwane University of Technology, Pretoria, 0002, South Africa*
[25]*Ol Pejeta Conservancy, Nanyuki, Kenya*
[26]*Department of Zoology, University of Johannesburg, Auckland Park 2006, South Africa*
[27]*Mara Conservancy, Nairobi, Kenya*
[28]*Institute of Environmental Sciences, Leiden University, POB 9518, 2300 RA Leiden, The Netherlands*
[29]*Evolutionary Ecology Group, Department of Biology, University of Antwerp, Groenenborgerlaan 171, 2020 Antwerpen, Belgium*
[30]*Sango Ranch, Savé Valley Conservancy, Zimbabwe*
[31]*Kenya Wildlife Service, P.O. Box 40241 00100, Nairobi, Kenya*
[32]*African Wildlife Foundation, Arusha, Tanzania*

© 2013 Blackwell Publishing Ltd/CNRS

INTRODUCTION

Populations of large carnivores are declining around the globe, often with dramatic effects on lower trophic levels (Estes *et al.* 2011). These species typically range over such wide areas that it can be difficult to maintain viable populations without some individuals coming into close proximity to humans, posing serious threats to human safety and domestic livestock. Conservationists have therefore sought methods to promote human carnivore coexistence outside the confines of national parks and wilderness areas (Woodroffe *et al.* 2005; Dickman *et al.* 2011). Given the potential conflicts with humans, however, separation of large carnivores from human communities may ultimately be preferable to a landscape level conservation approach as has been demonstrated for forestry (Boscolo & Vincent 2003) and agriculture (Phalan *et al.* 2011).

Few species encapsulate these problems more dramatically than the African lion. Lion densities are directly dependent on prey biomass (Van Orsdol *et al.* 1985; Hayward *et al.* 2007), and annual range requirements for a single lion pride can exceed 1000 km^2 (Funston 2011). Habitat loss in the past 100 years has reduced the lion's range by 75% (Riggio *et al.* 2012), and human lion conflicts have intensified because lions kill livestock (Woodroffe & Frank 2005; Kissui 2008) and people (Packer *et al.* 2005a, 2011a). In addition, poorly regulated sport hunting has resulted in over harvesting in several countries (Packer *et al.* 2009, 2011b), the effects of which can extend into unhunted National Parks (Loveridge *et al.* 2007; Caro 2008; Kiffner *et al.* 2009). Finally, numerous lion populations are genetically isolated (Slotow & Hunter 2009), and inbreeding has caused measureable reductions in reproductive rates and disease resistance in several small populations (Kissui & Packer 2004; Trinkel *et al.* 2008, 2011; also see Johnson *et al.* 2010).

Yet, not all lion populations have declined. The Serengeti lions, for example, have steadily increased over the past half century (Packer *et al.* 2005b), populations have remained stable in several large South African national parks (Ferreira & Funston 2010; Funston 2011), and numerous private reserves in South Africa and Zimbabwe have successfully restored lions to areas where they had previously been extirpated (Hunter *et al.* 2007; Lindsey *et al.* 2009a,b; Slotow & Hunter 2009). However, lions are considered so dangerous in South Africa that they can only be re introduced after management authorities erect lion proof fencing and agree to recapture or destroy any escaping lions (Hunter *et al.* 2007; Slotow & Hunter 2009).

Wildlife proof fences effectively prevent most potential conflicts between lions and humans in southern Africa (Ferguson & Hanks 2010), yet this strategy runs counter to a long standing conservation ethic of keeping protected areas unfenced and contrasts with the wildlife policies of many range states (Hayward & Kerley 2009; Licht *et al.* 2010; Slotow 2012). Depending on the size of the enclosed population, fencing often also necessitates routine genetic and demographic management of smaller populations via translocations of breeding aged individuals (Trinkel *et al.* 2008; Johnson *et al.* 2010). Thus, many conservationists have instead sought to encourage human wildlife co existence through conflict mitigation programmes, compensation schemes, insurance plans or payments for tolerance (e.g. Dickman *et al.* 2011). However, the costs of managing dangerous wildlife are formidable. For example, effective elephant and tiger conservation has been estimated to cost $365 930 per km^2 per year (Leader Williams & Albon 1988; Walston *et al.* 2010), and the overall costs of anti poaching and compensation will only increase in range states with growing human populations (Wittemyer *et al.* 2008; Pfeifer *et al.* 2012), declining purchasing power of external funds (Garnett *et al.* 2011) or worsening corruption (Garnett *et al.* 2011).

African lions are among the most extensively studied carnivores in the world with population data available from a wide variety of protected areas in nearly a dozen different countries with divergent conservation practices. Several recently developed ecological models can accurately estimate lion carrying capacities across a wide range of ecological conditions (Hayward *et al.* 2007; Loveridge & Canney 2009), making it possible to estimate the effectiveness of lion conservation in a given reserve by measuring how closely the observed population density matches the expected density. The large number of long term studies also provides measures of population trends across a wide variety of circumstances. Here, we explicitly test the effectiveness of fencing and management budgets on lion population size and growth rates, while including the impacts of human population density, governance, sport hunting, private management and protected area size.

MATERIALS AND METHODS

Data come from repeated surveys in 38 sites (median span = 12 years; range: 3 46 years) and single surveys in an additional four sites. Population growth rates were estimated from the exponents of exponential regressions of population size over the most recent 10 years for each time series, using nonlinear models in Program R (R Development Core Team 2011), function *nls*. Because many long term study sites were surveyed irregularly, data were sometimes only available up to 1995 2004, and the median time span was 9 years (range: 3 14 years) (Table S1); Figure S1 shows time series as densities (lions/100 km^2) except for Mole Park, Ghana, where data were collected as number of 'contacts per 100 ranger patrols'.

In an analysis of historical data from 49 undisturbed sites, Loveridge & Canney (2009) found a tight correlation ($r^2 = 0.9271$) between contemporaneous population sizes of lions and large to

[33]*Silole Sanctuary, PO Box 938, Karen, Kenya*
[34]*Bubye Valley Conservancy, Zimbabwe*
[35]*Mammal Research Institute, Department of Zoology & Entomology, University of Pretoria, Pretoria, South Africa*
[36]*Botswana Predator Conservation Trust, Maun, Botswana*
[37]*69 Comeragh Rd, London, W14 9HT, UK*
[38]*Bioinformatics Unit, University of Hohenheim, Stuttgart, 70599, Germany*
[39]*Wildlife Conservation Society, PO Box 7487, Kampala, Uganda*
[40]*Department of Zoology, Field Museum of Natural History, Chicago, IL, 60605, USA*
[41]*Graduate Group in Ecology, University of California, Davis, CA, 95616,*
[42]*Selous Lion Project, PO Box 34514, Dar es Salaam, Tanzania*
[43]*Laboratory of Applied Ecology, University of Abomey Calavi, Cotonou, Benin*
[44]*Ongava Research Centre, PO Box 58, Okaukeujo, Namibia*
[45]*Centre for Wildlife Management, University of Pretoria, Pretoria, South Africa*
[46]*Department of Applied Economics, University of Minnesota, St. Paul, MN, 55408, USA*
**Correspondence: E mail: packer@umn.edu*

© 2013 Blackwell Publishing Ltd/CNRS

medium sized ungulates; the resultant equation between lion and prey biomass was $Y = 0.0109x^{0.8782}$. Where ungulate surveys were not available, Loveridge & Canney found a close fit for ungulate biomass by modeling habitats according to NOAA's Africa Data Dissemination Service Rainfall Estimate (ADDS RFE) and cation exchange capacities taken from the ISRIC WISE soil profile data set (www.isric.org/data/isric wise international soil profile dataset) separated into high , medium and low nutrient levels. In the current analysis, 'expected' lion densities were calculated from known prey biomass where possible (34 sites); otherwise, herbivore densities were predicted from rainfall and soils (8 sites); the method used for estimating 'lion carrying capacity' did not significantly affect any of our results.

Each site is classified as managed by public or private agencies, subjected to sport hunting, separated from surrounding communities by wildlife proof fencing, country/geographical region, and method of estimating carrying capacity (prey biomass vs. rainfall/soils); we also tested effects of reserve size. Human population data were taken from the AfriPop Project (www.afripop.org) (Linard *et al.* 2012; measuring human densities within one kilometre of protected area boundaries extracted from the World Database of Protected Areas (IUCN & UNEP 2009)(see Pfeifer *et al.* 2012). Governance was based on UNDP's six indicators (Voice/Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption) (UNDP 2010). Principal Components Analysis showed that 87% of variation between indicators was captured by a single component ('Governance') (Table S2). In the statistical analyses, management budgets are US$ per km^2 per year while controlling for purchasing power and likely losses to corruption (Garnett *et al.* 2011). Budgets could not be partitioned according to anti poaching, outreach, fence repairs, road maintenance, etc.

For 14 of 42 sites, wildlife surveys were restricted to the best protected portion of each reserve, whereas budgets were only available for the entire reserve. Expenditures per km^2 were based on two alternative measures: first, total budget divided by the size of the overall protected area (a lower bound which assumes that management expenditures are spread evenly over the entire reserve); second, total budget divided by the size of the survey area (an upper bound which assumes that management expenditures are spent exclusively within the survey area). These alternative measures produced virtually identical results; statistical tests are based on the geometric mean of the two extremes.

Human population densities, protected area sizes, annual management budgets and the ratios of current to expected population size were all lognormal, so statistics on the two response variables (population growth rate and current to expected population density) were run on the log transformed data. We used an information theoretic approach (Burnham & Anderson 2002), with Akaike's Information Criterion (AIC) to calculate statistical models, using simple linear models in Program R, function *lm*. We determined the magnitude and direction of the coefficients for each independent variable using multi model averaging across all models with ΔAIC less than 4.0 (Grueber *et al.* 2011). These outputs were examined to determine which predictors were statistically significant and to measure the relative importance of each variable (Tables 1 3). 'Relative importance' refers to the sum of the Akaike weights over all of the models containing the parameter of interest.

Given the nested nature of the geographical data, we evaluated a mixed effects model with nested random intercepts for Region and Country. Log likelihood ratio tests provided no support for including random effects: the fixed effects model outperformed all random effects models (testing Region only, as well as Country nested within

Table 1 Multi-model averages across all reserves for A. ratio of current-to-expected population densities (n 40) and B. exponential growth rates over the past 10 years (n 33). See Table S3 for the full list of models with ΔAIC less than 4.0

Variable	Estimate	SE	Adj. SE	z value	P-value	Relative importance
A. Multi-model averages for Current vs. Expected in all reserves:						
(Intercept)	0.990	0.177	0.182	5.435	0.000***	1.00
Fence	0.478	0.112	0.115	4.153	0.000***	1.00
Management Budget	0.102	0.029	0.030	3.427	0.001***	1.00
Namibia + South Africa	0.212	0.138	0.142	1.493	0.136	0.50
Human Pop. Density	0.109	0.068	0.071	1.548	0.122	0.46
Governance	0.003	0.040	0.041	0.077	0.939	0.16
Method	0.089	0.121	0.126	0.706	0.480	0.15
Size of PA	0.044	0.073	0.076	0.578	0.563	0.12
Hunted	0.040	0.117	0.121	0.328	0.743	0.08
State run	0.013	0.091	0.094	0.141	0.888	0.07
B. Multi-model averages for exponential growth rates in all reserves:						
(Intercept)	0.040	0.070	0.072	0.565	0.572	1.00
Fence	0.094	0.043	0.045	2.098	0.036*	0.78
State Run	0.096	0.044	0.045	2.113	0.035*	0.69
Initial Pop. Size	0.096	0.051	0.053	1.830	0.067	0.52
Namibia + South Africa	0.079	0.055	0.057	1.386	0.166	0.44
Size of PA	0.026	0.026	0.027	0.965	0.335	0.17
Method	0.058	0.061	0.064	0.901	0.368	0.15
Governance	0.006	0.014	0.015	0.385	0.700	0.14
Human Pop. Density	0.006	0.030	0.031	0.198	0.843	0.08
Hunted	0.010	0.048	0.050	0.201	0.841	0.07
Management Budget	0.001	0.012	0.013	0.086	0.932	0.07

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$

© 2013 Blackwell Publishing Ltd/CNRS

Table 2 Multi-model averages of the fenced reserves for A. ratio of current-to-expected population densities (n 17) and B. exponential growth rates over the past 10 years (n 16). See Table S4 for the full list of models with ΔAIC less than 4.0

Variable	Estimate	SE	Adj. SE	z value	P-value	Relative importance
A. Multi-model averages for Current vs. Expected in fenced reserves:						
(Intercept)	0.297	0.411	0.421	0.706	0.480	1.00
Size of PA	0.169	0.095	0.100	1.691	0.091	0.60
Namibia + South Africa	0.238	0.137	0.148	1.604	0.109	0.45
State Run	0.233	0.133	0.142	1.634	0.102	0.38
Governance	0.036	0.030	0.032	1.132	0.258	0.38
Human Pop. Density	0.008	0.106	0.109	0.073	0.942	0.15
Hunted	0.089	0.314	0.325	0.274	0.784	0.14
Management Budget	0.063	0.073	0.076	0.827	0.408	0.13
Method	0.005	0.145	0.159	0.034	0.973	0.02
B. Multi-model averages for exponential growth rates in fenced reserves:						
(Intercept)	0.225	0.081	0.084	2.688	0.007**	1.00
Initial Pop. Size	0.108	0.037	0.040	2.706	0.007**	0.83
State Run	0.091	0.041	0.044	2.063	0.039*	0.37
Size of PA	0.039	0.018	0.020	1.924	0.054	0.37
Human Pop. Density	0.025	0.019	0.022	1.165	0.244	0.08
Management Budget	0.013	0.012	0.014	0.985	0.325	0.06

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$

Table 3 Multi-model averages of the unfenced reserves for A. ratio of current-to-expected population densities (n 22) and B. exponential growth rates over the past 10 years (n 17). See Table S4 for the full list of models with ΔAIC less than 4.0

Variable	Estimate	SE	Adj. SE	z value	P-value	Relative importance
A. Multi-model averages for Current vs. Expected in unfenced reserves:						
(Intercept)	1.186	0.332	0.344	3.443	0.001***	1.00
Management Budget	0.159	0.034	0.036	4.365	0.000***	1.00
Human Pop. Density	0.326	0.127	0.136	2.405	0.016*	0.93
Hunted	0.420	0.282	0.295	1.423	0.155	0.35
Namibia + South Africa	0.517	0.388	0.405	1.278	0.201	0.25
Size of PA	0.149	0.124	0.131	1.141	0.254	0.18
State Run	0.169	0.157	0.167	1.011	0.312	0.14
Method	0.078	0.150	0.161	0.486	0.627	0.06
Governance	0.012	0.044	0.047	0.265	0.791	0.05
B. Multi-model averages for exponential growth rates in unfenced reserves:						
(Intercept)	0.046	0.073	0.077	0.592	0.554	1.00
Namibia + South Africa	0.422	0.100	0.109	3.865	0.000***	1.00
Hunted	0.258	0.085	0.094	2.752	0.006**	1.00
Method	0.113	0.082	0.091	1.239	0.215	0.16
State Run	0.069	0.062	0.069	1.006	0.314	0.11
Initial Pop. Size	0.060	0.061	0.068	0.886	0.376	0.09
Governance	0.015	0.016	0.017	0.836	0.403	0.09
Size of PA	0.026	0.033	0.036	0.717	0.474	0.08
Management Budget	0.004	0.012	0.013	0.313	0.755	0.06

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$

Region). However, South Africa and Namibia deviated most strik ingly from other countries and geographical configurations, so we ran all AIC models using 'Namibia + South Africa vs. Other' as a fixed effect to minimise the number of coefficients. Note that because many of the fenced reserves were smaller than the overall average, 'fenced/non fenced' showed a moderate degree of co line arity with protected area size (Spearman rank order correlation, $r_s = -0.516$); however, protected area size was not strongly corre lated with either of the dependent outcome variables in a univariate analysis, and the effects of fencing remained robust in all AIC mod els that included protected area size. Finally, we extrapolated popula tion sizes at 5 year intervals for 100 years into the future by combining current population size with the exponential growth rate over the past 10 years. Populations were considered likely to persist if their extrapolated population sizes exceed 10% of their potential carrying capacities at particular time points in the future.

RESULTS

Table 1 summarises the variables with the strongest effects on lion population status and population growth rates across Africa. Current population densities are highest compared to their expected values in

© 2013 Blackwell Publishing Ltd/CNRS

reserves that (1) are fenced and (2) have the highest management budgets per km^2 (Fig. 1, Tables 1a and S3a). Over the past 10 yrs, population growth rates have been highest in (1) fenced reserves (Fig. 2) and (2) privately managed reserves (Tables 1b and S3b). Because fences have such a profound impact on lion management, we performed separate analyses for fenced and unfenced reserves. For fenced reserves, none of the tested variables had a significant effect on current population status (Tables 2a and S4a), whereas recent population growth has been highest in populations that had been farthest below their potential densities 10 years earlier (Fig. 2) with additional positive effects from private management (Tables 2b and S4b). For unfenced populations, current status is highest in reserves with the largest management budgets (Fig. 1) and lowest when surrounded by high human population densities (Tables 3a and S5a); growth rates were highest in Namibia + South Africa and in populations that were not subjected to trophy hunting (Tables 3b and S5b). Given current population sizes and recent trends, all of the fenced populations are expected to remain at or above their full potential for the next 100 years, whereas less than half of the unfenced reserves are likely to persist above 10% of their carrying capacities for the next 20 40 years (Fig. 3), including unfenced sites in Botswana, Kenya, Cameroon, Ghana, Tanzania and Uganda.

DISCUSSION

Negative conservation impacts of human land use can often be minimised by restricting conflicting activities to separate areas rather than by encouraging their co existence. For example, concentrating crop production in areas of intensive agriculture and sparing land as nature reserves can improve species conservation and crop produc tion more effectively than land sharing strategies that integrate con servation and low intensity agricultural production (Phalan *et al.* 2011). Establishing separate areas of intensive timber production while maintaining well defined forest reserves is also preferable to low intensity harvests over a greater proportion of forest (Boscolo & Vincent 2003). Similarly, physical separation is highly effective for conserving African lions: all of the fenced lion populations were close to their estimated carrying capacities (Fig. 1), growth rates of the fenced populations were density dependent (Fig. 2), and every

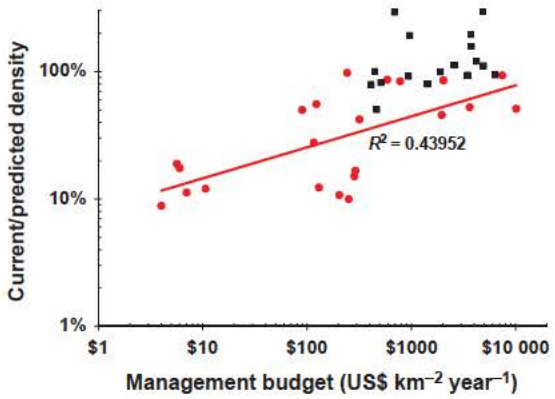


Figure 1 Percentage ratio of current population density to predicted carrying capacity of African lions in fenced (black squares) and unfenced (red circles) reserves according to management budget per square kilometre of lion survey area. The red regression line is for unfenced reserves; the effect of management budget in the fenced reserves is not statistically significant.

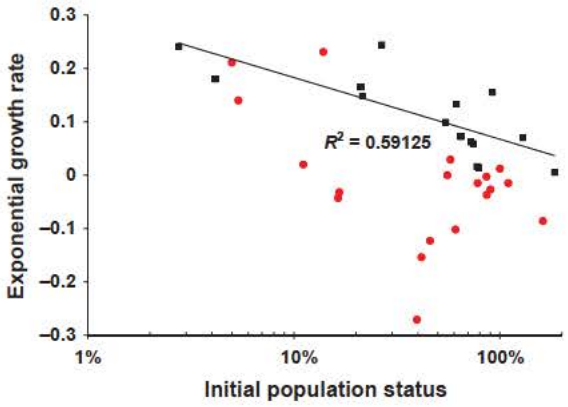


Figure 2 Effect of population density on population growth rate over the following 10 years for fenced (black) and unfenced (red) reserves. 'Initial population status' refers to the observed population density at the start of each time series compared to the expected density. The black regression line is for fenced reserves.

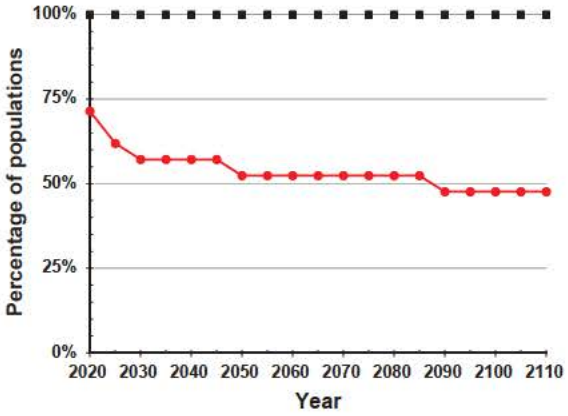


Figure 3 Percentage of populations expected to persist at densities > 10% of their potential in the future. Differences between fenced (black squares, *n* 16) and unfenced (red circles, *n* 21) reserves each year are all significant by Fisher test.

fenced population is expected to remain close to its carrying capac ity for the next century. Indeed, managers in many of the smaller fenced reserves currently remove 'excess' lions in attempts to stabi lise ungulate numbers (see Fig. S1). Fenced lion populations were less sensitive to human densities in adjacent areas than were unfenced populations, presumably because fences reduce poaching, minimise habitat loss, curtail illegal grazing and prevent direct human lion conflict (Kiffner *et al.* 2012). Such density independent 'edge effects' likely prevented recovery of numerous unfenced lion populations that had fallen substantially below their respective carry ing capacities 10 years earlier.

Conservationists have long recognised that large carnivores should be kept apart from humans. However, fencing has so far only been widely employed in a few African countries because of aesthetic objections, financial costs and the impracticality of enclosing large scale migratory ungulate populations. Thus, recent conservation efforts have increasingly promoted human wildlife co existence, either by initiating conflict mitigation projects in buffer zones or by providing economic incentives for local people to tolerate the costs

© 2013 Blackwell Publishing Ltd/CNRS

of living with wildlife (Woodroffe *et al.* 2005; Dickman *et al.* 2011). However, our analysis suggests that human lion co existence should only be considered in areas where large scale megafaunal (and pasto ralist) migration precludes any form of fencing. In some cases, human occupied zones within larger wildlife dominated ecosystems may even need to be fenced as enclaves (e.g. 30,000 people live in 40 villages inside Mozambique's Niassa National Reserve), as has been recommended for reducing conflicts between wolves and ranchers in livestock production areas around Yellowstone National Park (Stone *et al.* 2008).

Whether or not more lion populations are eventually fenced, large scale lion conservation will be expensive. Currently, many of the best financed reserves are too small to sustain long term ecosys tem processes without frequent and costly management interventions (e.g. Hunter *et al.* 2007), and a 10 to 100 fold increase in manage ment budget will be required to sustain many of the reserves that are not yet fenced (Fig. 1). Although fenced reserves can typically achieve considerable management success on annual budgets as low as \$500 km^{-2} (Fig. 1), fences cost ca. \$3000 per km to install (Ver cauteren *et al.* 2006). Long term costs of successfully managing unfenced lion populations are even higher: \$2000 per km^2 per year is only sufficient to maintain an unfenced lion population at 50% of its potential density (Fig. 1). By comparison, the 2010 management budget in Yellowstone was \$4100 per km^2 enough to maintain an average unfenced lion population at about two thirds of its potential. Under current financial practices in Africa, only a small proportion of tourism revenues are directly available to park managers (Bushell & Eagles 2007) and trophy hunting rarely raises more than \$1000 per km^2 (Lindsey *et al.* 2012).

Although our focus on a single species may seem narrow, top predators can only flourish in healthy ecosystems: many compo nents of lower trophic levels must also thrive for lion populations to remain close to their potential limits, thus the price of successful lion management provides an important gauge for the true costs of sustaining *intact* savannah ecosystems. Finding financial solutions to long term conservation of Africa's largest remaining intact ecosys tems such as Niassa, Okavango, Selous, Serengeti and the W Arly Pendjari Complex will present an enormous challenge to African governments and conservationists.

ACKNOWLEDGEMENTS

Research funded by Adrian Gardiner/Mantis Collection (AL), African Wildlife Foundation (SB,LF), Wendy Arnold (LF), Arthur Blank Fam ily Foundation (LF), Australian Research Council DP0987528 (KZ), Australian Research Council LP0990395 (SG), Banovich Wildscapes Foundation (LF), Bateleurs (RS), Boesak Kruger Fund (LF,AL), Born Free (SB,SC), Michael Calvin (LF), Charles Darwin University (STG, KKZ), Cheryl Grunbock & Martin King Foundation (LF), Chicago Board of Trade for Endangered Species (RG), Columbus Zoo (SB, TC,RG,LF), Conservation Force (LF,PF), Dallas Ecological Founda tion (LF), Dallas Safari Club (LF), Darwin Initiative for Biodiversity (AL), Paul Davies (SMD), Denver Zoo (LF), Directors of Ongava Game Reserve (KJS), Disney Worldwide Conservation Fund (CMB, KSB,CP,RS), Dominion Oil (EOO, AP), Earthwatch Institute #5123 (SMK,BP), Fairplay Foundation (CMB,KSB), Fauna & Flora Interna tional (CMB,KSB), Flora Family Foundation (LF), Frankenberg Foundation (AL), Stephen Gold (LF), Green Trust WWF SA (RS), GTZ/Pendjari Project (EAS), Hluhluwe Tourism Assoc. (RS), Hous ton Zoo (CMB,KSB,JWMcN), Idea Wild (HBr), Kenya Wildlife Ser vice (SK), Lakeside Foundation (SMD), Lee & Juliet Folger Foundation (JWMcN), Lillian Jean Kaplan Foundation (AL), Lion Ore (KN), Bruce Ludwig (LF), Malilangwe Trust (BC), Mara Conser vancy (BH), MGM Grand Hotel (CP,RS), Mohamed Bin Zayed Spe cies Fund (HHdeI), N. & R. Myhrvold (JWMcN), National Geographic Big Cat Initiative (HHdeI,JWMcN), National Geographic Society (SB,HBr,TC,LF,RG,CP), National Research Foundation (RS), Netherlands Committee for IUCN (HHdeI), Netherlands Support Program for the Garoua Wildlife School (HBa), NSF (LF,JS), NSF DEB 0 613 730(DMacN), NSF DEB 1 020 479(CP), Okavango Wildlife Society (KN), Ol Pejeta Ranch Ltd. (NG,CN), Panthera (GB, CMB,KSB,HBr,LF, LH,BK, PL,AL,CP,EOO,AP,EAS), Panthera Kaplan Awards Program (ACB,LF), PG Allen Family Foundation (JWMcN), Philadelphia Zoological Society (LF,KN,KS), Porini Camp Amboseli (LF), Potrero Nuevo Fund (LF), Predator Conservation Trust (CMB,KSB), Rann Safaris (CW,HW), Rufford Foundation (CMB,KSB,LF,KN), Rufford Maurice Laing Foundation (AL), Kathy Ruttenberg (AP), Safari South (C&HW), San Francisco Zoo (LF), SCI Foundation (LF), Seaworld/Busch Gardens Conservation Foundation (SB,LF), Technology and Human Resources for Industry Programme, SA (RS), Thandiza Foundation and the Rotterdam Zoo (KN), Tshw ane University of Technology Faculty Research Committee (PF), Tshwane University of Technology Postgraduate Scholarship Pro gramme (SMM), Tusk Trust (JWMcN), University of KwaZulu Natal (RS), US Forest Service (AP), US National Cancer Institute (LF), Van Tienhoven Foundation (HBa), Jonathan Vannini (LF), Vectronic Aerospace (LF), West Midlands Safari Park (KS), Debby Wettlaufer (LF), Wild about Cats (RS), Wild Entrust International (JWMcN), Wildlife Conservation Network (CMB,KSB,LF), Wildlife Conserva tion Society (CMB,KSB,LF,BK,EOO,AP), Wildlife Conservation Trust KZN (RS), Wildlife Direct (LF), Wildlife Division of the For estry Commission of Ghana (ACB), Woodland Park Zoo (JWMcN) and World Wide Fund for Nature (HHdeI).

AUTHORSHIP

CP, AL, GB, TC, AS, HBa, CMB, KSB, SB, CB, TB, HBr, AB, ACB, BC, SD, AD, TD, SMD, DD, LF, PF, NG, RG, CH, LH, HHdeI, CJJ, SMK, BK, WK, BL, PAL, SDM, JWMcN, SMM, SN, PN, CN, KN, JOO, EOO, BDP, AP, JS, EAS, KJS, CW and HW performed field research. SC and AL developed the ecological model. CP, SC, AL, STG, DMacN, MP, AS and KKZ analysed data. CP, TC, AS, STG and SP wrote the manuscript. All authors discussed the results and commented on the manuscript.

REFERENCES

Boscolo, M. & Vincent, J.R. (2003). Nonconvexities in the production of timber, biodiversity, and carbon sequestration. *J. Environ. Econ. Manage.*, 46, 251 268.

Burnham, K.P. & Anderson, D.R. (2002). *Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach*, 2nd edn. Springer-Verlag, Basel.

Bushell, R. & Eagles, B.F.J. (2007). *Tourism And Protected Areas: Benefits Beyond Boundaries*. CABI, Cambridge, MA.

Caro, T. (2008). Decline of large mammals in the Katavi-Rukwa ecosystem of western Tanzania. *Afr. Zool.*, 43, 99 116.

Dickman, A.J., Macdonald, E.A. & Macdonald, D.W. (2011). A review of financial instruments to pay for predator conservation and encourage human carnivore coexistence. *Proc. Natl Acad. Sci. USA*, 108, 13937 13944.

© 2013 Blackwell Publishing Ltd/CNRS

Estes, J.A., Terborgh, J., Brashares, J.S., Power, M.E., Berger, J., Bond, W.J. *et al.* (2011). Trophic downgrading of planet earth. *Science*, 333, 301 306.

Ferguson, K. & Hanks, J., eds (2010). Fencing impacts: A review of the environmental, social and economic impacts of game and veterinary fencing in Africa with particular reference to the Great Limpopo and Kavango-Zambezi Transfrontier Conservation Areas. (Mammal Research Institute, Pretoria. Available at: www.wcs-ahead.org/gltfca grants/grants.html).

Ferreira, S.M. & Funston, P.J. (2010). Estimating lion population variables: prey and disease effects in Kruger National Park, South Africa. *S. Afr. J. Wildl. Res.*, 37, 194 206.

Funston, P.J. (2011). Population characteristics of lions (*Panthera leo*) in the Kgalagadi Transfrontier Park. *S. Afr. J. Wildl. Res.*, 41, 1 10.

Garnett, S.T., Joseph, L.N., Watson, J.E.M. & Zander, K.K. (2011). Investing in threatened species conservation: Does corruption outweigh purchasing power? *PLoS ONE*, 6, e22749. doi:10.1371/journal.pone.0022749.

Grueber, C.E., Nakagawa, S., Laws, R.J. & Jamieson, I.G. (2011). Multimodel inference in ecology and evolution: challenges and solution. *J. Evol. Biol.*, 24, 699 711.

Hayward, M.W. & Kerley, G.I.H. (2009). Fencing for conservation: Restriction of evolutionary potential or a riposte to threatening processes? *Biol. Conserv.*, 142, 1 13.

Hayward, M., O'Brien, J. & Kerley, G.I.H. (2007). Carrying capacity of large African predators: predictions and tests. *Biol. Conserv.*, 139, 219 229.

Hunter, L.T.B. *et al.* (2007). Restoring lions (*Panthera leo*) to northern KwaZulu-Natal, South Africa: short-term biological & technical success but equivocal long-term conservation. *Oryx*, 41, 196 204.

IUCN & UNEP (2009) *The World Database on Protected Areas (WDPA) UNEP-WCMC*. WCMC, Cambridge, UK. Version 2010. Available at: http://www.wdpa.org/AnnualRelease.aspx.

Johnson, W.E. *et al.* (2010). Genetic restoration of the Florida panther. *Science*, 329, 1641 1645.

Kiffner, C., Meyer, B., Muhlenberg, M. & Waltert, M. (2009). Plenty of prey, few predators: what limits lions in Katavi National Park, Western Tanzania? *Oryx*, 43, 52 59.

Kiffner, C., Stoner, C. & Caro, T. (2012). Edge effects and large mammal distributions in a national park. *Anim. Conserv.*, 16, 97 107.

Kissui, B.M. (2008). Livestock predation by lions, leopards, spotted hyenas, and their vulnerability to retaliatory killing in the Maasai steppe, Tanzania. *Anim. Conserv.*, 11, 422 432.

Kissui, B.M. & Packer, C. (2004). Top-down regulation of a top predator: lions in the Ngorongoro Crater. *Proc. R. Soc. Series B.*, 271, 1867 1874.

Leader-Williams, N. & Albon, S.D. (1988). Allocation of resources for conservation. *Nature*, 336, 533 535.

Licht, D.S., Millspaugh, J.J., Kunkel, K.E., Kochanny, C.O. & Peterson, R.O. (2010). Using small populations of wolves for ecosystem restoration and stewardship. *Bioscience*, 60, 147 153.

Linard, C., Gilbert, M., Snow, R.W., Noor, A.M. & Tatem, A.J. (2012). Population Distribution, Settlement Patterns and Accessibility across Africa in 2010. *PLoS ONE*, 7, e31743.

Lindsey, P.A., Romanach, S.S. & Davies-Mostert, H.T. (2009a). The importance of conservancies for enhancing the conservation value of game ranch land in southern Africa. *J. Zool.*, 277, 99 105.

Lindsey, P.A., Romanach, S.S. & Davies-Mostert, H.T. (2009b). Moving beyond the descriptive: predicting the responses of top-order predators to reintroduction. In: *The Reintroduction of Top-order Predators* (eds. Hayward, M.W. & Somers, M.J.). Wiley-Blackwell, London, pp. 21 344.

Lindsey, P.A., Balme, G.A., Booth, V.R. & Midlane, N. (2012). The significance of African lions for the financial viability of trophy hunting and the maintenance of wild land. *PLoS-One*, 7, e29332.

Loveridge, A.J. & Canney, S. (2009). *African Lion Distribution Modeling Project, Final Report*. Born Free Foundation, Horsham, UK.

Loveridge, A.J., Searle, A.W., Murindagomo, F. & Macdonald, D.W. (2007). The impact of sport hunting on the population dynamics of an African lion population in a protected area. *Biol. Conserv.*, 134, 548 558.

Packer, C., Ikanda, D., Kissui, B.M. & Kushnir, H. (2005a). Lion attacks on humans in Tanzania. *Nature*, 436, 927 928.

Packer, C. *et al.* (2005b). Ecological change, group territoriality and non-linear population dynamics in Serengeti lions. *Science*, 307, 390 393.

Packer, C. *et al.* (2009). Sport hunting, predator control and conservation of large carnivores. *PLoS ONE*, 4, e5941.

Packer, C., Swanson, A., Ikanda, D. & Kushnir, H. (2011a). Fear of darkness, the full moon and the lunar ecology of African lions. *PLoS ONE*, 6, e22285.

Packer, C. *et al.* (2011b). The effects of trophy hunting on lion and leopard populations in Tanzania. *Conserv. Biol.*, 25, 142 153.

Pfeifer, M., Burgess, N.D., Swetnam, R.D., Platts, P.J., Willcock, S. & Marchant, R. (2012). Protected areas: Mixed success in conserving East Africa's evergreen forests. *PLoS ONE*, 7(6), e39337. doi:10.1371/journal.pone.0039337.

Phalan, B., Onial, M., Balmford, A. & Green, R.E. (2011). Reconciling food production and biodiversity conservation: Land sharing and land sparing compared. *Science*, 333, 1289 1291.

R Development Core Team (2011). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria.

Riggio, J., Jacobson, A., Dollar, L., Bauer, H., Becker, M., Dickman, A. *et al.* (2012). The size of savannah Africa: A lion's (Panthera leo) view. *Biodivers. Conserv.*, 22, 17 35.

Slotow, R. (2012). Fencing for purpose: A case study of elephants in South Africa. In: *Fencing for Conservation: Restriction of Evolutionary Potential or a Riposte to Threatening Processes?* (eds Somers, M.J. & Hayward, M.W.). Springer, Basel, 91 104.

Slotow, R. & Hunter, L.T.B. (2009). Reintroduction decisions taken at the incorrect social scale devalue their conservation contribution: The African lion in South Africa. In: *The Reintroduction of Top-order Predators* (eds Hayward, M.W. & Somers, M.J.) Wiley-Blackwell, London, pp. 43 71.

Stone, S.A. *et al.* (2008). *Livestock and Wolves: A Guide to Nonlethal Tools and Methods to Reduce Conflicts*. Defenders of Wildlife, Washington, DC.

Trinkel, M. *et al.* (2008). Translocating lions into an inbred lion population in the Hluhluwe-iMfolozi Park, South Africa. *Anim. Conserv.*, 11, 138 143.

Trinkel, M., Cooper, D., Packer, C. & Slotow, R. (2011). Inbreeding depression increases susceptibility to bovine tuberculosis in lions: An experimental test using and inbred-outbred contrast through translocation. *J. Wildl. Dis.*, 43, 494 500.

UNDP International Human Development Indicators (2010). (UNDP, New York. Available at: www.hdr.undp.org/en/data/trends).

Van Orsdol, K.G., Hanby, J.P. & Bygott, J.D. (1985). Ecological correlates of lion social organization. *J. Zool.*, 206, 97 112.

Vercauteren, K.C., Lavelle, M.J. & Hyngstrom, S. (2006). Fences and deer-damage management: A review of designs and efficacy. *Wildl Soc Bull.*, 34, 191 200.

Walston, J. *et al.* (2010). Bringing the tiger back from the brink The six percent solution. *PLoS Biol.*, 8(9), e1000485. doi:10.1371/journal.pbio.1000485.

Wittemyer, G., Elsen, P., Bean, W.T., Burton, A.C. & Brashares, J.S. (2008). Accelerated human population growth at protected area edges. *Science*, 321, 123 126.

Woodroffe, R. & Frank, L.G. (2005). Lethal control of African lions (*Panthera leo*): Local and regional population impacts. *Anim. Conserv.*, 8, 91 98.

Woodroffe, R., Thirgood, S. & Rabinowitz, A. (2005). *People and Wildlife: Conflict or Coexistence*. Cambridge University Press, Cambridge.

SUPPORTING INFORMATION

Additional Supporting Information may be downloaded via the online version of this article at Wiley Online Library (www.ecologyletters.com).

Editor, Nicholas Haddad.
Manuscript received 15 October 2012
First decision made 19 November 2012
Manuscript accepted 17 January 2013

© 2013 Blackwell Publishing Ltd/CNRS

Barry, Anna <anna_barry@fws.gov>

Lion documents

1 message

Gadd, Michelle <michelle_gadd@fws.gov> Fri, Aug 19, 2016 at 9:32 AM
To: Anna Barry <anna_barry@fws.gov>, Darcy Vargas <darcy_vargas@fws.gov>, Sandra Farkas <sandra_farkas@fws.gov>, Kathleen Moore <kathleen_moore@fws.gov>, Tim Vannorman <tim_vannorman@fws.gov>, Craig Hoover <craig_hoover@fws.gov>, Emma Nelson <emma_nelson@fws.gov>

Attached please find Craig Packer's powerpoint presentation from Nat Geo and several publications about impact of lion hunting.

---------- Forwarded message ----------
From: Craig Packer <packer@umn.edu>
Date: Tue, Aug 16, 2016 at 9:38 PM

Thanks for you message, though I'm not sure which rule you are referring. We had proposed a 6-yr age minimum, which is being observed quite strictly in Zimbabwe and Niassa Reserve in Mozambique. In the absence of any sort of age-based limit, we had recommended a limit of one lion per 2,000-km2. Recently, a paper was published based on demographic data from a declining population in Zambia -- and recommended that the age minimum in populations subjected to significant snaring, poaching, etc., be set at 7-8 yrs while also limiting offtakes to one lion per 2,000-km2.

Attached is the powerpoint of my talk plus the papers that were cited in the presentation.
The "Effects of trophy hunting" shows how lions were overhunted in Tanzania and that hunting was the primary cause of declining harvests.
The "Sport hunting and predator control" paper shows how lions had been overhunted in the '80s and '90s in Zimbabwe, Botswana, etc..
The "Dollars and Fence" paper shows, first, that lion populations hunted reserves are more likely to be in decline, and, second, provides an empirical measure of how much it costs to effectively manage lion populations ($2k per thousand square kilometers).
The "Declining lion" paper shows that two hunted reserves in Zimbabwe are among the fastest increasing lion populations in Africa (the only documented hunting success stories in Africa) -- but also emphasizes the need for independent population surveys in Tanzania. This latter statement was included because the Tanzanian Government has systematically blocked lion research in recent years. Besides terminating long-term lion studies in the Serengeti and the phototourism section of the Selous in the past 2 yrs, it has prohibited any lion surveys in 100% of its hunting blocks.

Please let me know if you'd like any other information. I also have newspaper clippings about the illegal activities of several of the most important figures in the Tanzanian hunting industry.

Craig

5 attachments

- Lion hunting for Lion Day at NGS - cp.pptx
  6990K
- Effects of trophy hunting on lions and leopards in Tanzania.pdf
  1024K
- Sport Hunting, Predator Control and Conservation of Large Carnivores.pdf
  3614K
- Conserving large carnivores - Dollars and fence - Ecology Letters 2013.pdf
  255K

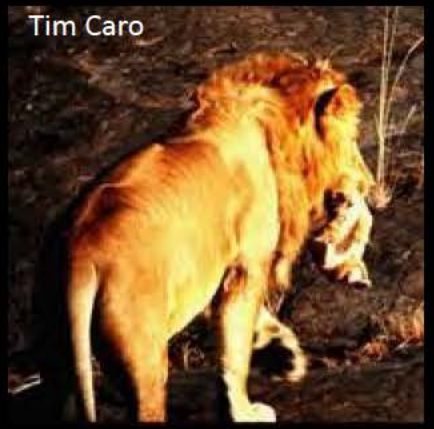
Bauer et al 2015 Lions are declining across Africa PNAS.pdf
5457K

Tourist Hunting and Lion Conservation

1. Unsustainable harvest strategies
2. Revenue shortfalls
3. Going forward

Craig Packer
University of Minnesota

Lion populations are sensitive to trophy hunting



- Resident males protect their prides
- Replacement males kill small cubs
- Males fully mature at 4 yrs of age & must remain resident for 2 yrs to rear their cubs
- Trophy hunting should be restricted to males ≥6 yrs old

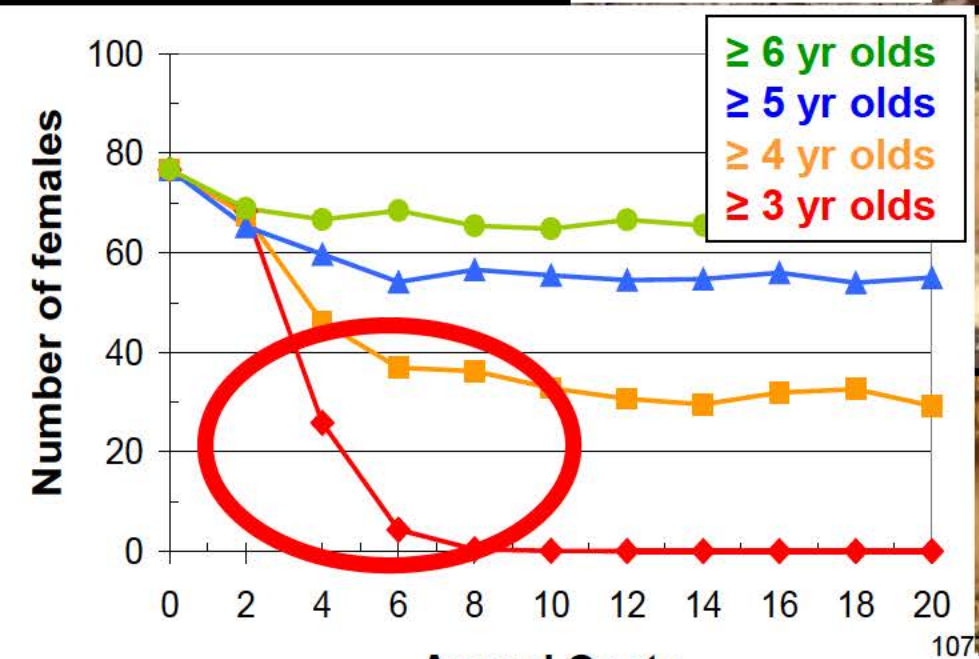
Males in hunting reserves rarely reach 6 yrs of age











Whitman, et al. 2004 Nature



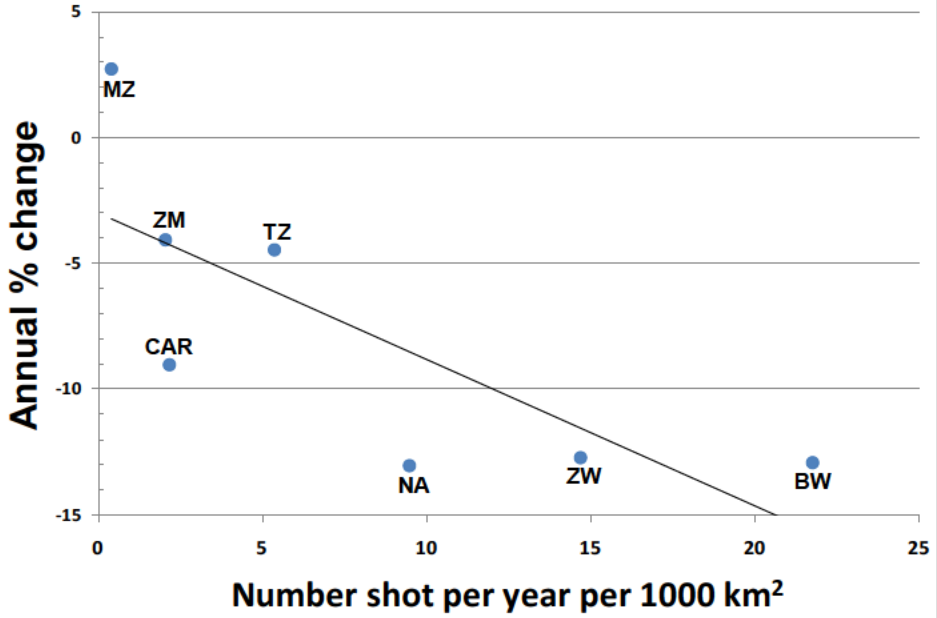






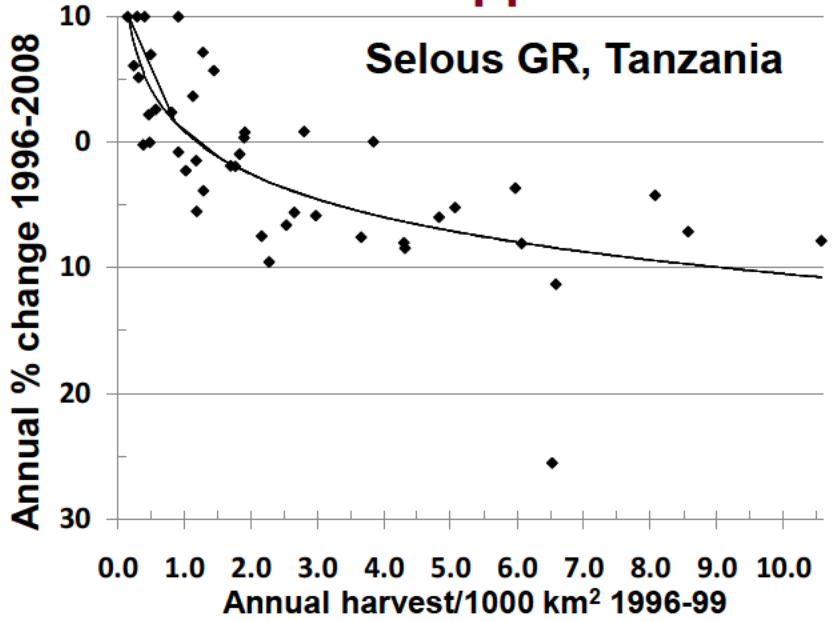
Trophy hunting can cause population declines

Countries that harvested the most lions showed the steepest declines



Packer, et al. 2009 PLoS-One

Hunting blocks with the highest lion harvests dropped fastest



Packer, et al. 2011 Conservation Biology

Mismanagement of lion hunting in TZ

- Lion "quotas" were production targets rather than limits
- Quotas could only be met by shooting immature males

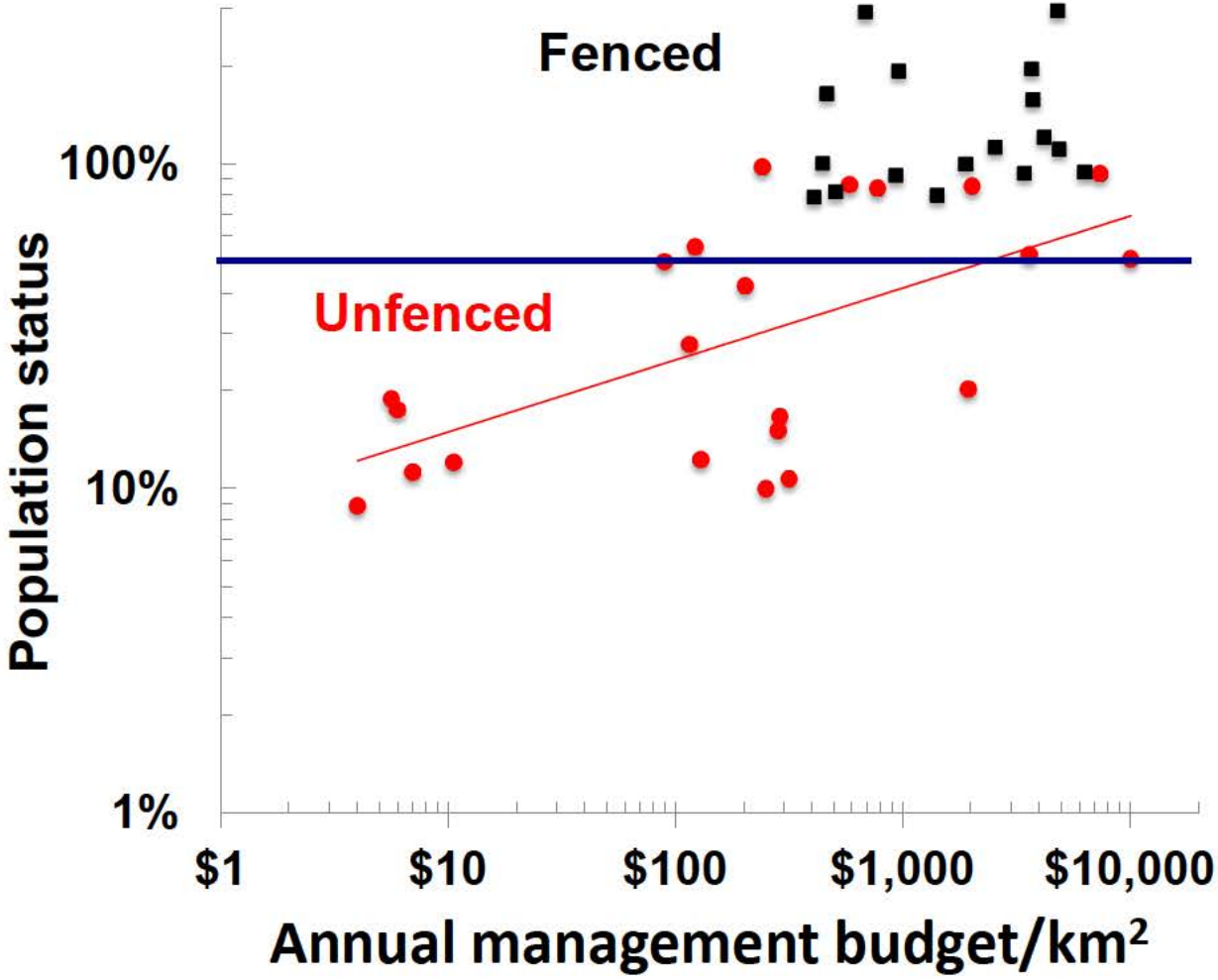
2010: TZ Parliament restricted harvest to males >6 yrs old… ***but the law was never enforced***





www.kilimanjarorifles.com/gallery_2010-5.html
www.pvt.co.za/gallery.asp?Section=2010TZ

Where's the money?



- Most hunting areas are unfenced
- Unfenced reserves require ~$2,000 km²/yr to keep lion populations at ~half their potential.

Packer, et al. 2013 Ecology Letters

Tanzania:

300,000 km^2 of hunting blocks
$15 million/year in Government revenues
$50/km^2/yr
Effective lion conservation costs >$2,000/km^2/yr

Why are revenues so low?

Block allocation = Patronage system

- **Current & recent elected politicians**
- **Corrupt insiders**
  - **Uranium scandal, Panama Papers**

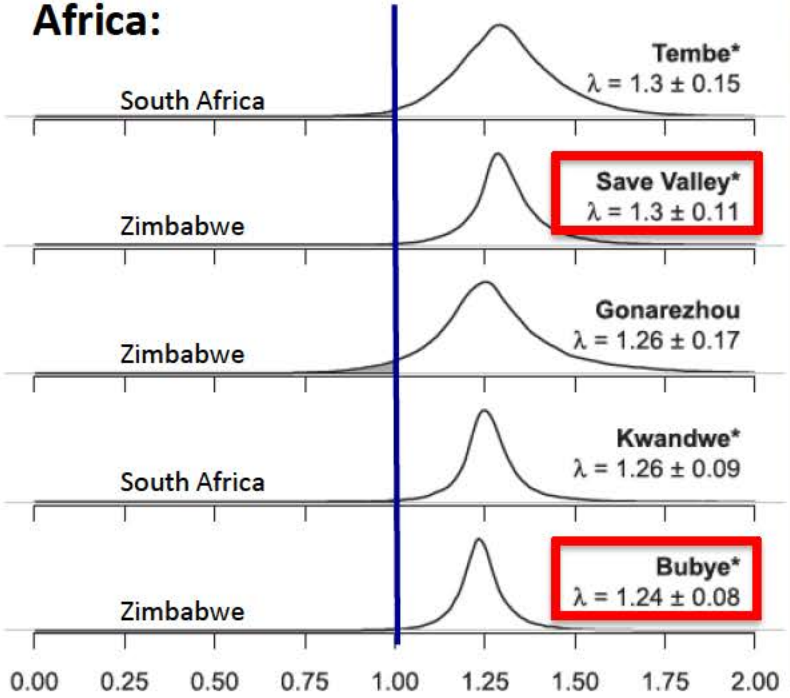
No re-investment

- **One-third of TZ hunting blocks abandoned since 2005**

Hunting Success Stories

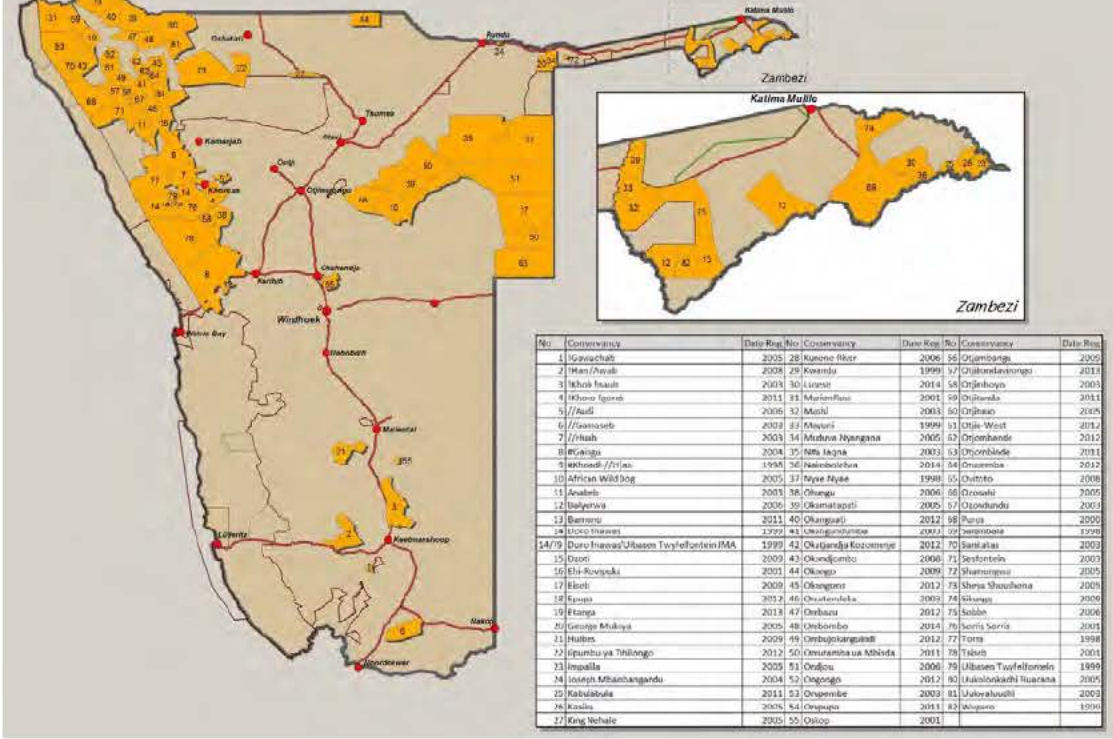
Communal Conservancies in Zimbabwe

5 fastest growing lion populations in Africa:



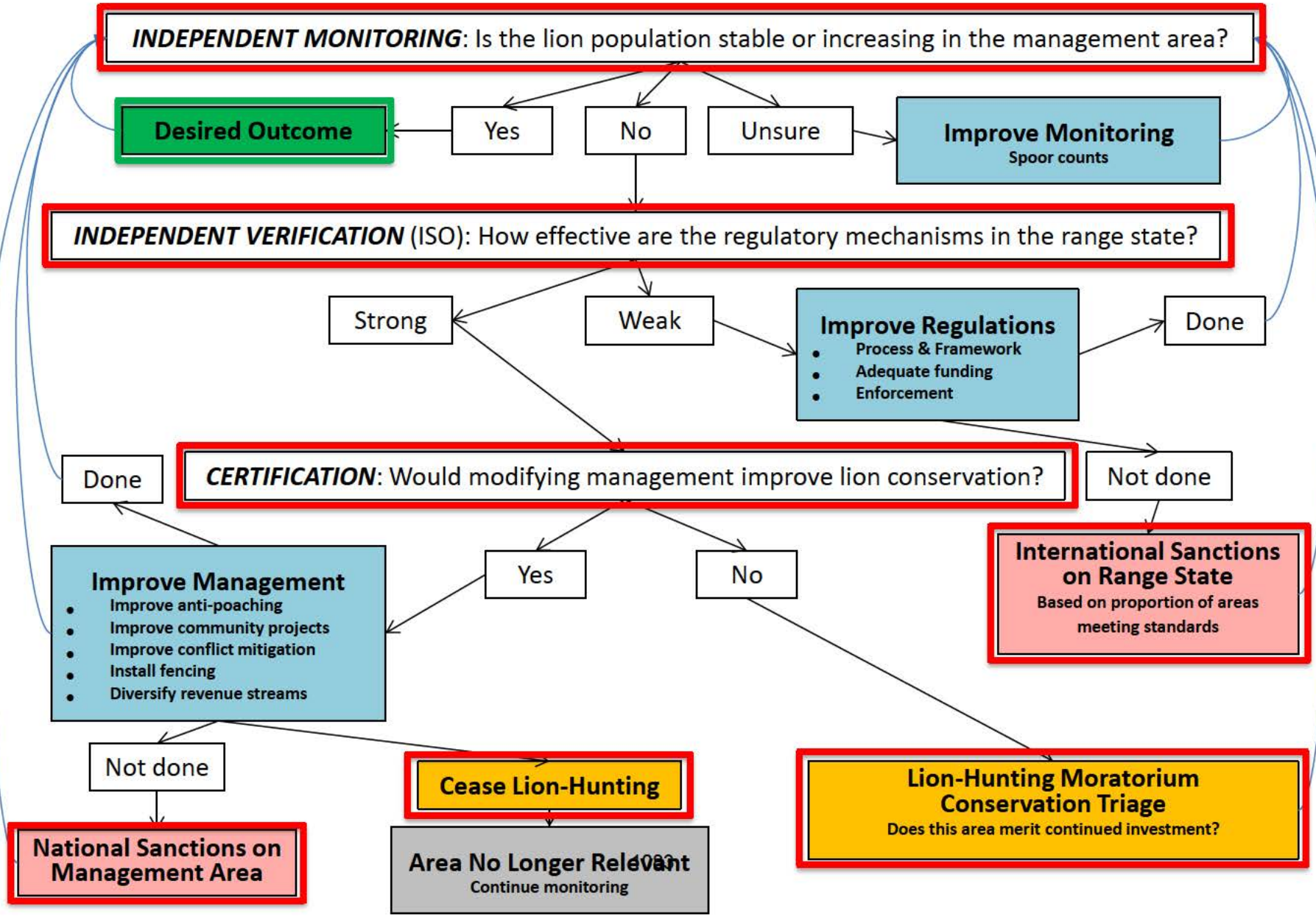
Bauer, et al. 2015 PNAS

Communal Conservancies in Namibia



No	Conservancy	Date Reg	No	Conservancy	Date Reg	No	Conservancy	Date Reg
1	!Gaiachab	2005	28	Kunene River	2006	56	Otjambanga	2005
2	!Han/Aoab	2008	29	Kwandu	1999	57	Otjikondavonjo	2013
3	!Khob !naub	2003	30	Lucsor	2014	58	Otjinhoya	2003
4	!Khore !goreb	2011	31	Mafiri-Flats	2001	59	Otjitanda	2011
5	//Audi	2006	32	Mashi	2003	60	Otjitasa	2005
6	//Gamaseb	2008	33	Mayuni	1999	61	Otjiu-West	2012
7	//Huab	2003	34	Mbuwa Nyangana	2005	62	Otjombande	2012
8	#Gaingu	2004	35	Nitta Iagna	2003	63	Otjombinde	2011
9	#Khoedi-//ri.as	1995	36	Nolendeleka	2014	64	Otuzemba	2012
10	African Wild Dog	2005	37	Nyae Nyae	1998	65	Ovitoto	2008
11	Anabeb	2003	38	Ohungu	2006	66	Ozondiri	2005
12	Balfanya	2006	39	Okamatapati	2005	67	Ozondundu	2003
13	Bamunu	2011	40	Okangwati	2012	68	Purros	2000
14	Doro !Nawas	1999	41	Okankolonkolo	2003	69	Sesfontein	1998
14/9	Doro !nawas'Uibasen Twyfelfontein IMA	1999	42	Okatjandja Kozonompe	2012	70	Sanitatas	2003
15	Dzoti	2009	43	Okondjombo	2006	71	Sesfontein	2003
16	Ehi-Ruvipuka	2001	44	Okongo	2009	72	Shamungwa	2005
17	Eiseb	2009	45	Okongoma	2012	73	Shorya Shauzibena	2005
18	Epupa	2012	46	Omatendeka	2003	74	Sikunga	2006
19	Etanga	2013	47	Ombazu	2012	75	Sobbe	2006
20	George Mukoya	2005	48	Ombombo	2014	76	Sorris Sorris	2001
21	Hoibes	2009	49	Ombujokanguindi	2012	77	Torra	1998
22	Epumbuya Thilongo	2012	50	Omuramba ua Mbinda	2011	78	Tsiseb	2001
23	Impalila	2005	51	Onjou	2006	79	Uibasen Twyfelfontein	1999
24	Joseph Mbambangandu	2004	52	Ongongo	2012	80	Uukolonkadhi Ruarana	2005
25	Kabulabula	2011	53	Onyenube	2003	81	Uukwaluudhi	2003
26	Kasika	2005	54	Orupupa	2011	82	Wuparo	1999
27	King Nehale	2005	55	Oskop	2001			

Monitoring, Verification & Certification



OPEN ACCESS Freely available online

PLoS one

Sport Hunting, Predator Control and Conservation of Large Carnivores

Craig Packer[1]*, Margaret Kosmala[1], Hilary S. Cooley[2], Henry Brink[3], Lilian Pintea[4], David Garshelis[5], Gianetta Purchase[6], Megan Strauss[1], Alexandra Swanson[1], Guy Balme[7], Luke Hunter[7], Kristin Nowell[8]

1 Department of Ecology, Evolution and Behavior, University of Minnesota, Saint Paul, Minnesota, United States of America, **2** Wildlife Demographics, Logan, Utah, United States of America, **3** Durrell Institute of Conservation and Ecology, Kent University, Canterbury, Kent, United Kingdom, **4** The Jane Goodall Institute, Arlington, Virginia, United States of America, **5** Minnesota Department of Natural Resources, Grand Rapids, Minnesota, United States of America, **6** The Zambesi Society, Bulawayo, Zimbabwe, **7** Panthera, New York, New York, United States of America, **8** Cat Action Treasury, Cape Neddick, Maine, United States of America

Abstract

Sport hunting has provided important economic incentives for conserving large predators since the early 1970's, but wildlife managers also face substantial pressure to reduce depredation. Sport hunting is an inherently risky strategy for controlling predators as carnivore populations are difficult to monitor and some species show a propensity for infanticide that is exacerbated by removing adult males. Simulation models predict population declines from even moderate levels of hunting in infanticidal species, and harvest data suggest that African countries and U.S. states with the highest intensity of sport hunting have shown the steepest population declines in African lions and cougars over the past 25 yrs. Similar effects in African leopards may have been masked by mesopredator release owing to declines in sympatric lion populations, whereas there is no evidence of overhunting in non-infanticidal populations of American black bears. Effective conservation of these animals will require new harvest strategies and improved monitoring to counter demands for predator control by livestock producers and local communities.

Citation: Packer C, Kosmala M, Cooley HS, Brink H, Pintea L, et al. (2009) Sport Hunting, Predator Control and Conservation of Large Carnivores. PLoS ONE 4(6): e5941. doi:10.1371/journal.pone.0005941

Editor: Michael Somers, University of Pretoria, South Africa

Received March 7, 2009; **Accepted** May 7, 2009; **Published** June 17, 2009

Copyright: © 2009 Packer et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Funding: Simulation modeling was supported by funding by NSF Biocomplexity grant BE 0308486. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors have declared that no competing interests exist.

* E mail: packer@umn.edu

Introduction

Management agencies typically skew harvests toward males in order to protect adult females. However, in species with extensive paternal investment such as African lions (*Panthera leo*), trophy hunting can increase the rate of male replacement (and associated infanticide) to the point of reducing population size unless offtakes are restricted to males old enough to have reared their first cohort of dependent offspring (≥5 6 yrs of age) [1 3]. Solitary felids have none of the "safety nets" provided by the cooperative cub rearing strategies of African lions [4 5], and Fig. 1ab illustrates the greater vulnerability of solitary species by examining the effects of trophy hunting on a hypothetical population of "solitary lions" while leaving other demographic parameters from ref. [1] unchanged (Supporting Information Table S1, also see ref. [6]). Leopards (*Panthera pardus*) may be more sensitive to sport hunting than solitary lions (with a safe minimum age of 6 7 yrs of age, Fig. 1c), whereas cougar (*Felis concolor*) males can be safely harvested as young as 4 yrs of age (Fig. 1d).

We tested whether infanticidal species are vulnerable to over hunting by focusing on four large carnivore species with sizable markets for sport hunted trophies, comparing three infanticidal felids (lions, cougars and leopards) to American black bears (*Ursus americanus*). We used black bears as a control case because males do not kill cubs in order to increase mating opportunities (sexually selected infanticide SSI), so rates of infanticide are not increased by male biased trophy hunting; in fact, among ursids, SSI has been documented in only one population of European brown bears (*U. arctos*) [7 9].

We extracted data from the UNEP World Conservation Monitoring Centre (WCMC) CITES trade database (See Materials and Methods). Data on total trophy harvests of lions and leopards are not available, so we used CITES reported exports, which in cougars and black bears were highly correlated with domestic sport hunting totals (Supporting Information Fig. S1); likewise CITES reported trade in Tanzania's lion trophies showed a close match between imports and exports. Given sustained market demand, harvest trends should provide a reasonable proxy of population trends since sport hunters use intensive methods such as baits and hounds to locate these animals, and quotas on annual offtakes are either too high to limit harvests or (for black bears) reflect the management agency's perception of population trend [10].

Results

Fig. 2 shows the annual CITES exports for lions and leopards and US offtakes of cougars and black bears (See Materials and Methods). The reported number of trophies increased rapidly across all four species as markets grew during the 1980's and 1990's [11 12]. Offtakes have continued to increase for black bears, reflecting the sustained growth of bear populations

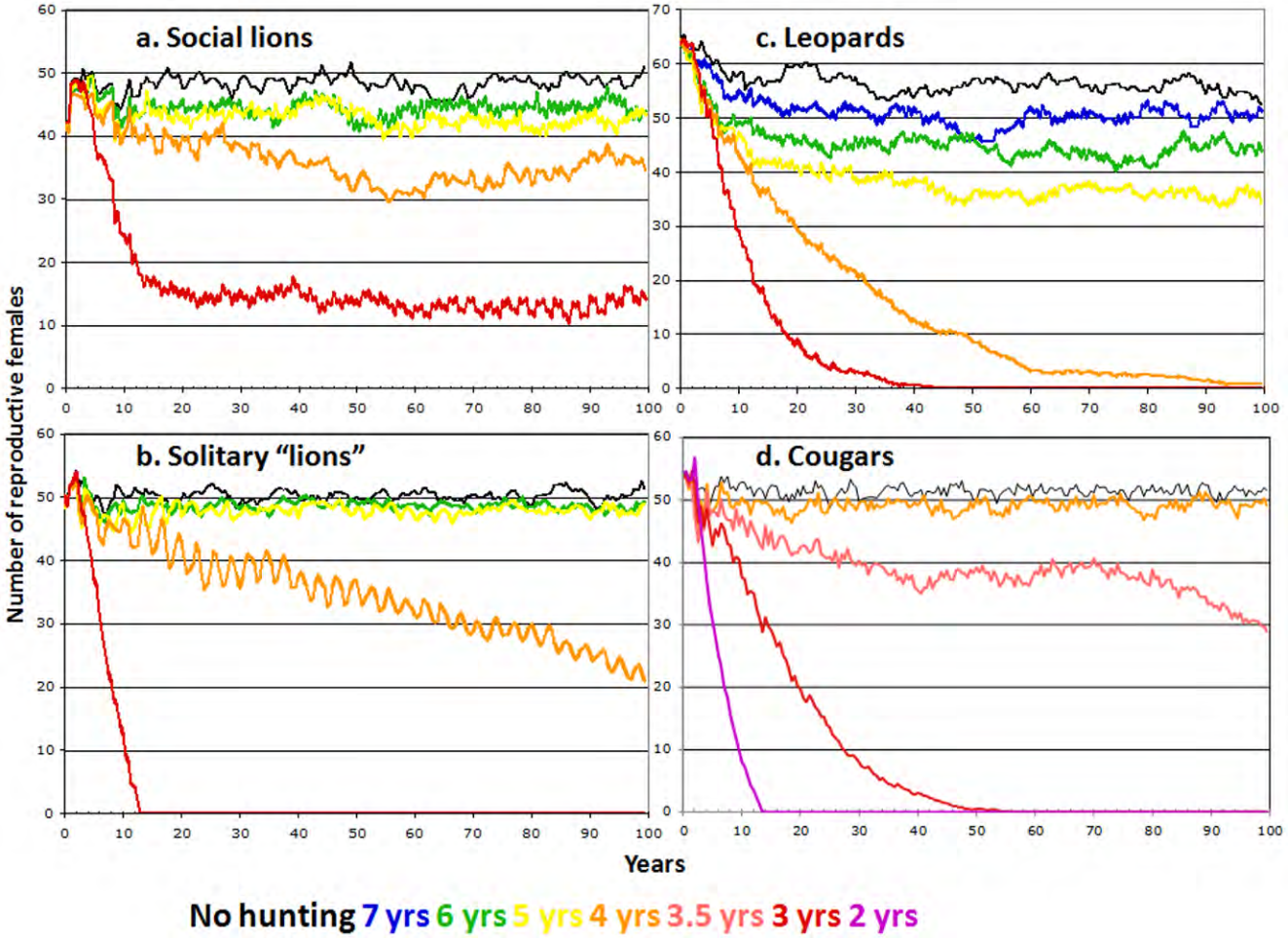


Figure 1. Average number of adult females in population simulations where all eligible males are removed during a 6 mo hunting season each year for 100 yrs. Colors indicate outcomes for different age minima for trophy males; each line indicates average from 20 runs. **A**. Population changes for "social lions" follow the assumptions and demographic variables in ref. [1] except to restrict hunting to 6 mo seasons and to incorporate additional details of dispersal, survival and reproduction [44 46]. **B**. Population changes for a hypothetical lion population where males and females are solitary and each territorial male controls one female. **C**. Population changes for leopards based on long term data from Phinda Private Game Reserve [33,47] and other sources [37,48]. **D**. Population changes for cougars based on demographic data from refs. [27,49 53].
doi:10.1371/journal.pone.0005941.g001

throughout North America [13]. Leopard offtakes reached an asymptote in most countries, except for declines in Zambia in the 1980's and Zimbabwe in the 1990's and a recent CITES granted increase to Namibia. In contrast, lion offtakes peaked then fell sharply in the 1980's and 1990's in Botswana, Central African Republic, Namibia, Tanzania, Zambia and Zimbabwe. Cougar offtakes showed similar peaks and declines in the 1990's in Arizona, Colorado, Idaho, Montana and Utah (Fig. 2).

The downward harvest trends for lions and cougars (highlighted in Supporting Information Fig. S2) most likely reflected declining population sizes: success rates (as measured by harvest/quota) have fallen for both cougars and lions (Supporting Information Fig. S3). Demand for lion trophies (as measured by total imports from across Africa) has grown in the US and held stable in the EU since the mid 1990s, sustained in recent years by imports of trophies of captive lions from South Africa [12,14] (Supporting Information Fig. S3). Several countries instituted temporary bans on lion trophy hunting (Botswana in 2001 2004, Zambia in 2000 2001 and western Zimbabwe in 2005 2008) or banned female lions from quota (Zimbabwe, starting in 2005), but these measures were implemented well after the major decline in lion offtake in each country. The harvest trends are also consistent with recent surveys suggesting a 30% continent wide population decline in African lions [15] and declining cougar populations in several US states [16 17]. Conversely, black bear populations appear to be increasing across their range [13], even in states where cougar populations have declined (Fig. 2). Although not apparent from most hunting offtakes, leopards have undergone an estimated range decline of 35% in Africa [18] and were recently listed as Near Threatened by IUCN due to habitat loss, prey depletion, illegal skin trade and problem animal conflicts [19].

Trophy hunting is likely to have contributed to the declines in lion and cougar populations in many areas. Over the past 25 yrs, the steepest declines in cougar and lion harvests occurred in jurisdictions with the highest harvest intensities (Fig. 3a). Similarly, hunting blocks with the highest lion offtakes per 1000 km^2 in Tanzania's Selous Game Reserve showed the steepest declines between 1996 and 2008 (r^2 0.26, n 45 blocks, P 0.0004). The Selous is the largest uninhabited hunting area in Africa (55,000 km^2) and has long been the premier destination for lion trophies. Across jurisdictions, declining harvests were unrelated to habitat loss for either lions or cougars (Fig. 3b) or to snow

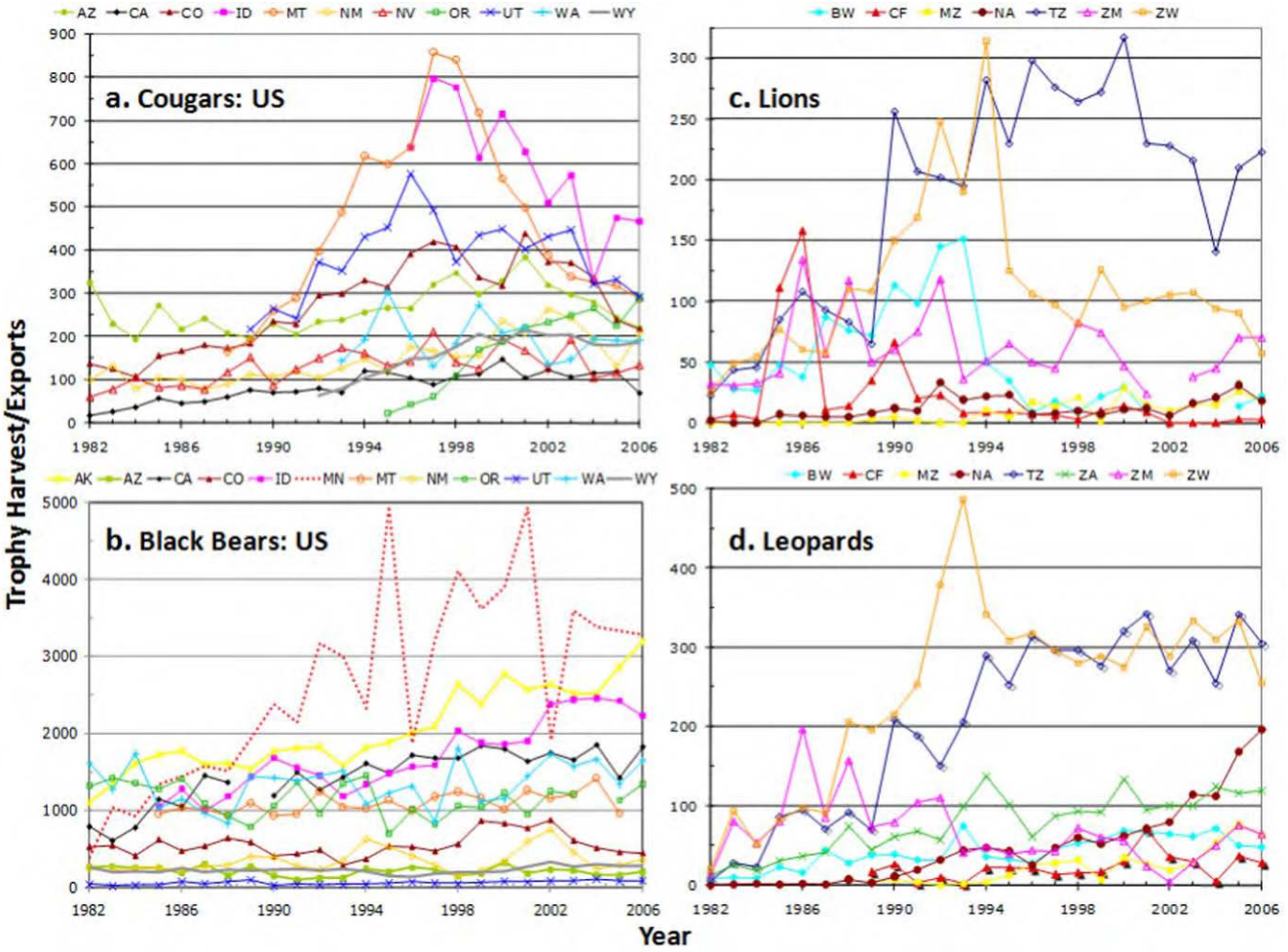


Figure 2. Domestic offtakes of a) cougars and b) black bears and CITES reported trophy exports of c) lions and d) leopards. For US states: AK = Alaska, AZ = Arizona, CA = California, CO = Colorado, ID = Idaho, MN = Minnesota, MT = Montana, NM = New Mexico, NV = Nevada, OR = Oregon, UT = Utah, WA = Washington, WY = Wyoming. For CITES data: BW = Botswana, CF = Central African Republic, MZ = Mozambique, NA = Namibia, TZ = Tanzania, ZM = Zambia, ZW = Zimbabwe.
doi:10.1371/journal.pone.0005941.g002

conditions for cougars. We modified our population simulation models to estimate impacts of sport hunting in a changing environment and found that habitat loss only imposes an additive effect on the impact of trophy hunting (Supporting Information Fig. S4). Note that habitat loss in many African nations has been so extensive (Fig. 3b) that lion offtakes have failed to recover for 10 20 yrs following the peak harvest years except in Namibia.

Although trophy hunting of lions and cougars is often portrayed as an economic strategy for increasing support for carnivore conservation, local communities often seek extirpation of problem animals [15,20 22]. Thus, sport hunting quotas may sometimes reflect pressures to control carnivores rather than to conserve them. Across Africa, countries with the highest intensity of lion offtake also had the highest number of livestock units per million hectares of arable land (P 0.047, n 7). In the US, Oregon announced plans in 2006 to reduce its cougar population by 40% to decrease depredation on livestock, pets and game mammals [23], Washington altered its cougar quotas in response to human wildlife conflicts in the 1990s 2000s, and recent offtakes have exceeded government sanctioned eradication programs in several states. For example, Utah's sport hunting cougar harvests averaged 500/yr in 1995 7 compared to peak culls of 150/yr in 1946 1949 [24], and Montana sport hunters harvested 800/yr in 1997 1999 vs. 140/yr in the peak "bounty" years of 1908 11 [25]. Likewise, South Africa exported 120 leopard trophies per year in 2004 2006, similar to the cull of 133 leopards per year in Cape Province (which covered most of the country) during 1920 1922 [26].

Fig. 4 shows the potential consequences of coupling a 40% cull of cougars with intensive sport hunting if the control program only targets males (reflecting traditional trophy hunting), removes males and females in proportion to their abundance, or only removes adult females. Fig. 4adg show population trends for the maximum fixed offtakes that never resulted in population extinctions during 20 simulations, whereas Fig. 4beh show the minimum fixed harvests that caused extinction in all 20 runs (often within 10 yrs of an initial decline). Fig. 4cfi show the consequences of applying the maximum "safe" offtakes if the population were inadvertently culled by 50% because of inaccurate population estimates. Consistent with population viability analyses [27 28], a female only harvest comes closest to maintaining a persistent population reduction; a mixed male female strategy allows the largest number of trophies to be harvested; a male only harvest never maintains a

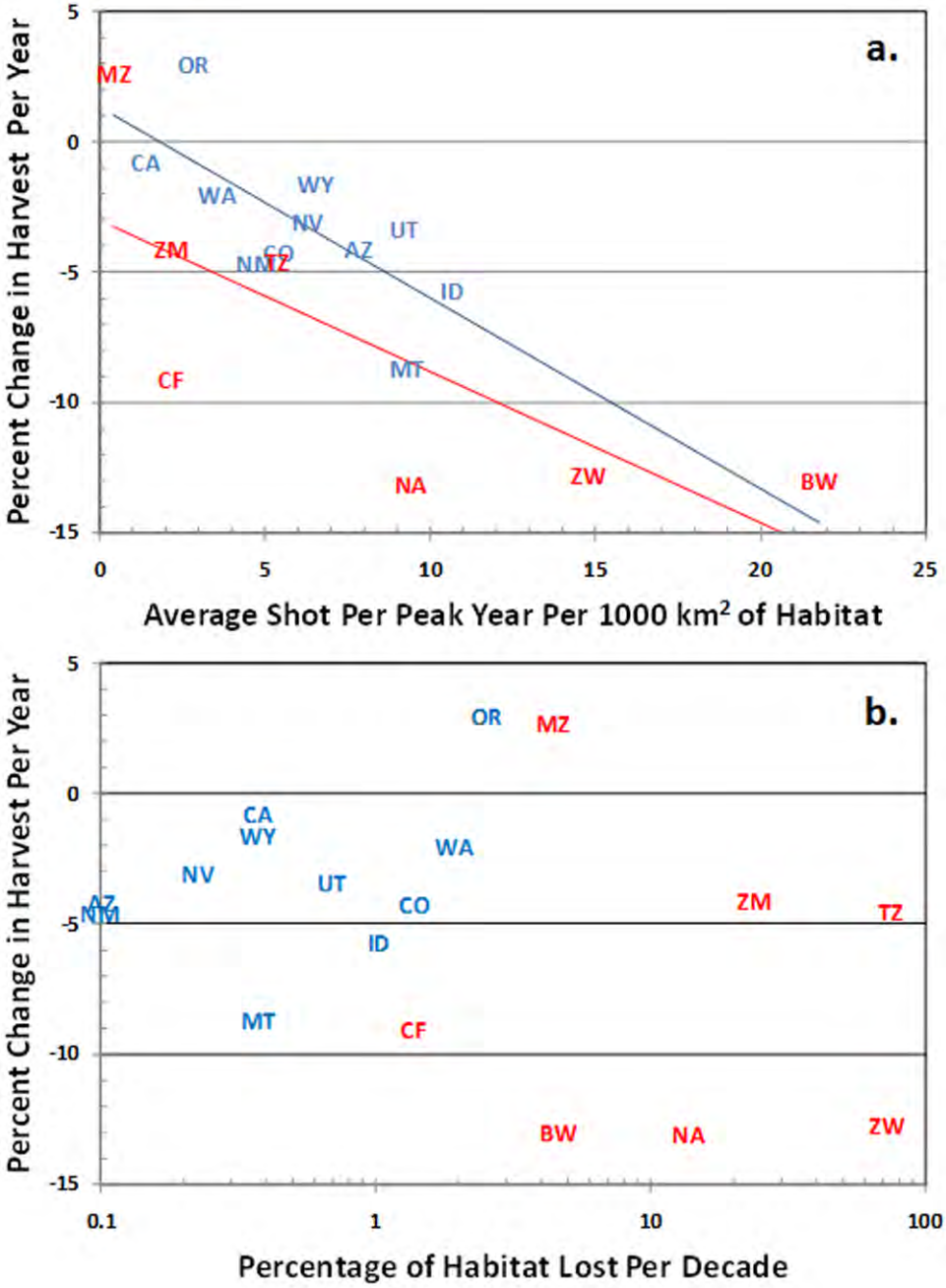


Figure 3. Recent trends in cougar offtakes (blue) and lion offtakes (red) as functions of a) harvest intensity and b) habitat loss. Jurisdictions with the highest harvest intensity showed the greatest decline in cougar offtakes ($r^2 = 0.5151$, $P = 0.0129$) and lion offtakes ($r^2 = 0.5796$, $P = 0.0468$). Habitat loss is plotted on a log scale to allow comparison between the African countries and the US states.
doi:10.1371/journal.pone.0005941.g003

40% reduction in population size and has the smallest margin of error (male only harvests can have catastrophic effects even in non infanticidal species [29]).

These simulations assume a fixed harvest whereas many wildlife agencies reduce their quotas in response to lowered offtakes (Supporting Information Fig. S3 also see ref. [30]). However, offtakes may often be maintained at constant levels through compensatory increases in hunting effort, running the risk of an "anthropogenic Allee effect" [31 32]. Hunters in Zambia, Zimbabwe and Tanzania maintain their lion harvests by shooting males as young as 2 yrs of age (Fig. 5). In Zimbabwe, high lion offtakes were sustained from 1995 until 2005 by allowing females on quota [3], and the duration of lion safaris increased by nearly 18% from 1997 to 2001 (Supporting Information Fig. S3). Similarly, hounds have been used to hunt leopards in Zimbabwe since 2001, potentially masking a continued population decline.

Discussion

Mortality from state sanctioned and illegal predator control likely contributed to the overall population declines of cougars and lions; while leopards are also killed as pests, the leopard's CITES Appendix I status requires international approval for national export quotas, potentially providing safeguards against overhar

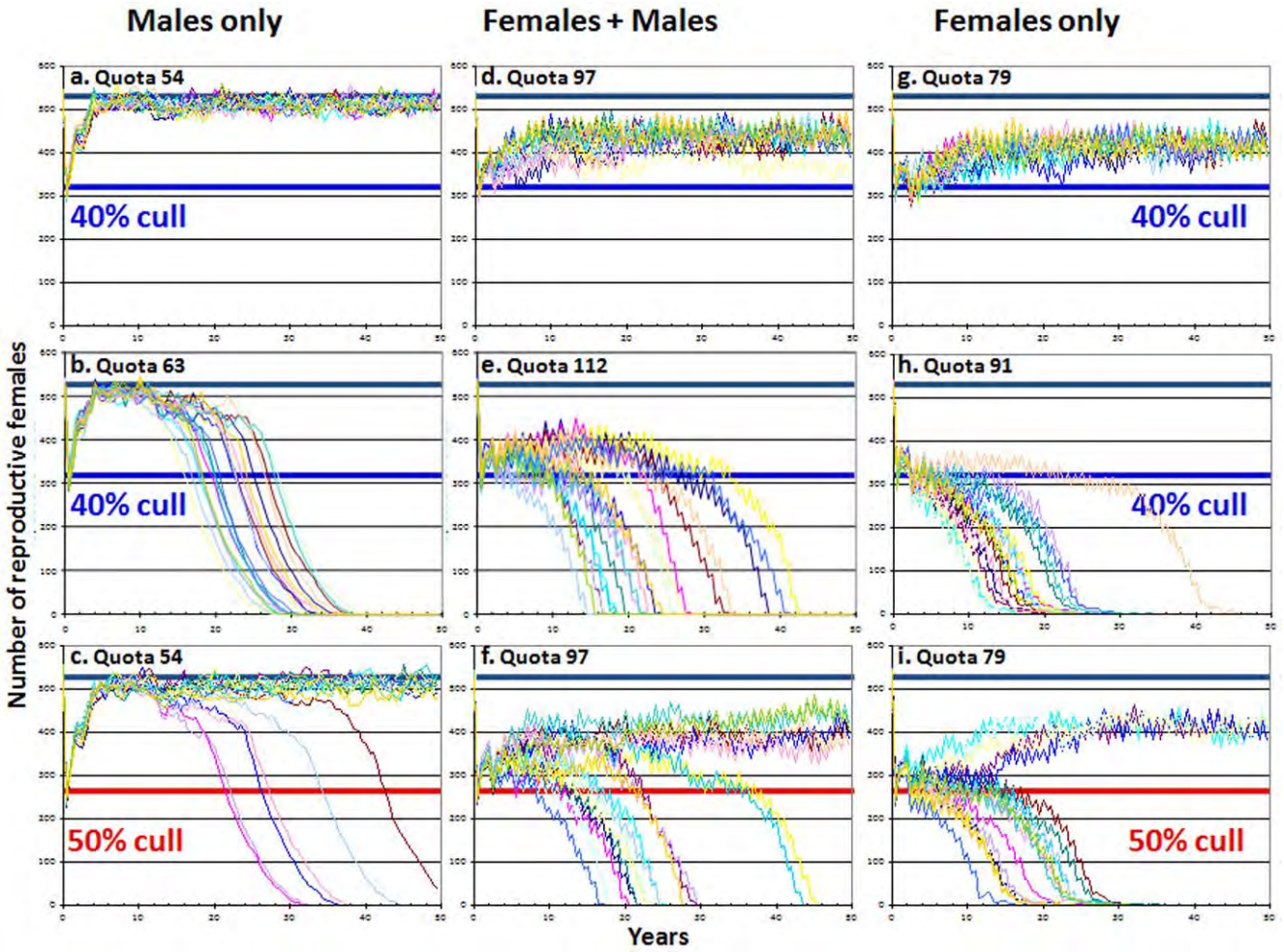


Figure 4. Simulated cougar populations subjected to an initial cull followed by fixed offtakes for 50 yrs. The initial cull is either 40% (top and middle rows) or 50% (bottom row), and the subsequent harvests are either the maximum offtake that incurred no extinctions in 20 runs following a 40% cull (top and bottom rows) or the minimum that produced 20 extinctions in 20 runs following a 40% cull (middle row). In the absence of sport hunting, the stable population size in these simulations is 527 reproductive females (indicated by the heavy black line in each graph); a 40% reduction in population size is indicated by blue lines, a 50% reduction by red lines. Each column represents a different harvest strategy: male only (left column), males and females (middle) and female only (right). Demographic parameters are set as in Fig. 1; quotas allow offtake of animals as young as 2 yrs; each graph shows outputs from 20 runs.
doi:10.1371/journal.pone.0005941.g004

vest. However, leopard exports have declined in some countries, quotas have risen in others, and concerns have been raised over the level of problem animal offtakes and the management of leopard hunting practices [33 35]. Further, leopard populations in many areas may have been "released" [36] by large scale declines in lion numbers: lions inflict considerable mortality on leopards [37]; consequently, hunting blocks in Tanzania's Selous Game Reserve with the highest lion harvest intensities showed the largest *increases* in leopard harvests (P 0.0059 after controlling for declines in lion offtakes, n 45 blocks). Thus the full impact of current trophy hunting practices on leopards may not be fully apparent for several more years.

Harvest policies for infanticidal species such as lions, cougars and leopards that relied on "constant proportion" or "fixed escapement" could help protect populations but require accurate information on population size and recruitment rates, which are virtually impossible to collect; a harvest strategy of "constant effort" can more easily be achieved by measuring catch rates and regulating client days [38 40]. Hunting efficiency could be reduced by banning or limiting the use of baits and hounds, but the absence of direct oversight in remote hunting areas would make enforcement difficult. Alternatively, the age minimum harvest strategies illustrated in Fig. 1 could be implemented without risk of over hunting, assuming that ages can be reliably estimated before the animals are shot [41] rather than afterwards [42]. Unsustainable levels of trophy hunting of lions and cougars appear to be driven by conflicts with humans and livestock: the intensity of lion hunting was highest in countries with the most intensive cattle production, and wildlife managers are under similar pressure from US ranchers to raise cougar offtakes. Thus an even more fundamental challenge for carnivore conservation will be to build community tolerance for predators by reducing the need for retaliatory predator control and by improving benefit sharing from well managed trophy hunting [15].

Materials and Methods

We analyzed trophy exports (http://www.unep wcmc.org/citestrade/) by using the term "trophy" and restricting the analysis to countries that exported at least 25 trophies of a particular



Figure 5. Sample of under aged male African lions shot by sport hunters in various countries from 2004 2008.
doi:10.1371/journal.pone.0005941.g005

species for at least 2 yrs from 1982 to 2006 (excluding captive bred lion trophies from South Africa). Other types of exports (skins) were also analyzed for lions, since non standard terms are sometimes used by reporting countries [43], but these did not alter overall export trends. Data on Tanzanian hunting quotas were provided by the CITES office at the Division of Wildlife headquarters in Dar es Salaam; data on duration of hunting safaris in Zimbabwe were from the head office of Parks and Wildlife Management Authority in Harare.

Offtake data for black bears and cougars were provided by the Alaska Dept. of Fish & Game, Arizona Game & Fish Dept., California Dept. of Fish & Game, Colorado Division of Wildlife, Idaho Fish & Game, Minnesota Dept. of Natural Resources, Montana Fish, Wildlife & Parks, New Mexico Game & Fish, Nevada Dept. of Wildlife, Oregon Dept. of Fish & Wildlife, Utah Division of Wildlife Resources, Washington Dept. of Fish & Wildlife, and Wyoming Game & Fish. Note that all cougar offtakes in California are due to predator control.

"Harvest intensity" is the average harvest of the three peak offtake years divided by the extent of habitat in that state/country. Regression coefficients were calculated across the time period beginning with the earliest of the three peak harvests and ending in 2006 for cougars or the last of the three lowest subsequent harvest years for lions (Supporting Information Fig. S3); percent change is the regression coefficient divided by the peak harvest. Limited lion and leopard offtake data were available from 1996 2008 in Tanzania's hunting blocks; trends were only calculated for blocks reporting ≥5 yrs of activity.

Cougar habitat is forest cover taken from the National Land Cover Database (NLCD) www.mrlc.gov/changeproduct.php; lion habitat is the extent of GLOBCOVER land classification categories 42, 50, 60, 70, 90, 100, 110, 120, 130, 134, 135, 136, 160, 161, 162, 170, 180, 182, 183, 185, 186 and 187 in each country, see http://postel.mediasfrance.org/en/DOWNLOAD/Biogeophysical Products/. Habitat loss is based on change in forest cover in the US 1990 2000 and in woodland/forest habitat in Africa 1990 2005 from FAO Global Forest Resources Assessment 2005, http://www.fao.org/forestry/32185/en/. Snow conditions for cougars are taken from http://www.wrcc.dri.edu/Climsum.html and African livestock production is taken from http://www.fao.org/es/ess/yearbook/vol 1 1/pdf/b02.pdf, using production levels from years of peak lion offtake in each country.

Supporting Information

Figure S1 The number of CITES reported exports of a) cougar trophies and b) black bear trophies from the US were highest in years when the most animals were harvested domestically in the western states ($P<0.001$ for each species).
Found at: doi:10.1371/journal.pone.0005941.s001 (0.69 MB EPS)

Figure S2 Trendlines for the population declines of a) cougars and b) lions. Individual states with statistically significant declines in cougar offtakes: MT, ID, AZ, UT and CO; individual countries with significant declines in lion offtakes: BW, TZ and ZW.
Found at: doi:10.1371/journal.pone.0005941.s002 (1.08 MB EPS)

Figure S3 Quotas, offtakes and catch rates each year since the peak harvests for cougars in Colorado, Montana and Utah and lions in Tanzania and Botswana; duration of lion hunts in Zimbabwe. Catch rates are (offtakes/quotas). Catch rates have generally declined because offtakes have fallen more quickly than quotas. Catch rates briefly improved in Utah and Botswana when quotas were adjusted downwards, but subsequently resumed an overall decline; Montana's adjustments in quotas are too recent to evaluate. For Zimbabwe, vertical lines indicate standard errors; numbers are sample sizes; duration of lion hunts became significantly longer between 1997 and 2001 ($P<0.01$). No other data are available on quotas or hunt durations from these or other countries/states. The bottom graphs show that declines in lion trophy exports are unlikely to reflect declining market demand; imports of lion trophies have increased, especially in recent years for captive bred or "canned" lion trophies for South Africa. The declines in trophy exports are also unlikely to be caused by irregular reporting; adding additional exports of skins from Botswana, Tanzania and Zimbabwe would not significantly change the pattern of decline.
Found at: doi:10.1371/journal.pone.0005941.s003 (1.38 MB EPS)

Figure S4 Simulated impacts of trophy hunting in cougars for varying degrees of habitat loss. Solid lines are the same as in Fig. 1: all available males above the age minimum are harvested each year and available habitat remains unchanged over 100 yrs. Dashed lines show population sizes with the same harvest strategies but with 20% habitat loss in 100 yrs; dotted lines represent outputs with 40% habitat loss.
Found at: doi:10.1371/journal.pone.0005941.s004 (1.49 MB EPS)

Table S1
Found at: doi:10.1371/journal.pone.0005941.s005 (0.03 MB DOC)

Acknowledgments

We thank Colleen Begg, Tim Caro, Laurence Frank, John Fryxell, Markus Gusset, Andrew Loveridge, Alan Rabinowitz and Paula White for comments and discussion.

Author Contributions

Conceived and designed the experiments: CP MK KN. Performed the experiments: MK. Analyzed the data: CP MK HB LP KN. Contributed reagents/materials/analysis tools: MK HC HB LP DLG GP MS AS GB LH KN. Wrote the paper: CP DLG KN.

References

1. Whitman K, Quadling H, Starfield A, Packer C (2004) Sustainable trophy hunting in African lions. Nature 428: 175 178.
2. Greene C, Umbanhowar J, Mangel M, Caro T (1998) Animal breeding systems, hunter selectivity, and consumptive use in wildlife conservation. In: Caro T, ed. Behavioral Ecology and Conservation Biology. New York: Oxford University Press. pp 271 305.
3. Loveridge AJ, Searle AW, Murindagomo F, Macdonald DW (2007) The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation 134: 548 558.
4. Packer C, Gilbert D, Pusey AE, O'Brien SJ (1991) A molecular genetic analysis of kinship and cooperation in African lions. Nature 351: 562 565.
5. Packer C, Pusey AE, Eberly L (2001) Egalitarianism in female African lions. Science 293: 690 693.
6. Grimm V, Revilla E, Groeneveld J, Kramer-Schadt S, Schwager M, et al. (2005) Importance of buffer mechanisms for population viability analysis. Conservation Biology 19: 578 580.
7. Swenson JE, Sandegren F, Söderberg A, Bjärvall A, Franzén R, Wabakken P (1997) Infanticide caused by hunting of male bears. Nature 386: 450 451.
8. McLellan BN (2005) Sexually selected infanticide in grizzly bears: the effects of hunting on cub survival. Ursus 16: 141 156.
9. Czetwertynski SM, Boyce MS, Schmiegelow FK (2007) Effects of hunting on demographic parameters of American black bears. Ursus 18: 1 18.
10. Hristienko H, McDonald JE Jr (2007) Going into the 21st century: a perspective on trends and controversies in the management of the American black bear. Ursus 18: 72 88.
11. Child B (2004) Parks in Transition: Biodiversity, Rural Development and the Bottom Line. London: Earthscan.
12. Barnett R, Patterson C (2006) Sport hunting in the SADC region: An overview. TRAFFIC, Johannesburg. http://www.traffic.org/general-reports/traffic pub gen8.pdf.
13. Garshelis DL, Hristienko H (2006) State and provincial estimates of American black bear numbers versus assessments of population trend. Ursus 17: 1 7.
14. Knapp A (2006) A review of the European Union's import policies for hunting trophies. TRAFFIC Europe.
15. IUCN (2006) Conservation Strategy for the lion (*Panthera leo*) in Eastern and Southern Africa, http://www.felidae.org/JOBURG/Lion E Sweb1.pdf.
16. Lambert CMS, Wielgus RB, Robinson HS, Katnik DD, Cruikshank HS, et al. (2006) Cougar population dynamics and viability in the Pacific Northwest. J Wildl Management 70: 246 254.
17. Stoner DC, Wolfe ML, Choate DM (2006) Cougar exploitation levels in Utah: implications for demographic structure, population recovery, and metapopulation dynamics. J Wildl Management 70: 1588 1600.
18. Ray JC, Hunter LTB, Zigouris J (2005) Setting Conservation and Research Priorities for Larger African Carnivores. WCS Working Paper 24: 1 203, New York: Wildlife Conservation Society.
19. IUCN Red List of Threatened Species (2008) http://www.iucnredlist.org.
20. Woodroffe R (2001) Strategies for carnivore conservation: lessons from contemporary extinctions. In: Gittleman JL, Wayne RK, Macdonald DW, Funk SM, eds. Carnivore conservation. Cambridge: Cambridge University Press. pp 61 92.

21. Packer C, Ikanda D, Kissui B, Kushnir H (2005) Ecology: Lion attacks on humans in Tanzania. Nature 436: 927 928.
22. Kissui BM (2008) Livestock predation by lions, leopards, spotted hyenas, and their vulnerability to retaliatory killing in the Maasai steppe, Tanzania. Animal Conservation 11: 422 432.
23. 2006 OREGON COUGAR MANAGEMENT PLAN (2006) Salem OR: Oregon Department of Fish and Wildlife. http://www.azgfd.gov/pdfs/w c/bhsheep/OregonCougarManagementPlan2006.pdf.
24. 1999 Utah Cougar Management Plan (1999) Utah Division of Wildlife Resources.
25. Riley SJ, Nesslage GM, Maurer BA (2004) Dynamics of early wolf and cougar eradication efforts in Montana: Implications for conservation. Biological Conservation 119: 575 579.
26. Beinart W (1998) The night of the jackal: sheep, pastures and predators in the Cape. Past and Present 158: 172 206.
27. Lambert CM, Wielgus RB, Robinson HR, Cruickshank HS, Clarke R, Almack J (2006) Cougar population dynamics and viability in the Pacific Northwest. Journal of Wildlife Management 70: 246 254.
28. Martorello DA, Beausoleil RA (2003) Characteristics of cougar populations with and without the use of dogs. In: Becker SA, Bjornlie DD, Lindzey FG, Moody DS, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming: Wyoming Game and Fish Department. pp 129 135.
29. Milner-Gulland EJ, Bukreeva OM, Coulson T, Lushchekina AA, Kholodova MV, et al. (2003) Reproductive collapse in saiga antelope harems. Nature 422: 135.
30. Anderson CR, Lindzey FG (2005) Experimental evaluation of population trend and harvest composition in a Wyoming cougar population. Wildlife Soc Bull 33: 179 188.
31. Courchamp F, Angulo E, Rivalan P, Hall RJ, Signoret L, et al. (2006) Rarity value and species extinction: the anthropogenic Allee effect. PLoS Biology 4: 2405 2410.
32. Hall RJ, Milner-Gulland EJ, Courchamp F (2008) Endangering the endangered: the effects of perceived rarity on species exploitation. Conservation Letters 1: 75 81.
33. Balme GA (2009) The conservation biology of a nominally protected leopard population. Ph.D. Thesis, University of KwaZulu-Natal, Westville. pp 1 179.
34. Purchase G, Mateke C (2008) The state of knowledge regarding leopard (*Panthera pardus*) in three range states (Mozambique, Zambia and Zimbabwe) in the context of improving management of trophy hunting. Report for the CAMPFIRE Association of Zimbabwe.
35. Balme GA, Hunter LTB, Goodman P, Ferguson H, Craigie J, Slotow R (in press) An adaptive management approach to trophy hunting of leopards Panthera pardus: a case study from KwaZulu-Natal, South Africa. In: Macdonald DW, Loveridge AJ, eds. Biology and Conservation of Wild Felids. Oxford: Oxford University Press.
36. Crooks KR, Soulé ME (1999) Mesopredator release and avifaunal extinctions in a fragmented ecosystem. Nature 400: 563 566.
37. Bailey TN (1993) The African Leopard: Ecology and Behavior of a Solitary Felid. New York: Columbia University Press. pp 429.
38. Sinclair ARE, Fryxell J, Caughley G (2006) Wildlife Ecology, Conservation and Management, Second Edition. Oxford: Blackwell.
39. Haydon DT, Fryxell J (2004) Using knowledge of recruitment to manage harvesting. Ecology 85: 78 85.
40. Fryxell JM, Smith IM, Lynn DH (2005) Evaluation of alternate harvesting strategies using experimental microcosms. OIKOS 111: 143 149.
41. Whitman KL, Packer C (2007) A Hunter's Guide to Aging Lions in Eastern and Southern Africa. Long Beach: Safari Press.
42. Laundre JW, Hernandez L, Strenbel D, Altendorf K, Lopez Gonzalez C (2000) Aging mountain lions using gum-line recession. Wildlife Society Bulletin 28: 963 966.
43. UNEP-WCMC (2004) A guide to interpreting outputs from the CITES Trade database, vers. 6.0.
44. Packer C, Herbst L, Pusey AE, Bygott JD, Hanby JP, et al. (1988) Reproductive success of lions. In: Clutton-Brock TH, ed. Reproductive Success. Chicago: University of Chicago Press. pp 363 383.
45. Packer C, Pusey AE (1995) The Lack clutch in a communal breeder: Lion litter size is a mixed evolutionarily stable strategy. American Naturalist 145: 833 841.
46. Craft M, Volz E, Packer C, Meyers LA (2009) Distinguishing epidemic waves from disease spillover in a wildlife population. Proc Royal Society B 276: 1777 1785.
47. Balme G, Hunter L (2004) Mortality in a protected leopard population, Phinda Private Game Reserve, South Africa: a population in decline. Ecological Journal 6: 1 6.
48. Martin RB, De Meulenaer T (1988) Survey of the status of the leopard (Panthera pardus) in Sub -Saharan Africa. Lausanne, Switzerland: Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora.
49. Ruth TK, Buotte PC, Haroldson MA, Murphy KM, Hornocker MG, Quigley HB (2008) Cougar reproduction and survival pre- and post-wolf reintroduction in Yellowstone National Park. In: Toweill DE, Nadeau S, Smith D, eds. Proceedings of the Ninth Mountain Lion Workshop, Sun Valley, Idaho. pp 150 151.
50. Logan KA, Sweanor LL (2001) Desert Puma: Evolutionary Ecology and Conservation of an Enduring Carnivore. Washington, DC: Island Press.
51. Maehr DS, Moore CT (1992) Models of mass growth in 3 cougar populations. Journal of Wildlife Management 56: 700 707.
52. Cooley HS (2008) Effects of hunting on cougar population demography. Ph.D. Dissertation. Washington State University. Pullman, WA.
53. Sweanor LL, Logan KA, Hornocker MG (2000) Cougar dispersal patterns, metapopulation dynamics and conservation. Conservation Biology 14: 798 808.

Darwin Initiative – Final Report

Darwin project information

Project Reference	DAR17-031
Project Title	**Ecological sustainability of leopard trophy hunting in Zimbabwe**
Host country(ies)	UK, Zimbabwe
UK Contract Holder Institution	WildCRU, Zoology Department, Oxford University
UK Partner Institution(s)	
Host Country Partner Institution(s)	Zambezi Society Zimbabwe Parks And Wildlife Management Authority
Darwin Grant Value	£214 886
Start/End dates of Project	December 2009 To November 2012
Project Leader Name	Dr Andrew J Loveridge
Project Website	http://wildcru.org/research http://zamsoc.david.co.zw/
Report Author(s) and date	Dr Andrew J Loveridge (WildCRU) Mrs Roseline L Chikerema-Mandisodza (Zamsoc/ ZPWMA) Mr Peter Musto (Zamsoc)



1 Project Background

This project aimed to address the need for improved management and sustainable conservation of African leopard (*Panthera pardus*) and the leopard habitat in Zimbabwe. The project collected ecological and management data to support a sustainable management of the species. The project was a three way partnership between the Wildlife Conservation Research Unit, Oxford University (WildCRU, lead UK institution), Zambezi Society (ZAMSOC) and the Zimbabwe Parks and Wildlife Management Authority (ZPWMA, project partner).

Zimbabwe have had a CITES allocated sport hunting quota of 500 leopards since 1992. However, this quota has never been fulfilled, which raises the question as to whether the leopard population can sustain the off take or whether the quota of 500 is allocated against a leopard population estimate that may no longer be realistic after several decades of land degradation and land use change.

This project sought to formulate the baseline data on which the impact of hunting on the leopard population could be assessed. There was little or no data to assess the impact of hunting on leopard populations or carry out a non-detrimental findings assessment. This project helped in the formulation of a CITES non-detriment determination for Zimbabwe through collecting baseline ecological and distribution data, establishing contacts with research experts and providing training.

2 Project support to the Convention on Biological Diversity (CBD)

Worldwide, leopards range from Critically Endangered (Amur, Javan and Arabian sub-species) to Near Threatened (Sub Saharan Africa). Sub –Saharan leopards (*P.pardus pardus*) were uplisted on the IUCN 'Red List' from a species of 'least concern' to 'near-threatened' in 2007 based largely on concerns over habitat loss. Leopards are on CITES Appendix 1. Trade in the species is strictly controlled. However CITES quotas are given to 12 African Countries on the basis of non-detriment reports to the CITES secretariat from the country concerned. Zimbabwe has the highest CITES quota of any African country. There is concern within the Wildlife Management Authority of Zimbabwe that this quota may no longer be appropriate given land use change and degradation within the country since the early 1990s when the quota was first implemented. This project has contributed information (with the first ever country wide survey for leopards) and capacity to addressing this question. Data collected by this project also contributes to the ongoing CITES 'Non-detriment finding' (NDF) determination for Zimbabwe.

Furthermore, leopards, being a large predator, are a crucial component of natural ecosystems in African Savannah ecosystems. Recent research suggests that ecosystems with intact predator guilds are more likely to be complex and biologically diverse. Finally large predators function as flagship species to motivate wide-scale conservation of natural ecosystems. Thus conserving large predators in their natural ecosystems contributes to the aims of the Convention on Biodiversity.

3 Project Partnerships

This project is a partnership of three institutions.

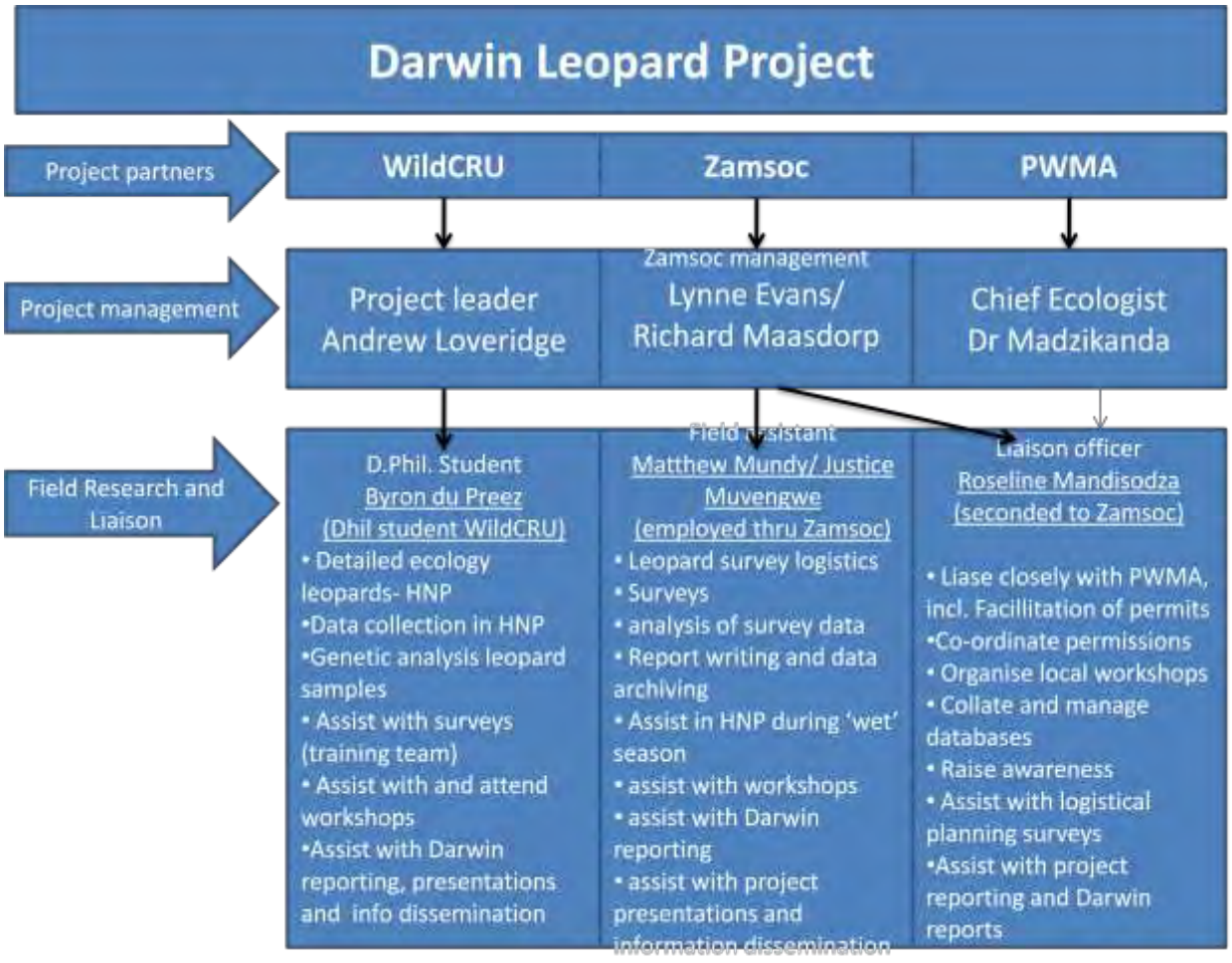
The WildCRU, Department of Zoology, Oxford University based research group is the UK partner in the project. Dr Andrew Loveridge is the project leader for this Darwin project. Mr Byron du Preez is a D.Phil. student registered at Oxford. Mr du Preez is working on a detailed study of leopard spatial ecology and social behavior in Bubye Valley Conservancy. His D.Phil study investigates the impact of trophy hunting on a closed/fenced population.

The Zambezi Society (ZAMSOC**),** an established conservation NGO that has previously undertaken assessments of the sustainability of leopard trophy hunting, has initiated the National Strategy for leopard conservation and brought together the partners for the project. ZAMSOC liaises closely with the Zimbabwe Parks and Wildlife Management Authority research staff, local stakeholders, will organise and run technical and management workshops, coordinate permissions and logistics for surveys, maintain the project website and disseminate results and information. ZAMSOC is the recipient of all host country DI funding.

Roseline Chikerema-Mandisodza, a Senior Ecologist in ZPWMA Scientific Services was seconded to ZAMSOC for the duration of the project and fulfilled a coordination and liaison role. Mr Peter Musto (Zamsoc Projects Officer) has been responsible for facilitating, co-ordination and running field surveys.

Zimbabwe Parks and Wildlife Management Authority (ZPWMA), is the government wildlife management authority responsible for management of protected areas and biodiversity, sustainable use of wildlife, population monitoring, and evaluation of CITES allocated quotas and other wildlife quotas. ZPWMA has commissioned this project and assigned a staff member to the research to facilitate and co-ordinate research, permission and compilation of data. ZPWMA are the management authority responsible for formulation of policy and implementation of CITES legislation. Thus, recommendations of this project can be translated into changes to policy and management. ZPWMA will provide access to official government records and databases. Staff time will be made available in CITES office, hunting and administration offices, permits office, scientific services, regional offices and national parks. ZPWMA will not receive direct funding. Roseline Chikerema-Mandisodza (ZPWMA, Senior Ecologist-Scientific Services), has been assigned to work on the project and has office space in the ZAMSOC office. The project has contact with and liaises with other projects working on leopards and other large carnivores. We anticipate collaborations arising from these contacts.

The organogram below sets out the operational structure of the project.



4 Project Achievements

4.1 Impact: achievement of positive impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

The goal of this project was to promote leopards as ecological flagships to reduce loss of biodiversity in whole ecosystems and as components of biodiversity to be sustainably used to generate revenue to benefit people. The project was able to highlight to wildlife authorities, professional hunters, photographic safari operators and other stakeholders within the country the need to monitor leopard population trends to ensure that levels of utilisation remain sustainable in relation to population size and the importance of future monitoring of population trends. Project staff (particularly R. Chikerema-Mandisodza) have also been integral in facilitating workshops and meetings, in particular a CITES facilitated Non-detriment finding workshop aimed at assessing the conservation needs and status of the species as a preamble to forming an NDF determination by the Parks and Wildlife Management Authority. This project's results, along with other stakeholder input, helped to inform this process and highlight management needs and gaps in knowledge.

4.2 Outcomes: achievement of the project purpose and outcomes

Project purpose

The project purpose was 'to collect ecological and management data to support a National Leopard Management Strategy and to build local and regional consensus to create and implement a conservation strategy to manage leopards and their habitats on a sustainable basis'. The project has made significant strides in gaining a detailed understanding of the distribution and size of leopard populations in Zimbabwe as well as of the factors that may determine population size and viability. A key output has been a series of baseline surveys of leopard populations that will inform current management and serve as a foundation for future assessment of population trends.

At the policy level this project did not achieve as much as had been hoped for, and in retrospect these aims may have been overly ambitious. However, significant strides were made in drawing attention to the need for sustainable management for leopards in Zimbabwe. This is likely to lead to further progress in implementing a more sustainable approach to setting quotas for leopard, based upon rigorous population data.

Furthermore, as part of improving and designing management strategies for leopards, the project has been engaged in the CITES non-detriment finding (NDF) process for this species. This is a crucial step in putting in place sustainable hunting practices in the country. The general consensus is that the current CITES quota of 500 leopard exports per year should be revisited to verify whether this is in fact sustainable for the species.

Project outcomes

Leopard population surveys

This project provided the first ever baseline leopard population data for many of the most important protected areas within Zimbabwe. This provides important information for wildlife managers to set hunting quotas sustainably on the basis of population size. In addition these surveys provide a starting point for future surveys designed to detect population trends over time. Population trend rather than finite population size is critical information on which wildlife managers should base their decisions. Survey sites were chosen based on areas identified as being important for leopard conservation in the county and covered a range of land-use areas ranging from fully protected National Parks, Safari Area, Communal Lands (Campfire Areas) and conservancies where leopards are trophy hunted

The survey method used by this project (spoor surveys) was chosen because it is relatively cheap and simple to implement and requires little training and expertise (aside from traditional tracking skills) and can thus be used to provide indices of population size over time. The project has provided the necessary training to wildlife managers to independently implement these surveys in the future. It is likely that ongoing engagement by the project PI (Loveridge), Zamsoc and research staff within PWMA will facilitate future survey work.

Surveys were undertaken at the following sites, largely by the Darwin Leopard Project survey teams, except for those sites marked '*' which were undertaken in collaboration with research teams based in these areas.

The map below shows the survey areas covered between 2010 and 2012.

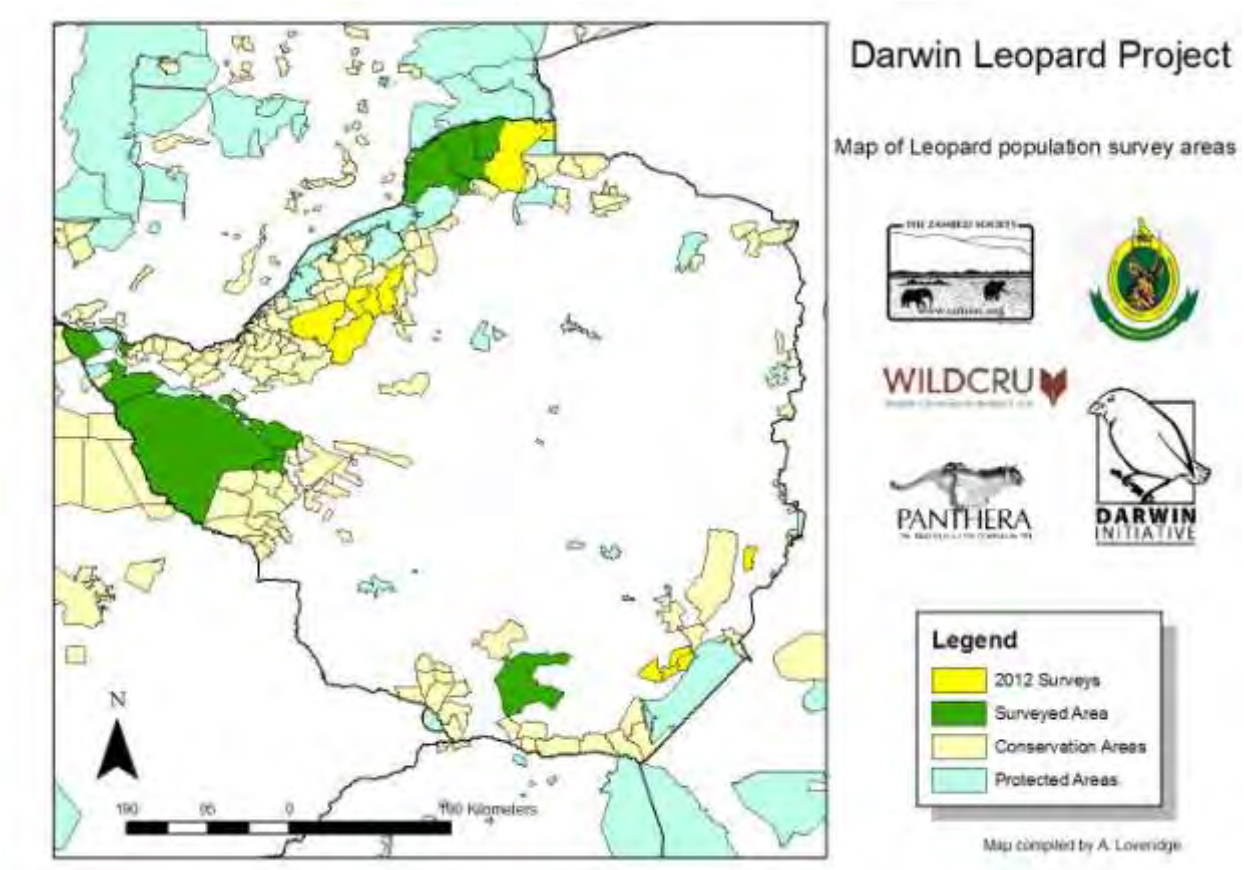


Figure 1: Map showing 2012 Leopard spoor survey areas

<u>Western Region</u>

Matetsi Safari Area

Hwange National Park (4 sites in 15 000km^2 Park)

Gwaai Intensive Conservation Area

Sikumi and Gwaai Forest

Tsholotsho Communal Land (Campfire Area)

Hwange Communal Land (Campfire Area, Chief Mvuthu's area)

<u>Northern Region</u>

Mana Pools National Park

Rifa and Urungwe Safari Areas

Chewore North Safari Area

Urungwe-Mukwichi Communal Land (Campfire Area)

Dande North and South Safari Areas

South-East Lowveld

Bubye Valley Conservancy

Save Valley Conservancy*

Malilangwe Conservancy*

Chipinge Safari Area

Gonarezhou National Park*

Baseline surveys to estimate leopard population size were undertaken at 18 sites, identified by PWMA and project staff as being important for conservation and management of leopards. These areas included three National Parks, seven Safari Areas, four Conservancies and three community areas. These surveys provide a starting point for future monitoring programmes for the species as survey routes are mapped and repeatable and repeat surveys can be undertaken relatively cheaply in the future to provide comparably data. The survey data provides the opportunity to assess key factors determining the presence of leopards. A pilot analysis (described in the output section) suggests that factors most influencing leopard presence are broad regional abiotic factors, human population size and the presence of competing carnivores (largely lions).

Detailed Study of Leopard Ecology

Detailed studies of leopards are rare because leopards are a cryptic and elusive species that are logistically difficult and time consuming to study. To address this paucity of ecological information a three year study of leopards was undertaken on the Bubye Valley Conservancy (BVC), led by WildCRU D.Phil. Student, Byron duPreez. BVC is a private conservancy of 3 600km^2, used primarily for high end trophy hunting safaris. Leopards are a key species in marketing safaris in this area. This study employed GPS collars to determine leopard (and lion) movements within the study site in relation to both competing carnivores and trophy hunting offtake. Intensive camera trapping (both baited and passive methods) was used to provide population estimates and provide information on leopard population demography. Population estimates derived from camera trapping were also intended to verify simultaneous estimates derived from spoor transects at this site. In addition data were collected on diet, habitat use and interactions with other species in the sympatric large predator guild were obtained and contribute to knowledge of leopard habitat requirements which is an important factor in population management.

BVC is a medium to high nutrient ecosystem that is primarily dominated by basalt soils and mopane woodland habitat. The area has a low mean annual rainfall of approximately 300mm. Research was conducted between May 2010 and September 2012 by a team consisting of a D.Phil. research student, at least one assistant, and one full-time local tracker. Additional help was sought from time to time as the situation demanded.

Between 2010 and 2012 18 leopards and 11 lions were captured and fitted with GPS/Satellite radio-telemetry collars that were programmed to record GPS fixes every hour on the hour – providing high resolution simultaneous spatiotemporal data on the movements and habits of both species in relation to one another.

75 camera-traps were deployed in 6 capture-recapture surveys in 2 different study sites between the years of 2011 and 2012 during which there was a major change to the conservation and management of one of the sites, when lions were introduced for the first time. The leopard population in this site was monitored before and after this introduction to assess

the effect that the introduction on lions would have on their behavioural ecology. Another, neighbouring, population of leopards coexisting with a stable lion population was monitored simultaneously to provide a level of control.

Between the surveys of 2011 and 2012 whilst the cameras were not being used for the core research in the Bubye Valley Conservancy, they were loaned to Wild Horizons in Victoria Falls to conduct a camera-trapping survey on their leopard population.

Spoor transects were conducted annually in BVC from 2009 – 2012, providing baseline data on the leopard and lion populations in the study sites. Several local Zimbabwean researchers and ecologists were trained by the DI Leopard Team on how to plan, conduct and analyse the results of these surveys, with the goal that they would conduct autonomous research. Indeed, several of the researchers trained went on to conduct the national spoor transect surveys as part of the Darwin Initiative Leopard Project research.

Compilation of leopard management data

Harvest and hunting quota data have been compiled for the key leopard populations for the project period to provide an overall assessment of sustainably of utilisation. These data are also being used in the analysis of the factors that affects the size and viability of leopard populations, in particular the harvest in relation to population size is potentially an important factor in determining population viability of many long lived species. In addition we have compiled quota and harvest data for lions and spotted hyaenas which are key competitors within the carnivore guild and could potentially also have an impact on leopard populations.

Management meetings, workshops and regional collaboration

A number of stakeholder meetings were held to bring together research and management expertise from within Zimbabwe. The first meetings took place in Oxford. Mrs Chikerema-Mandisodza was flown over to begin the planning process and also to familiarise herself with WildCRU. Meetings to plan the initial stages of the project took place between Mrs Chikerema-Mandisodza, Mr duPreez and Dr Loveridge over the period of a week. The first workshop was held in August 2011 in Marula at Stone Hills Lodge. This meeting comprised of 10 research scientists . The second meeting was held in Bulawayo on the 17 August 2011 (see workshop meeting report, attached), this was hosted by the Parks and Wildlife Authority and facilitated by Dr A. Loveridge and attended by 18 researchers, ZPWMA ecologists and managers. A key recommendation of this meeting was to hold a non-detriment finding workshop facilitated by a CITES approved facilitator. This took place in November 2012, facilitated by the Head of TRAFFIC, Southern Africa (Dr David Newton) and provided the preliminary stages of the CITES NDF process for leopards (see attached report).

Wider collaboration has been achieved with other researchers working in Zimbabwe as follows:-

- Mr Dusty Joubert (undertaking leopard monitoring in Save Valley Conservancy)
- Dr Rosemary Groom (carnivore research in Gonarezhou National Park and Save Valley Conservancy)
- Ms Tanith Grant (leopard study in Marula District, Matabeleland South
- Roger and Jess Parry (Victoria Falls Wildlife Trust)
- Dr Guy Balme and Dr Peter Lindsay (Panthera and Leopard research in KwaZulu Natal).

Extensive collaboration has been achieved with hunting operators in the various safari areas and conservancies surveyed by the project, with logistical assistance and support provided by staff on the ground. Support and assistance was also provided to survey staff undertaking leopard surveys by PWMA field stations and staff.

Training and capacity building

Training in survey methods (primarily spoor transects) has been provided for 21 field staff from field stations around Zimbabwe. Much of the training occurred when survey teams worked with field staff. In addition a training workshop to provide in depth training on population surveys was help from 9^{h}-13th of May at Hwange Main Camp. This workshop trained twenty-one PWMA, Forestry and Rural District council field staff as well as a number of staff from local NGOs.





The twenty one participants were trainee ecologists and rangers from Zimbabwe's National Parks, Safari Areas and Forestry Commission Areas, CAMPFIRE representatives from Rural District Councils, and staff from the Zambezi Society itself. A combination of classroom lectures (pictured left) and field work (pictured right) were used.

The following areas were covered:-

- Overview of leopard population biology
- Distribution of leopards in Africa and Zimbabwe
- Overview of techniques used in monitoring carnivores
- Why study/monitor leopards?
- Discussion on use of spoor as a technique to monitor animals including leopards
- Differences between leopard spoor and other cat spoor
- Leopard identification and aging - in the field
- Aging and sex determination from spoor
- Trophy size estimates using spoor
- Spoor data collection
- Spoor data analysis

A key area where training was facilitated by the project was by arranging for two senior ecologists from PWMA (Mr Godfrey Mtare and Mr Edwin Makuwe), to attend the Postgraduate diploma course in International Wildlife Conservation Practice at the Recanati-Kaplan Centre at Oxford (see www.wildcru.org/courses/diploma). Both men passed the course (Mr Mtare has since gone on to complete a Masters degree) which focuses extensively on conservation and management of large felids. Both Mr Mtare and Mr Makuwe have returned to Zimbabwe and both are based in the field and in a strong position to utilise their new skills.

In addition to training and capacity building the project undertook a public outreach campaign. Leopards are frequently confused with other predator species (serval, cheetah and sometime spotted hyaena) and this leads to over-estimation of numbers and also incorrect identification of problem causing animals. The project produced and printed posters in English, Shona and Ndebele. These were distributed to schools, provincial and ZPWMA offices across the country. Samples of these posters accompany this report.

4.3 Outputs (and activities)

Leopard population surveys

Table 1 presents details of the leopard surveys undertaken by the project and project partners. Sites marked (*) are those undertaken by project partners outside the remit of the main project, but where data were provided for the purpose of analysis. In total 48123km^2 of important leopard habitat were surveyed. This constitutes 12.3 % of the land area within Zimbabwe and the most important leopard areas. Surveys were undertaken on transects totalling 14400km in length (with each transect being run on two or more occasions). These survey routes have been logged for use in any ongoing survey work. These are measures of the significant amount of effort that was put into leopard surveys for this project.

Table 1: Leopard survey sites

Survey Area	Year	Region	Area (km^2)	Land Use	Transect km
Chirisa&Sengwa	2012	Central	1713	Hunting	453.4
Chizarira	2012	Central	1948	Protected	534.9
Omay	2012	Central	1865	communal	466.16
Chewore North	2012	Northern	1648	Hunting	399.8
Dande	2012	Northern	1155	communal	443.1
Hurungwe (Nyakasanga+Rifa)	2011	Northern	1709	Hunting	732.8
Mana pools	2011	Northern	1287	Protected	469.4
Mukwichi	2011	Northern	1853	communal	386.6
Bubye Kwalusi	2010	South East	480	Hunting	165.8
Bubye North	2010	South East	1071	Hunting	307.8
Bubye South	2010	South East	1394	Hunting	432.8
Chipinge	2012	South East	261	Hunting	126.9
Gonarezhou*	2009	South East	4965.9	Protected	490.4
Save North*	2006	South East	1753	Hunting	565.1
Save South*	2006	South East	834	Hunting	387.1
Malilangwe*	2010	South East	476.5	Hunting	120.6
Gwaai Valley	2007	Western	927	Hunting	841.4
Hwange MC	2009	Western	1737	Protected	486
Hwange Robbins	2008	Western	1699	Protected	436
Hwange Wilderness	2008	Western	1817	Protected	430
Hwange Central	2012	Western	5676	Protected	674
Hwange Southern	2012	Western	2513	Protected	500.8
Matetsi	2008	Western	1934	Hunting	1095
Ngamo forest land	2008	Western	1386	Protected	488
Tsholotsho	2010/2011	Western	1397	communal	1275
Hwange- Vic Falls	2011	Western	392	communal	269.9
Marula*	2010	South East	2674	communal	610
			48 123.4		**14 400**

The map below (Figure 2) presents the results of population surveys across all study sites and shows leopards per 100km2. In general, as indicated in the figure, high densities were found in the North and South East of the country corresponding to high nutrient soils and well protected wildlife areas. Populations in the West of the country tended to be lower density, likely because of low nutrient, dystrophic soil systems. Overall leopard populations were higher in protected areas and low in human dominated systems (Communal Lands).

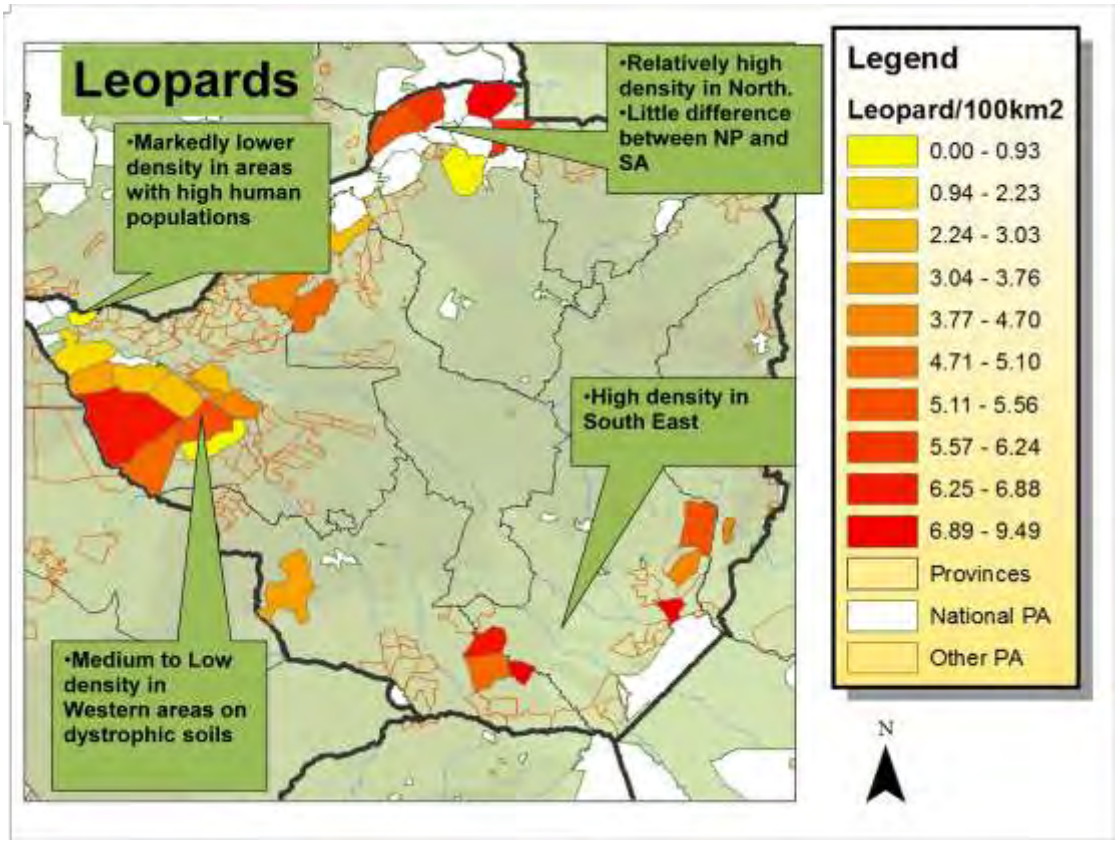


Figure 2: Map showing leopard population density in surveyed areas

Using the Akaike Criterion approach we examined factors that could potentially influence leopard distribution and population viability. Key factors were considered to be Human Appropriation of Net Primary productivity (HANPP), competing carnivores, Regional ecology, hunting pressure, Soil nutrient status and Rainfall. HANPP was closely correlated with human population density so that later was excluded from models to limit confounding correlation. The most highly weighted model (Table 2; 3 and 4) included the effects of HANPP, potential competitors within the carnivore guild and regional variation. Surprisingly the effects of trophy hunting were not included in any of the top weighted models. It is possible that use of quota rather than harvest data in the models may have limited the importance of this effect in the model, however harvest data were not available at the time of analysis. These models will be re-run with harvest data substituted for quota data. Nevertheless, human impact (HANPP/ human density) appears to have the most profound effects. The effect of competitors also appears to have a strong effect on leopard population density, suggesting that there may be an intriguing situation were in areas where lions are heavily hunted (and populations are therefore depressed) may improve the viability of leopard populations (Figure 3). Further data would help to disentangle these issues and steps are being taken to source data from extra sites. In particular sites where human impacts are high would be valuable (Figure 4). The project largely focused on survey sites that were important for leopards and these are in general well protected conservation areas with low human presence. These data are currently being written up for publication.

Model	Deviance	AICc	Delta	Weight
HANPP + Hyaena + Lion + Region	**77.14**	**131.42**	**0.00**	**0.28**
HANPP + Hyaena + Region	**95.34**	**133.37**	**1.95**	**0.10**
Hyaena + Region	**109.91**	**133.75**	**2.33**	**0.09**
Lion + Hyaena + Region	**97.93**	**134.12**	**2.70**	**0.07**
HANPP + Region	**111.76**	**134.22**	**2.80**	**0.07**
Hunting + Hyaena + Region	**102.82**	**135.48**	**4.06**	**0.04**

(+ 28 further models weighted < 0.04)

Table 2. Top weighted AIC models

Factor	Coefficient	SE	z value	Pr(>|z|)	P
Region (intercept)	**4.587516**	**1.692628**	**2.606**	**0.00916**	**0.001**
Human impact	**-1.345634**	**0.623206**	**2.064**	**0.03897**	**0.01**
Trophy hunting	**-0.406534**	**0.541359**	**0.715**	**0.47488**	**n/s**
Hyaena density	**1.615015**	**0.649844**	**2.381**	**0.01727**	**0.01**
Lion density	**-0.960855**	**0.501222**	**1.813**	**0.06983**	**0.05**
Soil nutrient	**-0.069419**	**0.460697**	**0.143**	**0.88640**	**n/s**
Rainfall	**-0.048322**	**0.636411**	**0.072**	**0.94260**	**n/s**

Table 3. Results of model averaging, showing that region, human impact and competitors remain the most important factors determining leopard density.

Variable	Relative importance
Region	1.00
Hyaena Density	0.83
Human Impact	0.70
Lion Density	0.56
Trophy hunting impact	0.17
Soil Nutrient	0.12
Rainfall	0.12

Multiple R-squared: 0.7036, Adjusted R-squared: 0.6189 F-statistic: 8.308 on 6 and 21 DF, p-value: 0.0001091

Table 4: showing the relative importance of variables in the model in determining leopard population size, Region, Competitors and human impact were all relatively important. Trophy hunting and abiotic factors contributed less weight to AIC models

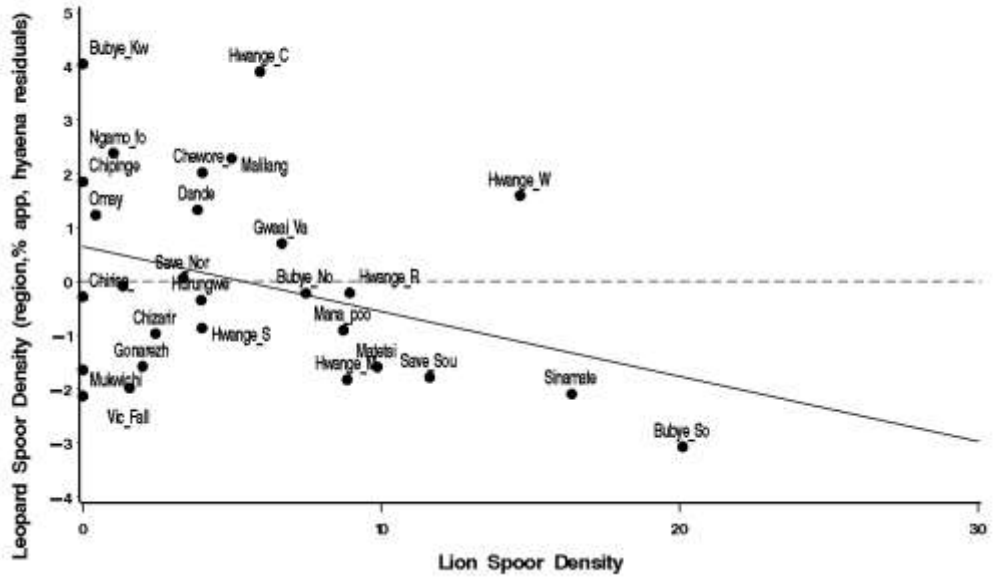


Figure 3: The relationship between Lion spoor density (a surrogate for population density) and variation in leopard spoor density.

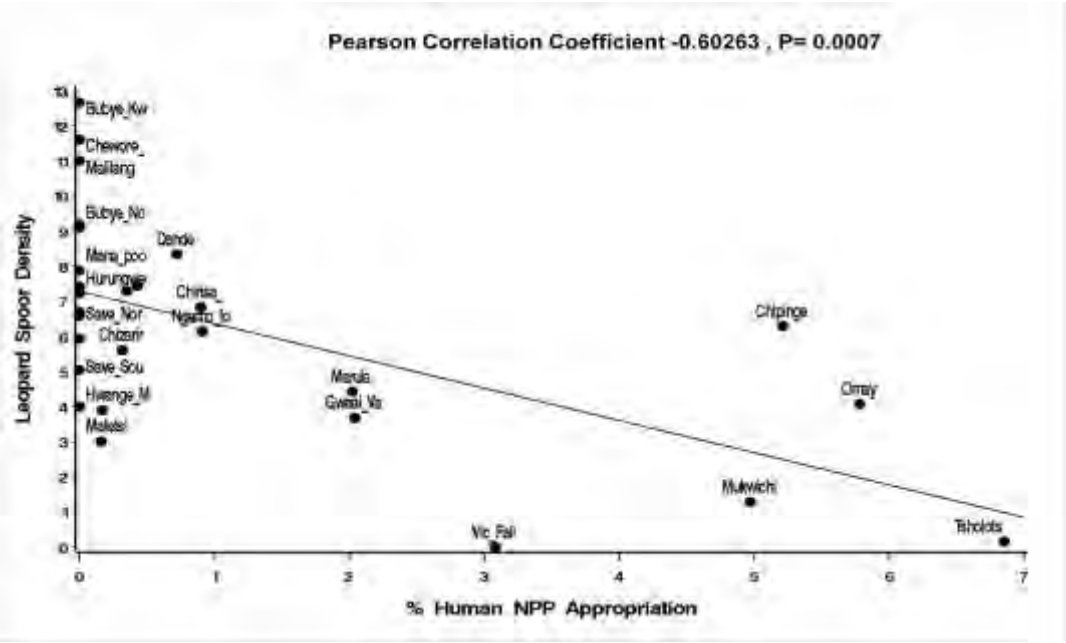


Figure 4: The relationship between leopard population density and human impact. Lower leopard densities were found when human impact was high.

Detailed field study of leopard population ecology

In total, over 150,000 GPS fixes from the radio-telemetry collars on both leopards and lions were recorded. These will be investigated for interaction between and within the species, and the outcome of these interactions. The GIS data also provides accurate details on species' home-ranges and territories, and the seasonality of these, as well as habitat preference and utilisation, survival rates, and habitat mediated behaviours.

Over 40,000 images of leopards were recorded in the 6 camera-trapping surveys carried out between 2011 and 2012. The cats in each of these photographs were individually identified and named, based on their unique pelage patterns. The results were then analysed using capture-recapture models that take the ratio of known ('marked') leopards to previously unmarked individuals, and repeat this over many occasions in order to estimate population abundance for

a given area. The more individuals that can be captured at each occasion, resulting in fewer unknown animals on subsequent occasions, the more accurate the results. We implemented a novel method of camera-trapping leopards using baits in order to attract them to the cameras so as to increase both capture probability and capture frequency. We tested this method against the traditional method that uses paired cameras carefully sited to capture both sides of the leopards as they naturally wander around their territory. This 'passive' method requires as much skill as luck, and whilst it has proven valuable in the past, we saw an opportunity for improvement. A comparison of these camera-trapping methods carried out on the same population of leopards in the same season shows that several resident leopards that were captured in the baited cameras are missed using the traditional passive set-up, and none of the cubs in the population are captured. Several cubs were captured on many different occasions at the baited camera-trap sites. This is an important demographic, and therefore result, as it indicates the health and stability of the leopard population, and may reflect and be affected by management decisions.

One collared male leopard was shot by trophy hunters during the course of the field work, and this provides important information on the effect of trophy hunting on leopard population demographics and behaviour, as the reactions from the leopards in nearby territories were monitored. An additional 2 collared leopards were killed by lions, and another by a leopard, indicating the importance and prevalence of intra-guild competition, and the need for solid data on this interaction so that management is able to make well informed decisions.

The data collected during the Darwin Initiative Leopard Project field work will be published as scientific papers in peer reviewed journals.

These will include papers on:

- A comparison between baited and passive camera-trapping methods
- Leopard ecology in the Bubye Valley Conservancy
- The effect of intra-guild competition on leopard behavioural ecology
- The effect of trophy hunting on leopard behavioural ecology
- Population management model

The leopard is a flagship species, but more importantly, it is an umbrella species. Leopards therefore have the ability to conserve other species by proxy. Researching relevant data on leopard behavioural ecology accurately is vital to sustainable management of the population, but also ensures conservation of a host of non-target species, as long as land and habitats are protected for trophy hunting of leopard. A reasonable regional hunting quota, based not only on abundance, but on the overall effect of removal at a population level, will ensure the long-term availability of leopards as a trophy species, and secure their future conservation status.

Results of the annual spoor transects and camera-trapping surveys were used to inform BVC management when setting trophy hunting quotas for lions and leopards. The lion quota was increased sustainably, and the leopard quota reduced based on the results of this research.

The results of this research were presented in Harare 2012, at a CITES Non-Detriment Finding workshop on leopard trophy hunting in Zimbabwe, during which a draft management plan for the future hunting off-take of leopards in Zimbabwe was formulated.

This study helped inform and shape several other local leopard research projects. We also planned and coordinated the National Leopard surveys, which is the first rigorous attempt to census Zimbabwe's leopard population.

Workshop and meetings

The project has organised several workshops involving key stakeholder groups and these have functioned to raise awareness of the need for improved management of the species and also provided opportunities for information exchange. Meetings undertaken are outlined in the section above and copies of workshop reports are provided.

Training and public outreach activities

Training was undertaken throughout the project, much of it as on the job practical training of ecological staff at ZPWMA stations in protected areas. In addition a formal training workshop was held and attended by ZPWMA research ecologists from across the country. Over the course of the project two Zimbabwean ZPWMA ecologists received post-graduate diplomas from Oxford University and one Zimbabwean is currently completing a DPhil. This training was all directly facilitated by the Darwin Initiative project. Posters aimed at increasing public awareness of leopards were widely distributed in the country as part of a public awareness campaign.

4.4 Project standard measures and publications

See table in Annex 4

4.5 Technical and Scientific achievements and co-operation

CITES Preliminary Non-detriment Finding (NDF) workshop

A key technical outcome of this work, largely resulting from attention to the issue of leopard sustainable use highlighted by ZPWMA, this project and other stakeholders (for instance Panthera Foundation), was a preliminary Non-detriment Finding workshop, held under the auspices of the CITES authority within Zimbabwe. The full report for this workshop accompanies this report and provides full details of the NDF process and workshop. This workshop was convened by PWMA and Panthera to bring together all stakeholders in leopard conservation and utilisation. The workshop, facilitated by Dr David Newton (head of TRAFFIC, southern Africa) brought together expertise from throughout the country. The radar chart (Figure 5) below summarises the findings of the workshop. Interpretation of the diagram suggests that points of information that fall far from the centre represent areas of uncertainty (and/or low confidence in the sustainability of harvest) that could result in a detriment finding by the CITES authority of the country. There was significant debate as to the real state of knowledge and consensus of the workshop was that a qualified or precautionary non-detriment finding be made, contingent on further management actions and research being carried out. The current CITES quota was to be continued for a further three years.

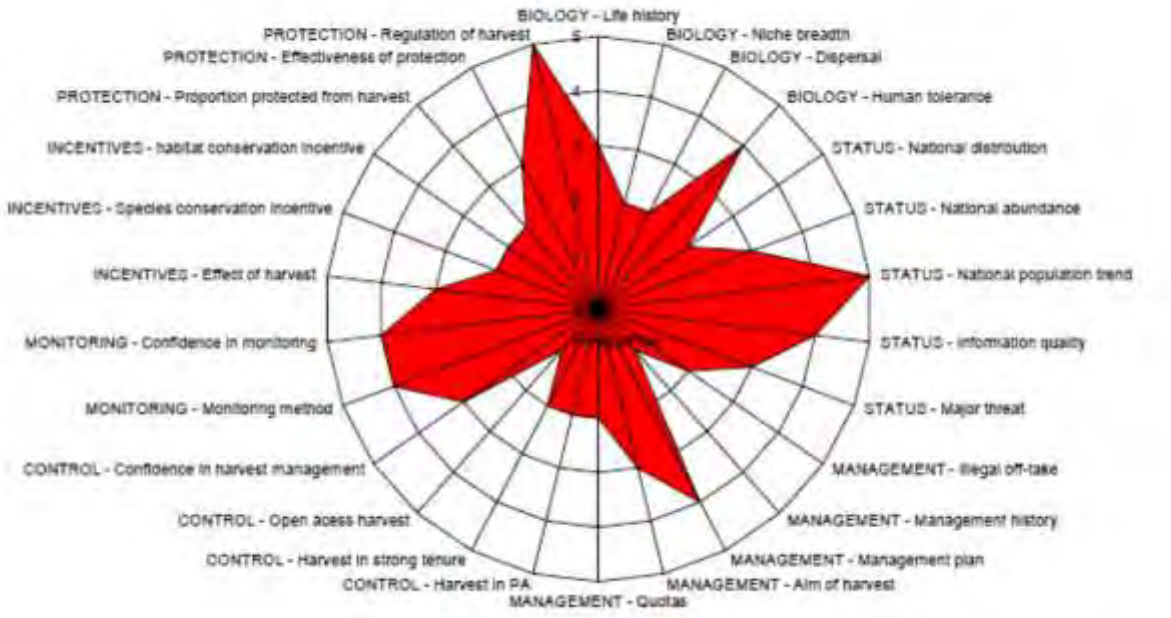


Figure 5: Radar chart showing the results of the NDF determination workshop (taken from NDF workshop report).

4.6 Capacity building

As outlined above the project undertook the following training activities

- Formal training of 21 ZPWMA / Forestry / Rural district council staff in survey methods. This was to enable local ecologists to undertake surveys in their areas of responsibility as part of the DI survey team and to continue with monitoring in future
- Practical on-the-job training provided to ZPWMA staff participating in surveys. Provision of this training ensures that staff on the ground are familiar with survey methods and are able to repeat baseline surveys in future
- Two ZPWMA ecologists (G. Mtare and E. Makuwe) received training at WildCRU, Oxford and qualified with Post-graduate diplomas (see www.wildcru.org/courses/diploma). Both ecologists have returned to Zimbabwe and are still employed within ZPWMA and are active in conservation management.
- A DPhil student (B. duPreez) is currently writing up a DPhil. Thesis at Oxford, having competed all the field data collection under the auspices of the project. Mr duPreez intends to return to Zimbabwe and contribute to Zimbabwean wildlife management and conservation

4.7 Sustainability and Legacy

In terms of legacy one of the key achievements of this DI project has been the baseline surveys for leopards and other carnivores in all the most important protected areas in Zimbabwe. This is the first wide-scale systematic survey of its kind. The surveys covered around 12% of the total area of the country and have provided baseline information for managers going forward. Should these surveys be repeated periodically by wildlife managers they will provide crucial trend data for many of the carnivore species in the country providing a basis for population trend assessment in future management. This will contribute to sustainability of wildlife resources in the country and be an outstanding legacy to the DI project. Further surveys, involving all the current project partners are planned for 2013, suggesting that project partners are likely to stay in touch and continue to work together. Project resources will continue to be used for their original purposes as part of ongoing research undertaken by WildCRU and continue to contribute to assessment of and research into sustainability and conservation of natural resources in Zimbabwe

Meetings and workshops organised and attended by the project have been important in bringing stakeholders together to discuss conservation and sustainable use of leopards in the country. Workshops (particularly the NDF process) have highlights gaps in knowledge and areas where the precautionary principle should be applied. It is hoped that attention drawn to the need for sustainable management of the species will have an influence on future management policy implemented by decision makers within the country's wildlife management authority.

5 Lessons learned, dissemination and communication

Throughout the project we have involved as many stakeholder groups as possible in dissemination of information. There has been a very enthusiastic response from other researchers in the country and many have contributed data to the project which has boosted the data available for analysis of factors influencing leopard distribution. ZPWMA ecologists have been included in training, planning and implementation of surveys and in all workshops. There is thus wide awareness of the DI leopard project in Zimbabwe. In addition project news has been posted on the Zambezi Society website (www.zamsoc.org). Talks on the project to stakeholder groups (such as professional hunting groups) have been given at suitable occasions and project partners are planning a final seminar presentation for mid 2013 to feedback the key results of the survey to Zambezi Society members and other stakeholders.

Scientific outputs of the project are in the process of being prepared. Data analysis from the detailed study and surveys is currently being undertaken and papers will be submitted for peer review during 2013.

Possibly the key lesson learned by the project is that changing management policy is a very slow process and three years is not enough to fully achieve this. However the project has highlighted the need for revision and reassessment of leopard management with Zimbabwe and this has been communicated to stakeholders and there is wide commitment within ZPWMA to achieving this.

5.1 Darwin identity

The Darwin project formed a distinct project (The Darwin Leopard Project) with a clear identity recognised by project partners and by other stakeholders within Zimbabwe. The Darwin Initiative for Biodiversity Logo was used on all project outputs and reports wherever possible. Logos were also used on project websites. There was recognition within the host country that the Darwin Initiative for Biodiversity funded much of the Darwin Leopard Project research and activities.

6 Monitoring and evaluation

Annex 1 has been completed and activities against project outputs and appropriateness of project indicators noted.

Output 1 was to undertake population surveys across Zimbabwe to ascertain leopard population distribution and abundance. Indicators of success were to complete surveys for leopards in at least 17 sites and to compile these data for analysis. 18 survey sites were completed and data compiled and presented to managers and ZPWMA decision makers at a workshop at the end of 2012.

Output 2 was to set up a detailed behavioural study of leopards to assess potential impacts of hunting and other important factors on leopard population dynamics. The study was undertaken at Bubye Valley conservancy from 2010 to 2012. As described above, this study successfully collared 18 leopards and undertook three camera trap surveys (providing demographic and population data). These data, once analysed, will contribute a better understanding of leopard population dynamics and the factors (including hunting) that affect leopard populations in protected areas. The data collected for this component of the project meet with the expected indicator of success put forward in the original log frame.

Output 3 was to compile data on past management from historical records, with the indicator success being a database of past management available to managers and policy makers to inform management of the species. We have compiled the hunting quota data for all out survey sites, but much information appears to be missing or unavailable from the official records and this highlights the need to overhaul record keeping within ZPWMA.

Output 4 was for a National management workshop. At the end of 2012 a National Non-detriment finding workshop was help for leopards. This workshop highlighted management needs for the species and came up with necessary activities to ensure sustainable management and better understanding of changing conservation needs of the species. This meeting was attended as far as possible by all identified stakeholders in leopard conservation (ZPWMA managers and ecologists, Conservation NGOs, independent research scientists and the hunting industry). It was originally envisaged that a more formal Management Strategy meeting would be held, however a stakeholder workshop held in 2011 identified that a CITES driven non-detriment finding workshop was crucial for ongoing leopard management and this largely subsumed and superseded the need for the management strategy meeting.

Output 5 was to organise workshops and meetings to facilitate regional collaboration of stakeholders and research scientists. These workshops were held and resulted in the wide and ongoing collaboration amongst stakeholders as well as identification of management needs such as the requirement for a non-detriment finding process to take place.

Output 6 aimed to provide opportunities for training of local field staff in survey techniques and to provide training to local ecologists and conservationists to facilitate ongoing management and conservation work in the country. Indicators were training provided for 25 field staff ,

opportunities sought for enrolment of local students in the WildCRU diploma course and training for a Zimbabwean DPhil. student and other field staff from partner institutions. A training course was held for field staff, two ZPWMA ecologists were enrolled, attended and passed the postgraduate diploma course and one Zimbabwean graduate student is currently completing a D.Phil. at Oxford. These appear to be suitable indicators of the success of the outputs for this component of the project.

The six monthly Darwin reporting schedule provided the project with the opportunity to evaluate progress as part of ongoing reporting. It was not felt that additional monitoring and evaluation was required in addition to this. There has been no external evaluation of this project.

6.1 Actions taken in response to annual report reviews

The last reviewer recommendation (May 2010) was that the Darwin project should be more fully reported on the host institution website, this recommendation was implemented. This was discussed with project partners. It was also suggested that a stakeholder analysis be undertaken. The project has considered carefully who may constitute stakeholder groups and attempts have been made to include all such in meetings and workshops.

6.2 Additional funds or in-kind contributions secured

- Toyota Zimbabwe provided a 4x4 vehicle for use on survey sites in the northern region of Zimbabwe
- Funds from the Recanati-Kaplan Trust were made available through WildCRU to purchase 30 additional camera traps for use in the field at the Bubye Valley Conservancy field site. This allowed the introduction of in depth passive camera trapping at the site and a comparison between baited and passive methods of camera trapping for leopards.
- Panthera (via PWMA and Roseline Chikerema-Mandisodza) funded and facilitated the CITES NDF workshop held in Harare in November 2012.

6.3 Value of DI funding

There is very little resourcing available for biodiversity conservation, field survey work or field studies and conservation work within Zimbabwe. Darwin funding was absolutely critical in making this project possible. It is inconceivable that this work could have been carried out to the extent that it has without the crucial support of DI funding. In addition, by covering core costs, the DI grant allowed the project to leverage additional funding and in kind assistance (outlined above) over the life of the project.

Annex 1 **Report of progress and achievements against final project logframe for the life of the project**

Project summary	Measurable Indicators	Progress and Achievements April 2007 - March 2008	Actions required/planned for next period
Goal: Effective contribution in support of the implementation of the objectives of the Convention on Biological Diversity (CBD), the Convention on Trade in Endangered Species (CITES), and the Convention on the Conservation of Migratory Species (CMS), as well as related targets set by countries rich in biodiversity but constrained in resources.			
Sub-Goal: Promote leopards as ecological flagships to reduce loss of biodiversity in whole ecosystems and as components of biodiversity to be sustainably used to generate revenue to benefit people.	Leopard populations are stabilised and increase, leopard habitats are conserved, providing protection for other components of biodiversity. Use of species is managed within sustainable limits.	• Non-detriment findings by National CITES Technical Committee submitted to CITES for the species • Future surveys show leopard habitats are better protected and leopard populations healthy	[redacted]
Purpose To collect ecological and management data to support a National Leopard Management Strategy and to build local and regional consensus to create and implement a conservation strategy to manage leopards and their habitats on a sustainable basis.	Increased understanding of the distribution, viability and previous management of leopard populations and improved motivation, capacity and tools to monitor and manage them.	This project collected both detailed behavioural (through GPS collars and camera trapping), abundance and distribution data (through population surveys) and compiled management information (from historical management records) on African leopards in Zimbabwe. This information has been used to inform reassessment of the management of the species. Training and capacity building has been undertaken to support future monitoring and research work.	
Output 1. National leopard survey provides knowledge of distribution, population viability and wider ecosystem that will inform national management.	Surveys of distribution and abundance of leopards and other mammals undertaken in 12 protected areas, 2 conservancies and 2-3 rural districts councils (years 1 and 2)	Population surveys were carried out in protected areas, safari areas, conservancies, forest land and communal land identified as key areas for leopard conservation. The indicator for this output was appropriate and suggests that the output was achieved by the project	
Activity 1.1 National leopard survey to determine leopard population size and distribution at ~17 sites across the country		Activity was undertaken and completed: 18 surveys were undertaken by the leopard project survey team.	
Activity 1.2, 1 Baseline survey data compiled. Results disseminated, reports to decision makers in management institutions, data inform quota allocation, CITES non-detriment findings		Activity was undertaken and completed and results of the surveys were compiled and presented to managers and decision makers at the workshop in December 2012. These results contribute to the CITES NDF	

		process.
Output 2. Impacts of trophy hunting on behavioural ecology and population viability recognised and incorporated into management during the life of the project and ultimately into policy through a National Management Strategy	Technical knowledge gained in years 1-3 by project scientists on the impacts of trophy hunting on behavioural ecology and viability of leopard populations, and put forward for inclusion in national planning, changes in management and policy	A detailed study of leopard behavioural ecology was undertaken over 3 years by DPhil. Student and project PI. The completion of this study is an indicator of the achievement of output 2. Valuable insights have been gained on behaviour of the species within a hunting area, including interactions with other competitors within the carnivore guild (which may have profound effects on leopard social and population dynamics).
Activity 2.1 Detailed ecological study to measure the demographic impacts of trophy hunting, undertaken at hunted and un-hunted study sites, results inform management strategy		Detailed study undertaken with 18 leopards radio-collared and 3 camera surveys completed (>150 000 photos of leopards taken). Results inform management at the conservancy and more widely.
Activity 2.2 Results disseminated, published in relevant peer reviewed journals, lessons inform management of leopards and setting of hunting quotas		The data collected by this study are currently being analysed as part of a DPhil. Thesis write-up. Data will be written up as 3-4 scientific papers and submitted for peer review.
Output 3. Trends in past management and utilisation identified and used to inform management during the life of the project and incorporated into the National Management Strategy	Database of historical leopard management and utilisation compiled by project staff by year two	Historical records of management leopard management were accessed and compiled where possible. Activity highlighted possible shortcomings in the current record system.
Activity 3.1 To inform future management, data on historical leopard hunting and management trends complied, database analysed for trends in quota allocation, trophy size, off-take		Where possible hunting quotas and off-takes have been compiled from historical management records. Quota data were compiled for all the survey sites in order to carry out analysis factors influencing leopard population size and distribution. Harvest data were unavailable, but are now being compiled.
Activity 3.2 Identify shortcomings of system and future management requirements. Propose solutions as part of National Strategy based on field/ historical data		A complete analysis of historical management data was not feasible as many records are missing or unavailable. Regional or locational analysis may however be possible and this is being explored.
Output 4. Sustainable management of leopard populations and leopard habitats implemented through National Leopard	National Leopard Management Strategy workshop held to devise strategy, in consultation with and attended by all stakeholders in year	Workshops were organised and attended by project staff, local conservationists, ZPWMA ecologists and managers and other stakeholders (eg hunting industry, local councils and conservation organisations). The final workshop contributed to a preliminary CITES non-detriment finding for leopards as well making significant management

Management Strategy	three	and conservation recommendations for future action. Given the urgent need (identified at a stakeholder and research workshop in 2011) for an NDF assessment a NDF meeting superseded the planned Management Strategy meeting.
Activity 4.1 Design a stakeholder driven National Leopard Management Strategy through participatory workshop		A participatory workshop (CITES NDF) organised and run by Roseline Chikerema-Mandisodza.
Activity 4.2 Approval sought by project partners from Minister for Environment & Tourism for National management strategy. Strategy endorsed		This activity has not been undertaken and it may have been over-ambitious to expect to achieve this within a three year project period as major policy change is relatively slow
Output 5. Improved regional collaboration and technical exchange between conservation managers and scientists in southern Africa	i) Regional technical and management meetings organised by the project (years 1 and 2). ii) Potential regional collaborations set up to enhance project impact	A number of meetings and workshops were held to facilitate exchange of information and technical knowledge between managers and research scientists. Significant collaboration between research scientists working on large carnivores was achieved and this has resulted in additional data being acquired for analysis (indicator i and ii). While some experts and scientists from beyond Zimbabwe attended workshops the project did not manage to include all experts from the wider region and this may have, in practice, been beyond the scope of what could be achieved (indicator ii).
Activity 5.1 Two Regional technical workshops, attended by regional and local scientists, conservationists and managers, organised. Knowledge transferred and collaborations established		Two meetings/ workshops organised and attended by stakeholders and scientists. Significant collaborations established and network of experts created that will have long lasting effects.
Activity 5.2 Workshops reports (2) complied, published and distributed to all stakeholders and workshop participants		Workshop reports compiled (see accompanying reports)
Output 6. Local conservationists monitor important components of biodiversity, using skills acquired during project, leading to improved monitoring of leopard trophy hunting off-takes and management of leopard populations and their habitats	i) 25 PWMA (field and administration staff), 5 RDC, 3 Forestry and hunting staff trained in monitoring of leopard populations, trophy hunting and survey methods ii) 2-4 Zimbabweans gain valuable training and experience on project, iii) 2-3 Zimbabwean graduates receive diplomas	Training was provided to ZPWMA, Forestry and RDC staff in survey techniques and followed up with field training where appropriate. Feild staff from WildCRU, Zamsoc and ZPWMA acquired experience of field survey techniques. Zimbabwean ecologists and conservationists receive training through a DPhil. Degree and Diploma courses. This training has increased the skills base within the ecology and conservation sector. Indicators of the success of Output 6 were appropriate.
Activity 6.1 Identify training needs, conduct field training exercises (surveys, radio-tracking, analysis of data), conduct in-house training programmes for administration staff		Training in survey techniques was identified as a key need. A training workshop was organised at Hwange Main Camp for 21 ZPWMA and Forestry ecologists. On the job training was provided by the survey team to local ecologists, managers and game scouts where ever possible.

Activity 6.2 Develop training manuals where needed (e.g., survey manual; quota allocation; trophy measurement protocols). Manuals used in conjunction with training sessions	A spoor survey manual was written and distributed as part of survey training provided by the DI project (see manual accompanying this report)
Activity 6.3 Identify host country personnel for Diploma training course	Two host country ZPWMA ecologist identified to attend the Oxford Diploma course and attendance facilitated by the DI project

Annex 2 **Project's final logframe, including criteria and indicators**

LOGICAL FRAMEWORK

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Goal: Effective contribution in support of the implementation of the objectives of the Convention on Biological Diversity (CBD), the Convention on Trade in Endangered Species (CITES), and the Convention on the Conservation of Migratory Species (CMS), as well as related targets set by countries rich in biodiversity but constrained in resources.			
Sub-Goal: Promote leopards as ecological flagships to reduce loss of biodiversity in whole ecosystems and as components of biodiversity to be sustainably used to generate revenue to benefit people.	Leopard populations are stabilised and increase, leopard habitats are conserved, providing protection for other components of biodiversity. Use of species is managed within sustainable limits.	• Non-detriment findings by National CITES Technical Committee submitted to CITES for the species • Future surveys show leopard habitats are better protected and leopard populations healthy	[redacted]
Purpose To collect ecological and management data to support a National Leopard Management Strategy and to build local and regional consensus to create and implement a conservation strategy to manage leopards and their habitats on a sustainable basis.	Increased understanding of the distribution, viability and previous management of leopard populations and improved motivation, capacity and tools to monitor and manage them.	• Survey data and technical information published as reports and peer reviewed papers, workshop reports published and disseminated • Information made publicly available to raise awareness • National Leopard Management Strategy published	• Ecological data collected through continuing collaboration of project partners • Workshops are attended by stakeholders and consensus reached on leopard management • Political motivation to protect and manage leopards as a sustainable resource is in place

Outputs 1. National leopard survey provides knowledge of distribution, population viability and wider ecosystem that will inform national management.	• Surveys of distribution and abundance of leopards and other mammals undertaken in 12 protected areas, 2 conservancies and 2-3 rural districts councils (years 1 and 2)	• Technical survey report published and made available to stakeholders • Information made available via websites and pamphlets • Peer reviewed papers submitted for publication	• Permissions remain in place to undertake surveys, collaboration between partners continues • Methods appropriate to survey leopards and suitable data collected and analysed
2. Impacts of trophy hunting on behavioural ecology and population viability recognised and incorporated into management during the life of the project and ultimately into policy through a National Management Strategy	• Technical knowledge gained in years 1-3 by project scientists on the impacts of trophy hunting on behavioural ecology and viability of leopard populations, and put forward for inclusion in national planning, changes in management and policy	• Technical reports made to PWMA yearly • Results and recommendations disseminated nationally and regionally through websites and printed material • Peer reviewed scientific papers submitted for publication	• Permissions remain in place to undertake research • Suitable and sufficient data collected using appropriate research tools • Data analysed and made available for use by managers
3. Trends in past management and utilisation identified and used to inform management during the life of the project and incorporated into the National Management Strategy	• Database of historical leopard management and utilisation compiled by project staff by year two	• Database available to managers • Reports disseminated to stakeholders and via project website • Peer reviewed papers submitted	• Data made available by stakeholders, RDCs, PWMA • Data effectively collated by project staff
4. Sustainable management of leopard populations and leopard habitats implemented through National Leopard Management Strategy	• National Leopard Management Strategy workshop held to devise strategy, in consultation with and attended by all stakeholders in year three	• Workshop reports prepared and disseminated • National Leopard Management Strategy disseminated to stakeholders, approved by Minister	• Co-operative relations established with all stakeholders • Stakeholders and resource managers willing to contribute to and adopt a management strategy
5. Improved regional collaboration and technical exchange between conservation managers and scientists in southern Africa	• Regional technical and management meetings organised by the project (years 1 and 2). • Potential regional collaborations set up to enhance project impact	• Two regional technical and management workshops facilitated, with scientists and managers invited from region • Workshop reports prepared and disseminated	• Regional scientists willing and motivated to collaborate with the project • Scope exists for regional collaboration

6. Local conservationists monitor important components of biodiversity, using skills acquired during project, leading to improved monitoring of leopard trophy hunting off-takes and management of leopard populations and their habitats	• 25 PWMA (field and administration staff), 5 RDC, 3 Forestry and hunting staff trained in monitoring of leopard populations, trophy hunting and survey methods • 2-4 Zimbabweans gain valuable training and experience on project, 2-3 Zimbabwean graduates receive diplomas	• Annual reports to PWMA • Annual project reports • Pre-survey training sessions at all 17 sites to be included as part of national survey	• Staff motivated to learn and apply new skills • Staff continue to be supported by PWMA and RDCs in conducting monitoring and management activities • Most project trained staff remain in conservation organisations • Entry requirements met by applicants for diploma course

Activities (details in workplan)

1.1 National leopard survey to determine leopard population size and distribution at ~17 sites across the country

1.2 Baseline survey data compiled. Results disseminated, reports to decision makers in management institutions, data inform quota allocation, CITES non-detriment findings

2.1 Detailed ecological study to measure the demographic impacts of trophy hunting, undertaken at hunted and un-hunted study sites, results inform management strategy

2.2 Results disseminated, published in relevant peer reviewed journals, lessons inform management of leopards and setting of hunting quotas

3.1 To inform future management, data on historical leopard hunting and management trends complied, database analysed for trends in quota allocation, trophy size, off-take 3.2 Identify shortcomings of system and future management requirements. Propose solutions as part of National Strategy based on field/ historical data

4.1 Design a stakeholder driven National Leopard Management Strategy through participatory workshop

4.2 Approval sought by project partners from Minister for Environment & Tourism for National management strategy. Strategy endorsed

5.1 Two Regional technical workshops, attended by regional and local scientists, conservationists and managers, organised. Knowledge transferred and collaborations established

5.2 Workshops reports (2) complied, published and distributed to all stakeholders and workshop participants

6.1 Identify training needs, conduct field training exercises (surveys, radio-tracking, analysis of data), conduct in-house training programmes for administration staff

6.2 Develop training manuals where needed (e.g., survey manual; quota allocation; trophy measurement protocols). Manuals used in conjunction with training sessions

6.3 Identify host country personnel for Diploma training course

Monitoring activities:

Indicator 1: Robust data available via monitoring data (collected by project-trained staff and with project protocols) to show that leopard off-take is demonstrably sustainable and allowing annual report, based on scientific evidence, to be made to CITES, by the CITES technical committee

Indicator 2: Leopard utilisation sustainable and populations stable (indicated by comparison of future surveys against baseline data collected by project) leading to habitat protection and improved benefits generated for stakeholders and communities

Annex 3 **Project contribution to Articles under the CBD**

Project Contribution to Articles under the Convention on Biological Diversity

Article No./Title	Project %	Article Description
6. General Measures for Conservation & Sustainable Use	5	Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring	30	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
8. In-situ Conservation	30	Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
9. Ex-situ Conservation		Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity	20	Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures		Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	10	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
13. Public Education and Awareness	5	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
14. Impact Assessment and Minimizing Adverse Impacts		Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
15. Access to Genetic Resources		Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.

Article No./Title	Project %	Article Description
16. Access to and Transfer of Technology		Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
17. Exchange of Information		Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol		Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Other Contribution		Smaller contributions (eg of 5%) or less should be summed and included here.
Total %	100%	Check % = total 100

Annex 4 **Standard Measures**

Code	Description	Totals (plus additional detail as required)
Training Measures		
1a	Number of people to submit PhD thesis	1 (to be submitted in later 2013)
1b	Number of PhD qualifications obtained	
2	Number of Masters qualifications obtained	
3	Number of other qualifications obtained	2 (post-graduate diplomas)
4a	Number of undergraduate students receiving training	
4b	Number of training weeks provided to undergraduate students	
4c	Number of postgraduate students receiving training (not 1-3 above)	
4d	Number of training weeks for postgraduate students	50 (2 x students at conservation in practice diploma course, attendance facilitated by project)
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification(ie not categories 1-4 above)	
6a	Number of people receiving other forms of short-term education/training (ie not categories 1-5 above)	21 attend survey training
6b	Number of training weeks not leading to formal qualification	
7	Number of types of training materials produced for use by host country(s)	1 (Spoor survey manual)
Research Measures		
8	Number of weeks spent by UK project staff on project work in host country(s)	25
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	
10	Number of formal documents produced to assist work related to species identification, classification and recording.	
11a	Number of papers published or accepted for publication in peer reviewed journals	
11b	Number of papers published or accepted for publication elsewhere	
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	3 (survey databases, camera trap database and trophy hunting/ quota database)

Code	Description	Totals (plus additional detail as required)
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	
13a	Number of species reference collections established and handed over to host country(s)	
13b	Number of species reference collections enhanced and handed over to host country(s)	
Dissemination Measures		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	2
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	2
15a	Number of national press releases or publicity articles in host country(s)	
15b	Number of local press releases or publicity articles in host country(s)	
15c	Number of national press releases or publicity articles in UK	
15d	Number of local press releases or publicity articles in UK	
16a	Number of issues of newsletters produced in the host country(s)	3
16b	Estimated circulation of each newsletter in the host country(s)	
16c	Estimated circulation of each newsletter in the UK	
17a	Number of dissemination networks established	
17b	Number of dissemination networks enhanced or extended	
18a	Number of national TV programmes/features in host country(s)	
18b	Number of national TV programme/features in the UK	
18c	Number of local TV programme/features in host country	
18d	Number of local TV programme features in the UK	
19a	Number of national radio interviews/features in host country(s)	1 (ZPWMA public relations office)
19b	Number of national radio interviews/features in the UK	
19c	Number of local radio interviews/features in host country (s)	

Code	Description	Totals (plus additional detail as required)
19d	Number of local radio interviews/features in the UK	
Physical Measures		
20	Estimated value (£s) of physical assets handed over to host country(s)	£10 000 (project assets still in use in the fieldwork or used by other field projects)
21	Number of permanent educational/training/research facilities or organisation established	
22	Number of permanent field plots established	18 (survey sites)
23	Value of additional resources raised for project	
Other Measures used by the project and not currently including in DI standard measures		
	Papers planned for publication in 2013/14	5

Annex 5 Publications

Type * (eg journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Report	Preliminary Non-detriment finding assessment	PWMA/ Panthera		Nil
Survey Report (*)	duPreez, B, Groom, R., Mundy, M and Loveridge, A. 2010. Results of the Bubye Valley Conservancy Spoor Survey 2010	Unpublished	andrew.loveridge@zoo.ox.ac.uk	Nil
Poster	Leopard awareness poster	ZAMSOC	http://zamsoc.david.co.zw/	Nil

Annex 6 **Darwin Contacts**

Ref No	DAR17-031
Project Title	Ecological sustainability of leopard trophy hunting in Zimbabwe
UK Leader Details	
Name	Dr Andrew Loveridge
Role within Darwin Project	Project Principle Investigator
Address	WildCRU, Department of Zoology, Recanati-Kaplan Centre, Tubney House, Tubney OX13 5QL
Phone	00 44 1865 611115
Fax	00 44 1865 611101
Email	andrew.loveridge@zoo.ox.ac.uk
Other UK Contact (if relevant)	
Name	Mr Byron duPreez
Role within Darwin Project	D.Phil. Student and field co-ordinator Bubye Leopard Project
Address	WildCRU, Department of Zoology, Recanati-Kaplan Centre, Tubney House, Tubney OX13 5QL
Phone	00 44 1865 611100
Fax	00 44 1865 611101
Email	byron.dupreez@jesus.ox.ac.uk
Partner 1	
Name	Mr Peter Musto
Organisation	Zambezi Society
Role within Darwin Project	Zamsoc Project's Officer
Address	
Fax	nil
Email	pmusto@gmail.com
Partner 2 (if relevant)	
Name	Mrs Roseline Chikerema-Mandisodza
Organisation	Zimbabwe Parks and Wildlife Management Authority
Role within Darwin Project	Project Co-ordinator
Address	PO Box CY140, Causeway, Harare, Zimbabwe
Fax	
Email	mandisodzar@gmail.com

MANA POOLS NATIONAL PARK PREDATOR SURVEY

July – October 2015

J. L. Seymour-Smith and A. J. Loveridge

Background

Park management requires accurate estimates of wildlife populations and population trends in order to make appropriate management decisions. Several methods are available ranging from aerial surveys (best for large easily observable species such as elephant and hippo) and sighted line transects (best for large diurnal species). Methods such as camera trapping and spoor surveys provide good estimates of carnivores and smaller less easily observed nocturnal mammal species. These methods are repeatable over time and can provide robust estimates of population trends. If multiple methods are used simultaneously (e.g. camera trapping and spoor transects) then cheaper more easily applied methods can be calibrated for accuracy.

Both lion and leopard are species for which more information is required and surveys are recommended actions in the 'Conservation Strategy and Action Plan for the Lion in Zimbabwe' (PWMAZ 2006) and the 'Preliminary Non-detriment finding assessment for leopards in Zimbabwe' (Lindsey and Chikerema-Mandisodza 2012) respectively for these species. The population sizes, distribution and co-occurrence with other carnivores and mammalian species is critical for long term management. The conservation value of the specially protected cheetah is acknowledged in a national conservation action plan. One of the main objectives within this plan is 'to improve the knowledge and expand research on the conservation biology of cheetah across Zimbabwe'. Based on their

questionnaire based field survey, the Cheetah Conservation Project Zimbabwe (CCPZ), currently estimates the cheetah population in Mana Pools to consist of 10-15 adult cheetah (see annual report CCPZ 2013). Ideally, this estimate would be supported by sightings and pictures received from the area. However, cheetah sightings and pictures from Mana Pools are scarce. Cheetah's have unique coat markings, which allows for the identification of individuals from pictures. Here we provide a report on predator a population survey undertaken between July and October 2015 in Mana Pools National Park (MPNP). This survey was a collaboration between WildCRU / Hwange Lion Research, Cheetah Conservation Project of Zimbabwe, Painted Dog Conservation, The Zambezi Society and Zimbabwe Parks and Wildlife Management.

Objectives

1) To undertake park wide surveys to estimate population density, distribution and habitat occupancy of common predator species in Mana Pools National Park.
2) To contribute to Cheetah Conservation Project Zimbabwe's (CCPZ) cheetah monitoring protocol.
3) To provide presence/absence data on all the larger mammal species.

METHODS

Camera Trap Survey

A pre-planned grid of camera traps was set up covering the national park from the Zambesi River in the North to the foothills of the escarpment in the South. The traps were approximately 4-5kms apart as this appears optimal for effective detection of large and medium sized carnivores and allows comparison with surveys undertaken by the team elsewhere in Zimbabwe. For logistical reasons the survey was conducted as two separate sub-surveys, North and South, with all the data being combined for the subsequent analysis. For statistical purposes and comparability between surveys each sub-survey (41 traps) was run for at least 40 days after the completion of the set-up process. At the end of the 40 day period the traps were removed in the same time frame and order in which they were deployed – as a result each trap was up for at least 48 days.

The basic grid was manipulated so that the position of as high a proportion as possible of the traps coincided with roads and tracks to provide easy access to the trap sites during the survey and also to ensure that subsequent monitoring was easier and more time effective. Prior to the setting up the trap positions are examined on Google Earth and the trap position optimised within a 500m radius of the selected point to maximize the captures of animals, positions along game trails and where trails cross the tracks, etc.

A camera trap station consists of two cameras, approximately six metres apart, facing each other though slightly off-set from one another to limit interference from the flash at night. The cameras were attached mostly to metal fencing standards hammered into the ground and where a suitable tree or stump was available they were strapped to it, all at approximately 60cms above ground level. The cameras and the metal stands were then covered with logs and branches so that they blended in to the background as much as possible, while the area between the cameras was cleared of any obstructions and the tall grass removed. It is important that there is nothing in or near the "capture zone" of each camera that may move in the wind as this will trigger the camera resulting in many unwanted images and the draining the cameras batteries.



Trap covering a road / path crossing



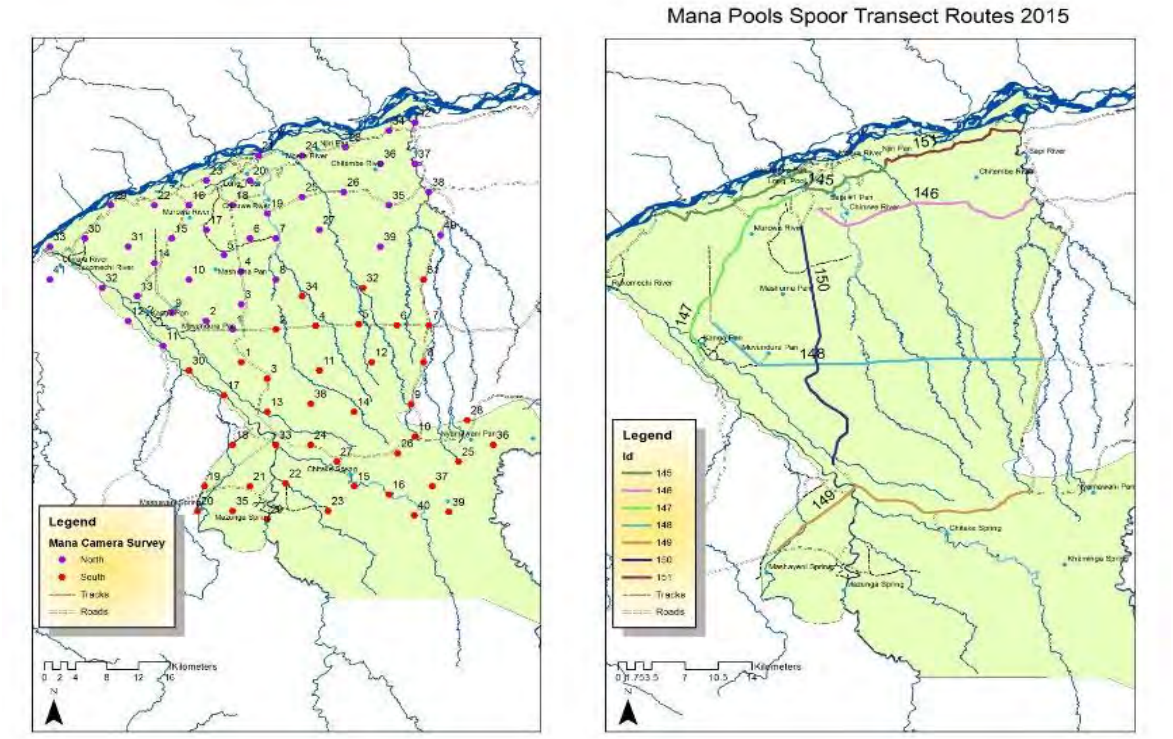
Trap covering intersecting paths

Once the cameras were set up the details of each camera, model, number and SD card, where applicable, were recorded so that it is known which images originate from which SD card or USB

download for each camera and therefore each trap. It is essential that this detailed recording of the origin of all the data images is done so that the "mark recapture" analysis can be undertaken to provide estimates of the population densities.

In the survey five different models of camera were used. Hwange Lion Research provided three different models of Cuddeback cameras (Models 1125, 1149 and C23) as well as some older Panthera cameras while the Cheetah Conservation Project of Zimbabwe and Painted Dog Conservation provided Stealthcam G42NG cameras. All the Cuddeback and Panthera cameras used standard "white or colour" flash for the night images while the Stealthcam cameras used the lower intensity "black" flash – this resulted in some images taken at night with the Stealthcams being "blurred" making the identification of individual animals more difficult. All the Cuddeback cameras were housed in protective metal boxes, primarily to protect them from the attentions of elephants and hyaena.

All the cameras are triggered by a motion sensor when an animal moves across the cleared "capture zone". The recycle interval for all the cameras used on the survey was 30secs, this being standardized as it is the fastest time that the older model Cuddeback cameras can recycle.



Maps of MPNP showing the position of camera stations (left) and spoor transect routes (right).

Spoor Transect Survey

Spoor transects are a standard method used for surveys of large carnivores. These involve a vehicle driven slowly (< 10kms/hr) along the designated transect road with a skilled National Parks tracker seated on the front of the vehicle while the driver or another person acts as the recorder of the data. From spoor encountered along the road the number of animals and the species, with the co-ordinates and distance from the beginning of the transect are recorded. Only spoor of not more than 24 hrs in age is recorded. In the case of lion and leopard the size of the tracks is measured for possible future analysis. Estimates of population densities, where there are sufficient recordings for each species, can then be calculated from this data using standard protocols (Funston et al. 2010).

The seven road transects used were a repeat of those that had been done on previous surveys in 2006 and 2011, these transects total 196 kms. Together they are considered to be representative of all the

major habitat types within the national park. Each transect was driven three times. This survey was conducted during the Camera Trap Survey so that the spoor survey results can be verified and possibly be recalibrated using simultaneously collected population estimates derived from an independent survey method. With the density of animals present it became practical to split Transect 145 and do it over two days, this resulted in each round of the survey taking eight days.

Additional Sightings

To try and improve the robustness of the camera trap survey it was decided to encourage the participation of the visitors and guides working in the national park. Posters were displayed in the Nat Parks offices at Nyamepi, Nyakasikana Gate and at Marongora showing what was required as well as a basic "business card" being distributed to members of the public within MPNP.

A Facebook page was also created for the survey that was regularly updated on the progress of the survey (Facebook.com/Mana Pools Survey 2015).

The information requested –

- Reasonable quality images of any of the five large predators seen. Only if images were taken then the following further details were then needed -
    - Date and time of the sighting
    - Basic details of the group size and composition
    - GPS co-ordinates or accurate description of the position

The above data could then be forwarded to the survey either using the Facebook page or by email using the gmail address set up for the duration of the survey. Details of the sightings where the individuals can be recognized are the fed into the Camera Trap Survey analysis – these extra data points then help improve the robustness of the survey.

RESULTS

Camera Trap Survey

A total of 30 319 data images were captured during the whole survey. The breakdown of the number of images and number of identified individuals for the large predators is as follows : -

Table 1: The total number of images capture for the main five large carnivore species and the number of individuals identified from camera trap images

Species	Images Captured	Individuals identified
Lion	267	67
Leopard	376	Not yet analysed
Cheetah	2	1
Wild Dog	191	51 (to be confirmed)
Spotted Hyaena	2969	Not yet analysed

During the survey five cameras were bitten by hyeana, five damaged to varying degrees by elephant, two destroyed by a bushfire, two removed by elephant and not found and one assumed to have been removed by poachers.



Wild Dog pups near the escarpment



Adult Cheetah near the Zambesi

Spoor Transects

Table 2: showing the number of spoor encounters and density estimates for the five main large carnivores

Species	Spoor Encounters	Estimate of Density/100kms²	Estimated numbers in MPNP
Lion	91	4.5	94
Leopard	51	2.5	55
Cheetah	4	Insufficient data	
Wild Dog	72	Calibration required	
Spotted Hyeana	746	Calibration required	

Lion and Leopard

The number estimated in the national park using the spoor transects is the same as that estimated using additional sightings / photographs / tour operator records, including the peripheral prides. If the peripheral prides are removed the number is 84. The density from the spoor transects is very similar to that of the 2011 survey.



Male lion in the centre of the Nat Park



Female leopard close to the Rukomechi River

Further analysis

Further technical analysis of the data collected in this survey is anticipated. For the main predator species, this will involve identification of individual animals from each camera trap station for each data of the survey and *ad hoc* photographs from researcher, guide and tourist sightings (for which there is accurate location data). The resulting data matrix will be analysed in a Spatially Explicit –Mark-Recapture analysis package (SPACECAP and/or SECR) which allows population density estimates to be derived along with confidence intervals (Gopalaswamy et al. 2012). It will be possible to analyse lion, leopard, spotted hyaena and wild-dog data in this way. There were insufficient cheetah and brown hyaena images captured to allow robust analysis using this method. These estimates will provide robust baseline population estimates for the park.

Additional Sightings

The participation of the public and guides was most disappointing. Only one image was forwarded to the Facebook page, this was not even of one of the large predators. There were eight emails from seven individuals, with 17 images attached, all from people personally known to the researcher-in-charge of the survey.

The researcher-in-charge provided 236 images while other interested parties provided another 157 images. All these additional sightings also assist with the identification of the individual large predators for the Camera Trap Survey.

SPECIES DETECTION

The following species were recorded on the Camera Trap Survey –

Lion	Elephant	Eland	Aardvark	Ground Hornbill
Leopard	Hippo	Kudu	Porcupine	Helmeted Guineafowl
Cheetah	Buffalo	Waterbuck	Chacma Baboon	Crested Guineafowl
Wild Dog	Zebra	Nyala	Vervet Monkey	Swainson's Spurfowl
Spotted Hyeana	Warthog	Impala	Ratel	Double-banded Sandgrouse
Brown Hyeana	Bushpig	Bushbuck	Civet	Red-billed Hornbill
Caracal	Scrub Hare	Grey Duiker	Genet	Yellow-billed Hornbill
Serval		Sharpe's Grysbok	White-tailed Mongoose	Meves' Starling
Wildcat			Bushy-tailed Mongoose	Bats
Side-striped Jackal			Banded Mongoose	
Black-backed Jackal			Slender Mongoose	

CAPTURES OF INTEREST

The capture of Brown hyaena (4 images) in two traps in the foothills of the escarpment and Black-backed Jackal (6 images) in the central areas of the national park are of considerable interest. This is further proof of the spreading of these two species in to the Lower Zambesi Valley, an area from which they have historically been absent.

Bushy-tailed mongoose were captured in five traps indicating a good representation of the species even though it is near the limits of its geographical range.



Brown Hyeana in “black” flash



Black-backed Jackal in colour



Bushy-tailed Mongoose in “black” flash





Porcupine | Wildcat carrying prey | Cararcal

FIELD PERSONNEL

The following people were involved in doing the surveys -

Camera Trap Survey

- WildCRU Justin Seymour-Smith Andrea Sibanda
- National Parks Ranger Samson Siakanoka

Spoor Transect Survey

- Cheetah Conservation Esther van der Meer Hans Dullemont
- ZamSoc Pete Musto Andy Wilkinson
- WildCRU Jane Hunt
- National Parks Ranger Bowers Edmond Zvenyika

We wish to thank the Area Manager, and his staff, for all their assistance and hospitality for the duration of the survey.

References

Funston, P.J., Frank, L., Stephens, T., et al., 2010. Substrate and species constraints on the use of track incidences to estimate African large carnivore abundance. Journal of Zoology 281, 56-65.

Gopalaswamy, A.M., Royle, A.J., Hines, J.E., et al., 2012. Program SPACECAP@ software for estimating animal density using spatially explicit capture-recapture models. Methods in Ecology and Evolution 3, 1067-1072.

Lindsey, P.A., Chikerema-Mandisodza, R., 2012. Preliminary Non-Detriment Finding Assessment:Preliminary report for leopards in Zimbabwe, p. 27. Parks and Wildlife Management Authority, Zimbabwe and Panthera, Harare, December 2012.

PWMAZ, 2006. Conservation Strategy and Action Plan for the lion (*Panthera leo*) in Zimbabwe, p. 21. Ministry of Environment and Tourism, Zimbabwe, Harare.

THE ETHICS AND COORDINATION COMMITTEE FOR ETHICAL AND SUSTAINABLE SAFARI HUNTING IN ZIMBABWE

POSITION STATEMENT

THE ROLE OF HUNTING IN BIODIVERSITY CONSERVATION AND LIVELIHOOD RESILIENCE IN ZIMBABWE

Dr CHAP MASTERSON (Editor)



Figure 1: The true face and harsh reality of conservation in Africa.

Here an old widow of the Mahenye Community in SE Zimbabwe lives and sleeps in a makeshift shelter throughout the rainy season to protect her meagre crops from raiding elephant from the adjacent Gonarezhou National Park.

The reality of living and coping with dangerous wildlife in Africa is far removed from idealised concepts of conservation in the developed world. Without financial incentive to conserve elephant and other wildlife it would make life far easier & livelihoods more secure for communities to simply eradicate wildlife.

Safari hunting demonstrably remains the single largest source of funding for wildlife-based land use and Community Based Natural Resource Management (CBNRM) in Zimbabwe – providing financial incentive to conserve. Would a ban on elephant hunting help to conserve elephants in these areas? On the contrary, without an alternative financial pay-back it would most certainly be detrimental to conservation of elephants and biodiversity at large.

i. EXECUTIVE SUMMARY

Safari hunting remains by far the highest earner of revenue directly sustaining biodiversity conservation and wildlife-based land use in Zimbabwe – be it under communal, private or state tenure. Hunting revenues not only incentivise and pay for wildlife as a primary land-use option on private and communal land, but so too, in the face of ever mounting pressure for land, does it stave off political and social pressure to de-gazette protected areas (PA's) on state land.

In the absence of alternative revenue streams for conservation and without substantial increase in provision of funding and technical support to rectify regulatory and conservation concerns, unilateral trade bans that are not time-limited or from which there is no realistic chance of reprieve are bound to be unambiguously detrimental to iconic species and biodiversity conservation in Zimbabwe.

The single largest threat to wildlife and biodiversity conservation remains habitat loss through human encroachment. Human encroachment and impact on wildlife areas will continue so long as the following equation holds true:



Well-regulated safari hunting at less than 0.75% for elephant and >2% of populations of most other species is scientifically proven to be non-detrimental to wildlife populations and moreover provides revenue and incentive for active management and conservation of the resource base.

The total area under wildlife based land use and conservation in Zimbabwe amounts to some 10.7 Million hectares – or an area larger in extent than Portugal – and representing some 27% of the total surface area of the country (ca. 390,000 km^2). Of this, some 7.9 Million hectares, or 75% of all conservation land in the country, falls under safari hunting as the primary or only source of revenue. The vast majority of this land occurs in arid agro-ecological regions unsuitable for agricultural use.

Whereas the authors fully acknowledge that safari hunting in Zimbabwe has some very real and serious problems which certainly need urgent redress, it is also true that all respondents having input to this document, including all of the non-consumptive ecotourism operators who are ordinarily rather critical of hunting, were unanimous and unequivocal in their opinion that the major outcome of sudden prohibition of trophy hunting in Zimbabwe will be wholesale loss of biodiversity and wilderness as hunting land is converted to alternative land uses – predominantly slash-and-burn agriculture and livestock husbandry – with concomitant loss of wildlife, habitat, protected area (PA) connectivity and eco-services.

Under the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), communities in Zimbabwe are able to benefit from natural resources and wildlife under their stewardship and resident on their land. The advent of CAMPFIRE was revolutionary in converting the value of wildlife from a direct commodity-based value, measured in kilograms of bush-meat or in terms of livelihood impact and danger factor, to a much greater financial value derived from sustainable utilisation and safari hunting. This changed perceptions and converted poaching communities into wildlife custodians and although the system is reliant on a small lethal harvest, its overall effect is to the betterment of wildlife conservation and wild-lands at large. Removal of this financial incentive to conserve and, moreover, their ability and right to manage their own resources, will not so much reduce their commitment to conservation, but will in fact necessitate impoverished communities to convert from wildlife to other land uses detrimental to the environment and conservation.

Communities that are not benefiting collectively from sustainable utilisation of wildlife are also not incentivised to counteract or abstain from poaching or to resist approaches from international wildlife trafficking (IWT) syndicates – to the detriment of wildlife as well as community security & resilience.

On private land hunting has also proved to be a valuable conservation tool. Bubye Valley Conservancy – funded entirely by hunting - has the largest population of wild lion and the largest population of endangered Black Rhino on private land anywhere in the world. In fact, 3 of the last 10 IUCN Key 1 Populations of Black Rhino remaining in Africa are to be found on private hunting conservancies in Zimbabwe.

Over-and-above financial factors, the real cost and danger of living with wildlife are also major factors influencing community disposition to wildlife and when communities come into direct conflict with wildlife it is the wildlife that will suffer. Revenues generated from safari hunting provide incentives for increased tolerance of wildlife that presents a direct danger to human life and livestock or is otherwise problematic.

Biodiversity conservation is drastically underfunded in Zimbabwe. Non-consumptive ecotourism is in the doldrums through a combination of intractable contributing factors - ranging from the global recession and downturn in tourism through to poor international perception and desirability of Zimbabwe as a tourist destination – compounded by a severely depressed local economy, decaying infrastructure and diminished road and air-travel access. The industry operates at well below 50% occupancy based on current beds available and there is not a single working and sustainable example of a community-owned non-hunting tourism venture catering to international clientele in the country.

Donor funding in support of conservation in Zimbabwe remains very low. Even the 11.5 Million €uro allocated to Environment under the 11th EDF over the next 5 years – although most vital and most appreciated – amounts to just 50% of the annual budget of the Zimbabwe Parks and Wildlife Authority (ZPWMA) administering just 25% of conservation land in the country.

ZPWMA has an operating budget of around US$20 Million per annum with around 50% of annual income being derived either directly or indirectly from hunting – through permits and fees. It is estimated that the remaining conservation areas in the country would require at least as much again in order to truly meet their conservation and community development objectives. It is unrealistic to believe that these budgets could be sustainably met through donations and neither can they be subsidized by other industries which themselves are disintegrating under the burden of escalating costs and diminishing returns. Where then is this money to be found if not through well-regulated sustainable-use of the very resource we are trying to conserve?

Notwithstanding the above, in many cases, hunting is not able to fully cover costs of anti-poaching and wildlife management as a stand-alone, but it nevertheless remains a key component of sustainable revenue generation for wildlife-based land use. It is therefore imperative that wildlife-based land use is diversified to create parallel and sustainable revenue streams from eco-tourism, non-timber forest products (NTFP's) and Payments for Eco-Services (PES).

Good governance, science-based adaptive management and regulation are key to sustainable resource management. Whereas blanket bans affect both good and bad hunting practices and undermine benefits to both conservation and livelihoods (1), conditional, time-limited bans targeting specific problems and accompanied by support for practical reform are more effective in achieving positive conservation and regulatory outcomes.

Rather than instigating counterproductive unilateral bans from afar, it is incumbent upon true conservationists and the developed world to assist conservation authorities, communities, NGOs and private sector partners to re-build technical, regulatory, scientific and administrative capacity to enable developing countries to conform to minimum standards of non-detriment, science-based conservation and accountability in accordance with best international hunting and conservation practice. Moreover, this has to be inclusive of as broad an array of stakeholders as possible and must be addressed with the utmost urgency.

Finally, it was the European Colonists who dispossessed native Africans of their stewardship and ownership rights over their natural resources before coming to the realisation that these very communities were in fact the most effective custodians and protectors of wildlife. Will it now be the Europeans who once again decide the interplay of Africa's people and her rich wildlife heritage?

ii. DESCRIPTION OF THE ETHICS AND COORDINATION COMMITTEE FOR ETHICAL AND SUSTAINABLE SAFARI HUNTING IN ZIMBABWE

On 21-22 June 2015 a National Hunting Stakeholders Review and Reform Workshop was held in Harare, Zimbabwe. This workshop was co-hosted by the Zimbabwe Parks and Wildlife Management Authority (ZPWMA), the Safari Operators Association of Zimbabwe (SOAZ) and the Zimbabwe Professional Hunters and Guides Association (ZPHGA) in recognition of the need to address key challenges to the financial and ecological sustainability, ethics, regulation, management and reputation of the hunting industry in the country.

The workshop was attended by a broad array of conservation and hunting stakeholders, regulators, community representatives, hunters, non-consumptive tourism operators, NGOs, academics and consultants.

The major recommendations and outputs of the workshop are contained in the workshop output document presented as an addendum hereto. One of the key recommendations was the formation of an Ethics and Coordination Committee (ECC) (or "Steering Committee") for Ethical and Sustainable Hunting in Zimbabwe, comprising representatives of the following organisations:

- Zimbabwe Parks and Wildlife Management Authority (ZPWMA)
- The National Council of Chiefs was included in the ECC at the suggestion of the Minister of Environment Water and Climate (MEWC), Hon. O.C.Z. Machinguri and underlined by a presentation by Senator Chief Charumbira at the stakeholders' workshop on 11 April 2016.
- The CAMPFIRE Association
- Safari Operators Association of Zimbabwe (SOAZ)
- Zimbabwe Professional Hunters and Guides Association (ZPHGA)
- Zimbabwe Hunters Association (ZHA)
- Zimbabwe Tourism Authority (ZTA)
- Wildlife Producers Association (WPA)
- Co-opted consultants, NGOs and academics

According to the recommendations of the Workshop Output Document, the specific terms of reference of the ECC is to develop and to *"preside over compliance to the Code of Conduct by [hunting] operators" … "and to assist with coordinating other functions of the industry, such as data collection and management; reporting; adaptive participatory quota setting; funding & fund-raising; public relations; advocacy; group marketing; etc*."

iii. MOTIVATION AND CONSULTATION FOR THIS POSITION STATEMENT

This position statement is intended as a primary response to the recent motion brought to the EU parliament to restrict import of trophies into the European Union – which, although of a non-technical nature and lacking substantive legal basis during initial phases, if implemented will nonetheless impact heavily on the safari industry, conservation authorities, communities and other conservation stakeholders in Zimbabwe.

More recently it has been learned that the European Environment Commission (EEC) intends to table a technical proposal at CITES 2016 calling for review of Leopard quotas and for Non-Detriment Findings for all Appendix I and II species and specimens intended for export. Although this statement sets out the principle position of the Ethics and Coordination Committee for Ethical Sustainable Hunting in Zimbabwe, greater technical detail will be required to answer such proposals to CITES as well as to formulate tools to gather and process information required for Non-Detriment Findings.

The statement has been drafted as an output of the Ethics and Coordination Committee for Ethical and Sustainable Safari Hunting in Zimbabwe including feedback from as broad a consultation process within all sectors of the conservation fraternity as possible given the very short notice of the motion under consideration.

Following initial invitation for inputs from stakeholders the first draft was re-circulated for comment and the second draft was the subject of a workshop convened by the Minister of Environment Hon. O.C.Z. Machinguri on 11 April 2016 – to provide further comments and consultation with stakeholders.

TABLE OF CONTENTS

THE ETHICS AND COORDINATION COMMITTEE FOR ETHICAL AND SUSTAINABLE SAFARI HUNTING IN ZIMBABWE 1

1. INTRODUCTION 8

2. ONGOING INITIATIVES FOR THE REVIEW AND REFORM OF CONSERVATION, HUNTING AND COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT IN ZIMBABWE 9

2.1. Stakeholder Workshop for the Review and Reform of the Safari Hunting Industry in Zimbabwe 9

2.2. CAMPFIRE Stakeholders Review 9

2.3. Other recent or ongoing initiatives 10

3. INTERNATIONAL RECOGNITION OF HUNTING AS A CONSERVATION TOOL 11

3.1. European Union 11

3.2. The United States Fish and Wildlife Service 11

3.3. International Union for Conservation of Nature (IUCN) 11

3.4. United Nations Convention on Biological Diversity (CBD) 12

3.5. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 12

4. BENEFITS OF HUNTING TO CONSERVATION AND LIVELIHOODS 12

5. PROPOSAL TO BAN VERSUS SUPPORT FOR REFORM: IS IT LEGALLY OR ETHICALLY CONSISTENT? 14

6. HUNTING VERSUS POACHING 15

7. IMPACT OF HUNTING ON WILDLIFE POPULATIONS 16

8. THE IMPERATIVE OF FINANCIAL SUSTAINABILITY 17

9. ECOLOGICAL CONSIDERATIONS 18

9.1. AMOUNT OF LAND UNDER CONSERVATION AND SAFARI HUNTING IN ZIMBABWE 18

9.2. TYPE OF LAND UTILISED 19

9.3. ECO-SERVICES PROVIDED UNDER WILDLIFE-BASED LAND USE 20

9.4. BUFFERING BETWEEN PROTECTED AREAS AND COMMUNITIES 20

9.5. ECOLOGICAL AND MIGRATORY CONNECTIVITY BETWEEN PROTECTED AREAS 21

9.6. RHINO, LION AND ELEPHANT CONSERVATION IN ZIMBABWE: EXAMPLES OF HUNTING AS AN IMPORTANT AND EFFECTIVE CONSERVATION TOOL. 23

9.7. POPULATION MANAGEMENT & MITIGATION OF HUMAN WILDLIFE CONFLICT 24

10. FINANCIAL CONSIDERATIONS 25

10.1. RELATIVE SIZE OF THE HUNTING INDUSTRY IN AFRICA 25

10.1. RELATIVELY LOW-CLIENT THROUGH-FLOW AND CAPITAL OUTLAY 25

10.2. RELATIVE RESILIENCE OF SAFARI HUNTING TO SOCIO-POLITICAL DISTURBANCES, SECURITY THREATS AND HEALTH RISKS. 25

11. SUSTAINABLE UTILISATION: COMMUNITY LIVELIHOODS, USER RIGHTS AND STEWARDSHIP 25

11.1. CRITICISMS AGAINST LACK OF EQUITABLE COMMUNITY BENEFITS 26

11.2. ANNUAL CONSERVATION INCOME 26

12. WHERE THE MONEY GOES – COSTS OF CONSERVATION. 28

13. ALTERNATIVE REVENUE STREAMS 29
13.1. DIVERSIFICATION 29
13.2. ECO-TOURISM AS AN ALTERNATIVE REVENUE STREAM 29
13.3. WILDLIFE AND ECO-SERVICE OFF-SET CREDITS 29
14. FIRST WORLD VS. DEVELOPING WORLD BASE-VALUES 30
14.1. UNILATERALISM VS. CONSULTATION 30
14.2. AFRICAN WILDLIFE AS A GLOBAL ASSET 30
14.3. COUNTER-PRODUCTIVITY OF UNILATERAL BANS 31
14.4. COMMENT ON “NON-DETRIMENT” 32
14.5. ACCOUNTABILITY OF LOBBYISTS AND PRESSURE GROUPS 32
15. CONCLUSION 32
16. ACTION PLAN 33
References 35

1. INTRODUCTION

Properly managed and regulated, consumptive and non-consumptive wildlife-based land use is not only the most drought-tolerant and ecologically resilient but also one of the most profitable and sustainable land uses in drought prone agri-ecological regions 3, 4 and 5 of Zimbabwe and more broadly in southern, central and east Africa. However, in the absence of sustainable financial return from wildlife-based land use, setting aside land for wildlife and habitat conservation represents an opportunity cost to alternative land uses under communal, state and private tenure in Zimbabwe.

The bulk of income to fund conservation and to justify wildlife-based-land-use in Zimbabwe is derived from legal safari hunting.

It is a simple economic fact that without sustainable income arising from the investment in wildlife-based enterprise, wildlife and wilderness in Africa will be exterminated and at a terrifying rate.

In the absence of financial compensation and incentive, presence of wildlife – especially large predators, elephant and other dangerous game animals – is a net liability to communities, state conservation agencies and private land owners. Liabilities arise not only through direct Human-Wildlife-Conflict and impacts on human safety, livestock and crops and indirectly through competition for resources and conflict with alternative land use systems but also through direct costs in conserving, protecting and managing these animals and habitats.

The management of lion on the privately owned Bubye Valley Conservancy (BVC) in SE Zimbabwe is a topical case in point, which highlights not only the ideological conflicts around hunting and conservation, but also the hard economics of conservation of such high-impact species.

The establishment of BVC in the 1990s involved the conversion and rehabilitation of former cattle ranching land to wildlife-based land-use. Under cattle ranching lion had been completely extirpated from the area but, following reintroduction during establishment of the Conservancy, augmented over the years by intermittent natural ingress of vagrant animals, BVC is now home to some 500 lions, being the second largest population of lions in Zimbabwe (after Hwange National Park) and the largest population of free-ranging wild lions on private land anywhere in the world. It is estimated that this number represents an overpopulation of some 200 lions – having dire impact on antelope populations as well as a number of endangered species such as wild dogs and cheetah.

The BVC's sole source of revenue is derived from very well managed, well regulated, ethical and legal trophy hunting – providing the financial means for the conservancy's exemplary conservation infrastructure and management model spanning and conserving some 3400km^2 of rehabilitated habitat (formerly under extensive cattle ranching) and protecting the single largest population of endangered black rhino on private land anywhere in the world.

In January 2016, BVC advertised the auction of a legal lion hunt on the Conservancy with the proceeds earmarked to go towards funding of tracking collars and applied research intended to inform ecological management and planning within the Conservancy. This initiative was met with a furore of international opinion and protestation – led by well-publicised anti-hunting lobby groups who effectively shut-down the initiative through a concerted publicity campaign. When invited by BVC to find a home and funding to translocate 200 surplus lions off of BVC, who would donate the lions free of charge to the aforementioned groups, provided that minimum ecological, security, ethological, management and social conditions could be guaranteed in the area of destination - all further communications from the aforementioned lobby groups ceased. A classic example of not putting your money where your mouth is.

It is clear that safari hunting as a conservation tool is both highly technical and highly emotive. It would be a gross disservice to our morality and responsibility as human beings if we saw wildlife and wild places merely in terms of dollars and cents. But to sacrifice all common sense, sustainability and realism on the altar of

emotion would be equally feckless, superficial, irresponsible and dissolute. We are challenged to derive a sound and sensible and above all sustainable and morally defensible means of conserving the wildlife and wild-lands for which we are responsible and it is our duty to choose wisely.

2. ONGOING INITIATIVES FOR THE REVIEW AND REFORM OF CONSERVATION, HUNTING AND COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT IN ZIMBABWE

2.1. Stakeholder Workshop for the Review and Reform of the Safari Hunting Industry in Zimbabwe

As alluded to in the preface, in June 2015, a workshop was co-hosted by the Zimbabwe Parks and Wildlife Management Authority (ZPWMA), the Safari Operators Association of Zimbabwe (SOAZ) and the Zimbabwe Professional Hunters and Guides Association (ZPHGA) in recognition of the need to address key challenges to the financial and ecological sustainability, ethics, regulation, management and reputation of the hunting industry in Zimbabwe.

The Hunting Review and Reform Workshop identified the following seven somewhat interrelated pillars for urgent attention and redress:

1. Implementing adaptive, participatory and transparent science-based quota setting.
2. Implementing accurate and transparent record keeping, information and data management as the basis for science-based adaptive management, regulation and accountability of the industry.
3. Ensuring effective management, conservation and protection of the hunted resource and supporting conservation of habitats and wild-lands.
4. Development and enforcement of a Code of Ethics and Best Hunting Practice for sustainable hunting.
5. Resourcing the Wildlife Authority and promoting wildlife-based land uses outside of the Parks Estate – including realistic beneficiation and participation of communities in wildlife based land use.
6. Coordinated Public Relations and Improved Public Image based on measurably improved industry practice and performance.
7. Review of key policy and legislative issues.

Amongst other things, this Workshop established the Ethics and Coordination Committee to implement reforms in the industry – including the drafting and enforcement of a Code of Ethics and Best Hunting Practice for sustainable hunting in Zimbabwe.

2.2. CAMPFIRE Stakeholders Review

At its inception in the 1980s, the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) was a world leader in Community Based Natural Resource Management (CBNRM) allocating natural resource user and stewardship rights to communities at local level. In recent years there has been growing acknowledgement that CAMPFIRE is falling somewhat short of both its conservation and community development objectives – especially as they relate to community capacity, decision-making and beneficiation.

In recognition of this the Government of Zimbabwe has initiated a “National CAMPFIRE Stakeholder Review”, mandated - by the Ministry of Environment, Ministry of Rural Development, Ministry of Tourism, Zimbabwe Parks and Wildlife Management Authority (ZPWMA) and the CAMPFIRE Association - to derive improved models and institutional frameworks for sustainable CBNRM in Zimbabwe. The Review is due to begin in April 2016 and is funded by the European Union.

The ongoing Wildlife in Livelihood Development (WILD) Programme (www.wild-africa.org) – also funded by the European Union – seeks to pilot improved and professionalised holistic CBNRM models based on robust

and accountable governance structures that empower communities to participate more centrally in, and benefit more fully from, conservation enterprises, tourism and other sustainable Natural-Resource-based opportunities appropriate to semi-arid regions of Zimbabwe. It is intended that models piloted under WILD will help to inform the National CAMPFIRE Stakeholders Review.

2.3. Other recent or ongoing initiatives

These are by no means the only steps that Zimbabwe has taken to redress issues of ecological sustainability, ethics and community beneficiation from conservation. For example:

2.3.1. National Elephant Management Plan

Following the National Elephant Census in 2014 the National Elephant Management Plan for Zimbabwe was comprehensively overhauled through a series of broad-based consultative processes during 2015 - incorporating the input of local and national stakeholders and international experts in each of the four key wildlife eco-regions of the country. The National Elephant Management Plan has been approved, adopted and published as of March 2016.

2.3.2. Lion age restrictions and adaptive quota setting

In 2013 a system for improved regulation of lion hunting was introduced – driven primarily by Panthera.org – one of the most highly respected, science-based wild felid conservation organisations in the world.

The improved system is designed to heavily penalise hunting of young male lions in their prime (2.5 to 6 years) - which has severely detrimental effects on cub survival and population size and dynamics – and to incentivise hunting of lone mature males past their breeding prime (i.e. >5 years – shortly to be increased to 6 years). The initiative has also driven the complete abolishment of “fixed quotas” on lions and precludes any hunting of lionesses across the country.

After just 2 years of implementation the age of male lions hunted in Zimbabwe has increased by an average of 3 years with enormously beneficial effect on cub survival rate and population growth. In 2015, 47 lions were hunted from an overall population of between 2,400 and 2,600 – equating to a 2% off-take.

A recent paper – by Bauer et Al 2015 (2) – has shown that Zimbabwe is one of just 4 African countries in which Lion populations are stable or increasing in number.

2.3.3. Leopard age restrictions and adaptive quota setting

In March 2016 a workshop was held in Harare to introduce measures for sustainable hunting of leopard with similar guidelines to those already successfully implemented for lion – with appropriate species-specific modifications.

From leopard research done on Save Valley Conservancy and Bubye Valley Conservancy, both hunting areas, leopard populations have been shown to remain stable if male leopard of 4 years or older are hunted. Based on this research, Zimbabwe has implemented a system to encourage the hunting of male leopard of 4 years or older, and penalties are imposed if young male leopards are hunted.

Further recommendations include that quotas are to be limited to 75% of utilization and female leopards are not to be hunted at all. Hunters are now required to record and report more species specific, geospatial and hunt data to enable adaptive management and fine-tuning of the system in the future.

3. INTERNATIONAL RECOGNITION OF HUNTING AS A CONSERVATION TOOL

Legal hunting is regarded as an important and effective conservation tool by a number of important conservation agencies and governments around the world.

3.1. European Union

The European Union's "Habitats Directive" (92/43/EEC) aimed at conserving EU's most threatened mammal species and natural habitats, along with the "Birds Directive" (2009/147/EC) lie at the heart of EU nature policy and together form the cornerstone of the EU's vast network of protected areas under *Natura-2000*.

Both of these directives recognise the role of sustainable hunting, while specifying limitations with regard to which species can be hunted, when hunting can take place and which methods and tools can be used.

According to the website of the European Commission (3):

> *"Hunting is an activity that provides significant social, cultural, economic and environmental benefits in different regions of the European Union."*

The webpage goes on to say that:

> "*In 2007, the annual meeting of the Parties (Standing Committee) to the Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979), adopted the European Charter on Hunting and Biodiversity. This charter is meant to reinforce the implementation and coherence of global and European biodiversity instruments such as the Convention on Biological Diversity and the European Community's Birds and Habitats Directives, and is fully supportive of the EC's Sustainable Hunting Initiative"*

If hunting is a legitimate and legal practice in the European Union and, moreover, one that is recognised as an effective and important conservation tool contributing to the social, cultural, economic and environmental wellbeing of Europe – then how is it legally or morally justified that European lobby groups would seek to effectively ban hunting in third world countries that lack capacity for proper regulation?

3.2. The United States Fish and Wildlife Service

On their website (4) the US Fish and Wildlife Service make an eloquent argument in favour of hunting, trapping and fishing as legitimate and sustainable activities which are both compatible with and complimentary to biodiversity conservation within wildlife refuges in the US. The webpage reads as follows:

> "*Hunting, trapping and fishing are considered by many to be a legitimate, traditional recreational use of renewable natural resources. The National Wildlife Refuge System Administration Act of 1966, other laws, and the Fish and Wildlife Service's policy permit hunting on a national wildlife refuge when it is compatible with the purposes for which the refuge was established and acquired.*
>
> *National wildlife refuges exist primarily to safeguard wildlife populations through habitat preservation. The word "refuge" includes the idea of providing a haven of safety for wildlife, and as such, hunting might seem an inconsistent use of the National Wildlife Refuge System (Refuge System). However, habitat that normally supports healthy wildlife populations produces harvestable surpluses that are a renewable resource.*
>
> *As practiced on refuges, hunting, trapping and fishing do not pose a threat to the wildlife populations, and in some instances, are actually necessary for sound wildlife management. For example, deer populations will often grow too large for the refuge habitat to support. If some of the deer are not harvested, they destroy habitat for themselves and other animals and die from starvation or disease. The harvesting of wildlife on refuges is carefully regulated to ensure an equilibrium between population levels and wildlife habitat.*"

3.3. International Union for Conservation of Nature (IUCN)

IUCN is the world's oldest and largest global environmental organisation with primary focus on valuing and conserving nature, ensuring effective and equitable governance of its use, and deploying nature-based

solutions to global challenges in climate, food and development. IUCN supports scientific research, manages field projects all over the world, and brings governments, NGOs, the UN and companies together to develop policy, laws and best practice.

> *"IUCN has long recognized that the wise and sustainable use of wildlife can be consistent with and contribute to conservation, because the social and economic benefits derived from use of species can provide incentives for people to conserve them and their habitats."* (5)

3.4. United Nations Convention on Biological Diversity (CBD)

The Convention on Biological Diversity (CBD) is a multilateral treaty under the United Nations Environment Programme. The Convention has three main goals:

i. Conservation of biological diversity (or biodiversity);
ii. Sustainable use of its components; and
iii. Fair and equitable sharing of benefits arising from genetic resources

One hundred and ninety-five states, including Zimbabwe and the European Union are parties to the convention and all UN member states—with the exception of the United States—have ratified the treaty (6).

The Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity, published by the CBD, consist of fourteen interdependent practical principles, operational guidelines and a few instruments for their implementation that govern the uses of components of biodiversity to ensure the sustainability of such uses.

The under item 2 the Addis Ababa principles recognise that:

> "*Sustainable use is a valuable tool to promote conservation of biological diversity, since in many instances it provides incentives for conservation and restoration because of the social, cultural and economic benefits that people derive from that use. In turn, sustainable use cannot be achieved without effective conservation measures. In this context, and as recognized in the Plan of Implementation of the World Summit on Sustainable Development, sustainable use is an effective tool to combat poverty, and, consequently, to achieve sustainable development*." (7).

3.5. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

By its very nature, CITES recognises the legitimacy of safari hunting as a conservation tool and itself seeks to provide international regulation, checks and balances to ensure that safari hunting, amongst other trade channels, remains sustainable and non-detrimental to source populations.

4. BENEFITS OF HUNTING TO CONSERVATION AND LIVELIHOODS

Well-regulated and ethical hunting can be a positive tool for conservation by increasing the value of wildlife and the habitats on which they depend – providing benefits and revenues that can motivate and enable sustainable resource management. Specific benefits include:

i. **Generation of incentives for land-owners & communities to restore and conserve wildlife on their land.**
   In Zimbabwe, policies enabling land-owners to benefit from sustainable use of wildlife on their land - in conjunction with natural resilience and productivity of multi-species wildlife populations and the relatively favourable financial return in $/hectare by comparison to traditional livestock and crop production - led to the conversion of large tracts of private and community-owned land being rehabilitated from cattle and crop land back to wildlife in the 1980s and 1990s.

ii. Generation of revenue for wildlife management, anti-poaching and conservation.

Contrary to popular belief, wildlife management and particularly anti-poaching is costly and requires active technical management, ongoing security and maintenance – including payment of wildlife managers, scouts and rangers, maintenance, admin and tourism staff; purchase of vehicles and equipment; purchase and maintenance of communications equipment, road networks, maintenance facilities, admin offices, staff accommodation, workshops, tourist accommodation and other infrastructure; resource research, monitoring and management; fire management; provision of water for wildlife, etc.

In Zimbabwe, over 75% of all conservation land under private, community and state tenure is entirely dependent on safari hunting revenues to fund these activities and of particular importance it is the hunting operators and the anti-poaching patrols that they directly employ which mitigate and reduce poaching.

iii. **Devolution of decision making, stewardship and user rights to communities and land-owners.**

As well as being the cornerstone enabling financial benefit to accrue to communities and land-owners, the ability of communities to participate directly in decision-making and management of natural resources is an oft-underestimated aspect influencing community acceptance, understanding and support for wildlife and resource management and is separate and distinct from financial benefits and incentives.

iv. **Increased tolerance for living with wildlife, reduced effects of human-wildlife-conflict and reduced retaliatory and other illegal killing of wildlife.**

Where wildlife poses significant cost and threat to people, livestock and crops and there are no legal means of benefiting from it or where benefit streams are inadequate, retaliatory killing, local poaching and integration of locals into international syndicated poaching increases. This is particularly true in the case of dangerous wildlife species such as elephant and lion which respectively destroy crops and livestock and which both pose real threats to human life.

Revenues from trophy hunting can also increase local tolerance of lions and elephants, and thus reduce persecution resulting from the threat that these species pose to livestock, livelihoods and human life (8).

In Africa cattle are the single most important cultural and financial asset to communities. Recently there have been several, well-publicised examples of cattle-raiding lions being poisoned across the length and breadth of Africa. Relations become even more strained in the case of threat or insult to human life and in more serious cases of conflict compounded by poor benefits, communities become more susceptible to involvement in syndicated poaching and trafficking.

CASE STUDY

The much publicised incident involving the poisoning of over 80 elephants in Hwange National Park in 2013 illustrated all three points listed above as sketched in the interview with local headman Owen Dladla paraphrased below (9):

- "*We are starving here. For the past five years we have not harvested anything from our fields because of erratic rains and our crops being destroyed by elephants," headman Owen Dladla from Vukuzenzele Village in whose jurisdiction the jailed reside, said.*
- *"Since 2010 elephants have been a problem to us. We have been reporting … about the elephant menace, but we received no joy. No one came to our rescue."*
- *He said criminals then took advantage of the villagers' plight and brought in cyanide to poison the elephants and get ivory for a fee.*
- *"Because of that, cyanide found its way into the area and our people were so receptive because they had no one to cry to or help them since everyone seemed to shy away from them.*
- *"They then took things into their own hands hence this catastrophe," Dladla said.*

- *"However, you should understand that most of these people here are unemployed so to get money they had to engage in these criminal activities.*
- *"Our people are not criminals but are taken advantage of because of their circumstances."*
- *Another villager who spoke on condition of anonymity said the collapse of Campfire in the area also contributed to the problem.*
- *"Campfire money was not being remitted to the people as before. So people were left with no option but to kill the elephants," he said.*

As revealing as the incident was as to causal factors, the efficacy and positive attitudinal shifts brought about by under-reported remedial actions - implemented by a new and proactive hunting operator in conjunction with the CAMPFIRE Association and Local Authorities - and which eventually brought the situation under control are equally informative.

What is little known about this incident is that whereas disaffection towards a defunct CAMPFIRE programme in the area was largely to blame, this was largely the result of very poor performance and ethics on the part of the erstwhile hunting operator who was replaced by Lodzi Hunters in 2013. Shortly after taking over the concession, and evidently inheriting negative sentiments and ramifications of the poor management and discordant relationship between the previous operator and the local community, Lodzi Hunters soon discovered the extent of elephant poaching in the concession and neighbouring National Park and brought it to the attention of conservation authorities and the media.

Subsequent criminal investigations and prosecution as well as in-depth consultation with the Community hinted at disaffection and causative factors and Lodzi Hunters, in conjunction with the CAMPFIRE Association, Local Authorities and National Parks quickly turned the situation around through prompt identification and implementation of remedial actions emphasising reconciliation with the Community and recognition of their primary rights to benefit from their natural resources.

Amongst other changes and community outreach initiatives, Lodzi Hunters introduced a new revenue sharing model which sees significantly higher percentages of hunting revenue being realised by the community – especially for elephant. The operator has also taken their community outreach and consultation activities very seriously and have contributed significantly to rehabilitation of community boreholes, dams, schools, roads and recreational facilities as well as contributing directly to food security through distribution of food-aid and livestock fodder during times of drought and failed harvests in the District (10).

The results have manifested in verifiably reductions in poaching as well as reductions in conflict situations, human wildlife conflict and reversal of human and livestock encroachment into the concession and neighbouring National Park.

5. PROPOSAL TO BAN VERSUS SUPPORT FOR REFORM: IS IT LEGALLY OR ETHICALLY CONSISTENT?

Given that hunting is recognised as a legitimate conservation tool by the European Union itself, we have to question the legitimacy of the proposed ban over import of hunting trophies into the EU and what the real motives might be.

At first glance it might seem that anti-hunting lobby groups are taking an ideological and emotive swipe at weaker nations while ignoring the fact that hunting is an integral part of their own conservation ethos in the first world. This assessment is admittedly an oversimplification of the more probable one which is that this motion is a reflection of the urbanised populations in the developed world having an increasingly protectionist and anthropomorphised view of wildlife without understanding the real costs and dangers of living with wildlife and the costs associated with protecting wildlife or setting aside land for it.

On the other hand – lobbyists for the proposal might also recognise that hunting is a legitimate conservation tool but one that needs highly competent, accountable and rigorous science-based regulation, and which embraces the principles of sustainability, transparency and objectivity. This latter view is most definitely a position shared by ourselves. However, if this is the case and the protagonists have genuine concerns relating to regulation and sustainability and how these relate to iconic species and biodiversity conservation then their motion should speak more directly to measures to rectify these same causative issues. Rather, these groups should be furthering motivations to provide, with appropriate checks and balances, active technical and

financial support for African Nations and poverty-stricken communities to implement and comply with principles of science-based management, regulation, accountability, good governance and best conservation practice.

Unfortunately the language used in couching the emotive and non-scientific arguments contained in the motion to restrict trophy imports into the EU – some verging on the disingenuous - would indicate that the motives for the motion are of the former variety and are being brought with little appreciation for the realities of conservation in Africa and what life is really like when living in very close proximity to dangerous wildlife that present real and present dangers to personal safety and livelihoods.

Regardless of motive, it is nevertheless ironic that hunting is so widespread in Europe and the US and is a fundamental part of those cultures – but doesn't come under anywhere near as much scrutiny as it does in Africa. Although part of the reason for this might be that our wildlife and wilderness are more charismatic and although part of it might be that we are less effective in communication and defence of sustainable use as part of our conservation culture and ethic, we also have to acknowledge and admit that a large part is in fact due to our own underperformance in regulation, ethics and sustainability and that this has to be rectified.

Nevertheless, it is neither legally nor morally consistent for the first world to apply pressure to effectively ban a practice in a developing country for want of effective means and capacity for regulation when that same practice is perfectly legal and acceptable in the developed world. Consistency would argue in favour of assisting developing nations to develop their capacity and regulatory framework to acceptable international norms and standards.

According to a 2015 report by the European Environment Agency, in Europe "*a high proportion of protected species (60%) and habitat types (77%) are considered to be in unfavourable conservation status, and Europe is not on track to meet its overall target of halting biodiversity loss by 2020, even though some more specific targets are being met.*" (11). Should we therefore conclude that the conservation tools, regulations and efforts in Europe are inappropriate and should be scrapped or would it be more appropriate to focus on identification and remedy of specific failings and weaknesses within the system?

6. HUNTING VERSUS POACHING

It is unfortunate that some parties most outspoken in driving the motion against hunting are apparently confused, or intentionally confusing, about the vast difference between illegal poaching and legal safari hunting – both in terms of their respective legality and effects on wildlife and biodiversity conservation.

As a first point of distinction, poaching is an illegal, non-regulated activity whereas safari hunting is both legal and regulated so as to sustainably manage, utilise and pay for conservation.

Poachers are indiscriminate. They kill animals of all genders and of any age for ivory. They kill to sell. They kill what does not have ivory in order to not have to follow that track again. They take other protected species with them such as pangolin. They use poison that kills not only elephant but species at almost every level of the food chain and which persists in the environment for years on end – long after they have gone. They are incredibly hard to find in vast swathes of wilderness.

Poaching results in a net loss of wildlife without financial recompense accruing to protection and management of the source population or benefit to associated communities or conservation stakeholders. Indeed the major cost of conservation, and funded in many areas by safari hunting, is directed towards anti-poaching activities.

Poaching in Africa varies from low-level subsistence poaching for bush-meat, that itself varies from subsistence to large scale commercial operations, through to very high level organised crime and international wildlife trafficking (IWT) of high value animals and animal parts. IWT has reached epidemic proportions and has fast become one of the most lucrative trades of choice for well-organised international crime syndicates, being the

fourth most lucrative trans-national crime after drugs, arms and human trafficking (12) and estimated to be worth between GBP6 Billion (13) and GBP15 Billion (12) annually.

In many cases, demand for wildlife products originates in Asia and the principle beneficiaries of the massive revenues are not local communities or even poachers but rather international crime syndicates. IWT has long been used to finance civil wars in Africa – including the current unrest in Mozambique and Sudan, and, more recently is reported to be increasingly financing terror groups. According to an online video bulletin by TIME Magazine - entitled "TIME Explains: the link between wildlife trafficking and terrorism" (14), up to 40% of revenue to al Shabaab, al Qaeda's affiliate in Somalia, is derived from IWT.

Across Africa, this highly organised syndicated poaching has resulted in the extermination of almost two hundred thousand elephant and three thousand rhino since 2013. Over the same period, safari hunting in Zimbabwe has accounted for the legal harvesting of some 600 elephant (of an overall population of around 80,0000), bringing in gross revenues of around US$36 Million into the general and conservation economies of the country.

On the other hand, in most cases it is only safari hunters and the anti-poaching units that they fund who provide any effective mitigation to poaching on the ground. Based on actual figures provided by a hunting operator in 2015, the cost of operating a 42 man anti-poaching unit covering 600 km^2 is around US$170,000 and is three times this amount (ca. US$600,000) to protect the same acreage against poachers once high value species such as rhino are involved. These are actual costs being covered by hunters in Zimbabwe.

On the subject of poaching – it is important to realise that a key premise at the heart of community based natural resource management and sustainable utilisation is the concept of "beyond enforcement" in which wildlife and resource protection is achieved primarily through partnerships and involvement of local communities and incentives provided by sustainably commercialised resource utilisation. This is a departure from the traditional enforcement model of anti-poaching and resource protection which relies purely on punitive enforcement measures.

7. IMPACT OF HUNTING ON WILDLIFE POPULATIONS

Ethical and well-regulated hunting should have no deleterious on wildlife populations. Quota setting guidelines in Zimbabwe provide for a sustainable legal quota of 0.75% of overall population in elephant and around 2% off-take in most other species.

Off-takes of past-prime male animals at these levels have been scientifically proven to have no detrimental effect on source populations nor trophy quality and hunt effort (which are very good indicators of overall sustainability and non-detriment at population level) (15), (16).

In this matter the motion brought to the EU parliament claiming under point 2, that "*Trophy hunting contributes to the loss of iconic species, and claims that proceeds from trophy hunting benefit conservation and local communities have been debunked by scientists*" is in the first half of the sentence selectively simplistic and thereafter simply untrue.

By the very essence of safari hunting it is the older male animals with charismatic, worn trophies that are targeted – those animals that are past their prime, past breeding age and which have fulfilled their reproductive role in the population.

Furthermore, breeding success in any given polygamous species – which the vast majority of African wildlife are – breeding rate and population growth is determined primarily by the number of reproductively active females in the system with far fewer males being required for maximal biological reproduction. The normal breeding-male to female ratio in most species ranges between 4% and 25% - meaning that harvesting of non-breeding male specimens past their prime has absolutely no effect on population breeding and performance.

The obvious proviso here is that it is indeed the old, past prime and non-breeding males that are targeted and this is a matter of hunter experience and ethics and, moreover, of proper and effective regulation.

The sustainable quota off-take levels given above are prescribed over-and-above natural mortality rates. Problems due to over-harvesting have undoubtedly arising when downward adjustments in quota calculations are not made for various unusual natural or unnatural losses through poaching, drought, habitat loss, disease, fire, etc. as well as in instances in which ecological monitoring and data collection has been deficient and where "fixed-quotas" are imposed or quotas have been artificially inflated in an effort to boost revenues.

Improved ecological monitoring, data collection and reporting in respect of source populations; improved monitoring and regulation of safari hunts; improved inspection, recording and monitoring of harvested trophies; improved transparency and methodology in science-based adaptive quota setting; effective prevention of quota transfer; issuance of quotas at population or ecological level as opposed to "farm level"; consideration of special permits, quotas, poaching and other losses and abolishment of "fixed" quotas were all important recommendations of the Stakeholder Workshop for Review and Reform of the Hunting Industry in June 2015. Systems are also required to ensure that only the best-performing operators are allowed stewardship of hunting blocks and that those who do not adhere to minimum conservation investments and practices are prevented from operating.

These are nevertheless recommendations which require finance, technical expertise and capacity to implement and it is therefore necessary to assist State, Private and Community stakeholders to re-build technical, logistical and financial capacity to upgrade and exercise existing tools for ecological and hunt monitoring, recording, reporting, adaptive management and quota setting for improved industry regulation, accountability and sustainability.

8. THE IMPERATIVE OF FINANCIAL SUSTAINABILITY

Like any other enterprise or land use, financial sustainability is fundamental to success and continuation of wildlife-based land use and biodiversity conservation in Africa.

To draw an analogy, beef cattle are so numerous world-wide simply ***because*** they are profitably harvested for meat. If slaughter of beef cattle for sale were to be prohibited by law then it is beyond doubt that their numbers would plummet around the globe as farmers removed beef cows to make space for alternative revenue generating activities.

In similar fashion, private conservancies and communities, or for that matter even state conservation authorities cannot be expected to subsidize or justify the existential value of dangerous wildlife such as lion and elephant without a financial recompense. Dangerous game animals, particularly elephant and lion need large home ranges and their single biggest threat is in habitat loss and human encroachment, compounded by ever escalating commercial poaching and IWT.

Setting land aside for these animals represents significant opportunity cost in terms of alternative land uses for impoverished communities. In this regard, visiting safari hunters contribute directly to biodiversity and wilderness conservation by providing financial value to wildlife – particularly dangerous wildlife like lion and elephant - and allow communities to offset crop and stock losses as well as risk via income from hunting quotas.

Experience has demonstrated that if the means of generating income from these species were to be removed through banning of safari hunting, then wildlife would simply be exterminated to make way for other land uses. In the case of subsistence communities these alternative land uses will be environmentally devastating communal livestock production and slash-and-burn cultivation. In the process communities tend to capitalise on poached wildlife as a source of subsistence protein and for income generation through bush-meat trading as well as through international wildlife trafficking (IWT) of ivory, lion bone, rhino horn, pangolin and other high value wildlife products. This not only undermines ecological resilience and diversification of community

livelihoods but so too does it seriously undermine governance and community security as communities become increasingly infiltrated by organised crime syndicates and corrupt officials involved in IWT.

9. ECOLOGICAL CONSIDERATIONS

The conservation of wildlife is not simply a function of conserving a single species or even group of species, such as elephant, lion, rhino or leopard. Conservation is the protection of the natural environment and all the components of a natural environment, the entire ecosystem that begins with land and habitat itself.

9.1. AMOUNT OF LAND UNDER CONSERVATION AND SAFARI HUNTING IN ZIMBABWE

Notwithstanding the recognised problems within the hunting industry, aside from designated National Parks, wildlife based land use under communal, state-hunting and private land tenure in Zimbabwe is almost exclusively funded, financially justified and protected through revenue generation from Safari Hunting.

The total area under wildlife based land use and conservation in Zimbabwe amounts to some 10.7 Million hectares[1] (table 1) - or a massive 27% of the total land area of the country (ca. 39 million hectares). Of this, some 7.9 Million hectares, or 75%, falls under safari hunting as the primary source of revenue.

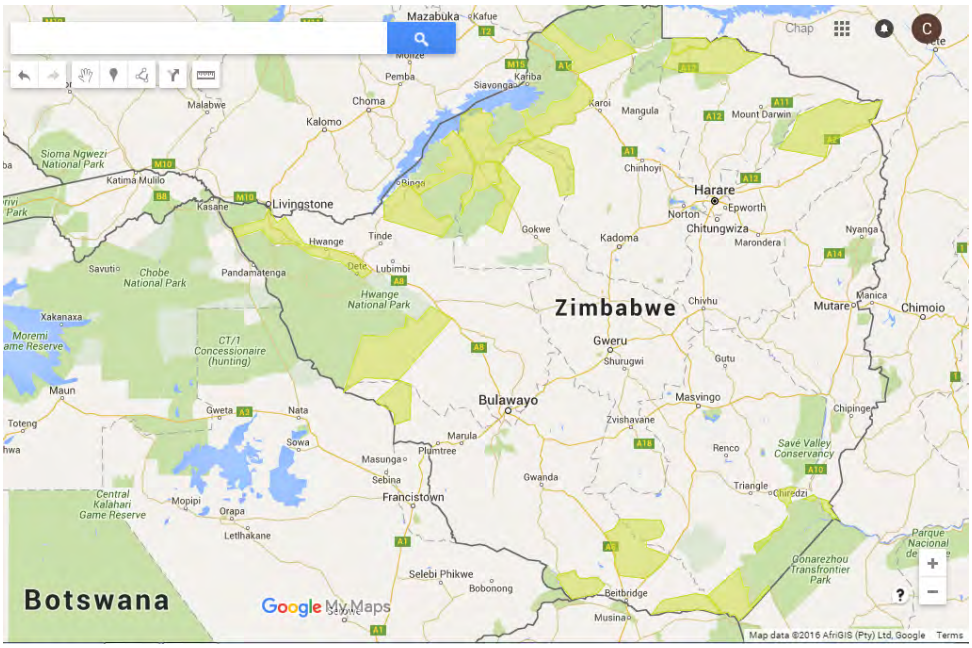


Figure 2: Google Map® of CAMPFIRE and other hunting areas (light green) in relation to National Parks and State Safari Areas in Zimbabwe.

At 27%, the percentage of land set aside for conservation and wildlife-based land use in Zimbabwe is significantly higher than in most developed countries which, in the case of Europe, is typically around 2% of total area being under conservation.

In sub-Saharan Africa, hunting areas encompass at least 1.4 Million km^2 – or an area the size of Germany, France and Spain combined.

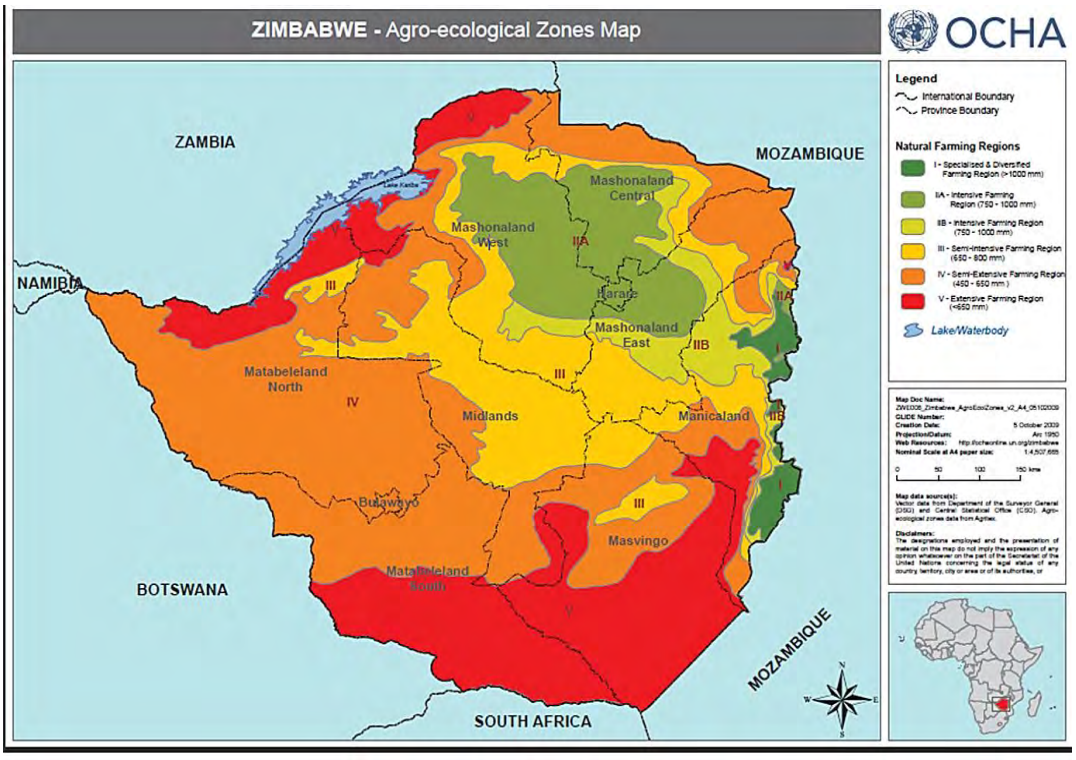
[1] Or larger in extent than Portugal (9.2 million hectares)

Table 1: summary of land under conservation and hunting in private, community and public sectors in Zimbabwe

		Hectares	km2	Approx. Carbon offset Credits
National Parks (non-hunting)				
	Subtotal	2,628,460	26,285	26,284,600
National Parks on Rhodes Estate (non-hunting)				
	Subtotal	89,550	896	
Safari Areas on Parks and Wildlife Land				
	Subtotal	1,896,300	18,963	18,963,000
Safari Areas on State Forestry Land				
	Subtotal	655,615	6,556	6,556,150
Safari Areas on Communal Land				
	Subtotal	4,800,000	48,000	48,000,000
Safari Areas on Private Conservancies				
	Subtotal	590,000	5,900	5,900,000
	Total Conservation Land	10,659,925		
	Total under Safari Hunting	7,941,915		72,863,000
	% of conservation land under Safari Hunting	75%		

9.2. TYPE OF LAND UTILISED

Although safari hunting generates revenues across a greater diversity of land tenures – including state, private and community land (16), hunting areas in Zimbabwe are typically found in hot, arid regions that are not suitable for agriculture.



The properties and desirability of wildlife land as eco-tourism destinations are not uniform across all wilderness areas. Across Africa, there are large tracts of wilderness that are unsuitable for non-consumptive ecotourism by virtue of any combination of the following:

- Remoteness and poor access
- Lack of attractive scenery, features and aesthetic value

- Low wildlife densities
- Presence of livestock and people
- Real and perceived threats re. security and political stability
- Disease risks – e.g. Malaria, sleeping sickness and Ebola
- Discomfort factors – such as very high ambient temperatures, humidity and insect infestation

Research has shown that eco-tourists seldom visit these areas whereas hunting clients are less concerned with these factors and so hunting tends to be more important and more resilient as a generator of revenue to maintain and conserve such areas (17).

Thus, within any given country or even within a single wilderness area – some areas lend themselves to eco-tourism and others to hunting and for wildlife-based land-use to be sustainable and financially justifiable as the primary land-use it is necessary to diversify and develop all activities and revenue streams compatible with wildlife and habitat conservation.

9.3. ECO-SERVICES PROVIDED UNDER WILDLIFE-BASED LAND USE

Bio-diverse, heterogeneous systems are more proficient at provision of multiple eco-services such as water filtration, detoxification and purification; water retention within sponges, wetlands and river catchments; air filtration and oxygenation; promotion of improved soil structure and fertility; erosion control; carbon trapping and retention; nutrient recycling; waste decomposition and detoxification; pollination; temperature and climate amelioration; mitigation against droughts and floods and the like which are all fundamental processes absolutely vital to the continuation of life on earth but which we all-too-often take for granted.

As an indication, based on an average of 10 carbon offset credits per hectare of intact forest / woodland (which is somewhat less than the average woody + soil carbon sequestration of the registered Kariba REDD+ Project in northern Zimbabwe), conservation areas under trophy hunting in Zimbabwe provide the basis for some 80 Million carbon offset credits per annum and it is hunting that generates the income to conserve and protect these areas. Having said that, alternative revenues – e.g. from carbon credits and REDD+ need to be added to the overall income generation for conservation and community benefit.

It is the conservation of animals and plants within these ecosystems which, through tourism, sustainable harvesting and utilisation by public and private enterprise, natural-resource credits (e.g. carbon and water credits) and donor support, provides the financial means to sustain and maintain such systems in an ecologically robust state. It should therefore be obvious that removal of the primary, and in most cases the only, form of sustainable income will undermine all ecological and conservation sustainability – not only of iconic species, but of wilderness and biodiversity at large.

9.4. BUFFERING BETWEEN PROTECTED AREAS AND COMMUNITIES

Once the pre-eminent model for community-based natural resource management in Africa, CAMPFIRE was established to derive mutual benefit for National Parks and neighbouring communities, through community-managed buffer zones. These buffer of “utilization zones” were meant as a means to translate potential value of wildlife and natural resources inside protected areas into realisable benefit and value for neighbouring communities.

Under this model communities derive tangible benefits from mitigation of human wildlife conflict and sustainable revenue generation through consumptive and non-consumptive tourism and harvesting enterprises, providing livelihood opportunities, which in turn incentivise sustainable management and build local support for conservation.

In the same way that marine reserves, sustain commercial fisheries in neighbouring waters, National Parks provide the source populations, critical ecological mass and tourism potentials, from which communities benefit, and the Parks in turn benefit from socio-political good-will, improved fire management, resource

protection, expansion of effective habitat, reduction of poaching and geographic buffering resulting from wildlife and habitat management in the peripheral CAMPFIRE areas.

Unfortunately, in certain areas, CAMPFIRE has become less effective in meeting its conservation and community development objectives and, in certain instances, this failure has been underscored by dramatic upturns in poaching. The poisoning of hundreds of elephant in Hwange National Park by disaffected CAMPFIRE Communities since 2013 is a very pertinent and graphic example of what can transpire when financial incentives to conserve become insufficient. In other areas, the dwindling of CAMPFIRE revenues has been reflected in increased human encroachment, habitat destruction, increasing conflict between communities, conservation stakeholders and authorities and, in the most extreme cases, even overt invasion and settlement inside National Parks and other Protected Areas.

It is a fact that, due to limited resources and manpower, the ZPWMA is not able to provide adequate coverage of security and protection through anti-poaching activities even within designated National Parks let alone Safari Areas, CAMPFIRE Areas and Conservancies. Many of these areas rely on anti-poaching activities and wildlife management inputs from hunting operators albeit with limited and inadequate resources, manpower and mandate in most cases. Removal of the hunting industry would consequently render most hunting areas totally exposed without any management or anti-poaching effort whatsoever – with devastating consequences on wildlife populations and habitat integrity.

This is not to say that hunters are providing or are able to provide adequate wildlife management and security and much more needs to be done – both in terms the statutory and contractual obligations and incentives for hunting operators to reinvest in resource protection and management as well as in terms of defining their mandate and ability to do so. These are additional issues requiring redress as recommended by the Stakeholder Workshop for Review and Reform of the Hunting Industry in Zimbabwe (June 2015).

9.5. ECOLOGICAL AND MIGRATORY CONNECTIVITY BETWEEN PROTECTED AREAS

Many community and state-owned safari hunting areas are very important conservation areas in the context of preservation of intact, functional habitats and natural forests and, moreover, in provision of ecological and migratory connectivity between wildlife populations in other protected areas.

Without these corridors and linkages, many protected areas and National Parks would otherwise be completely isolated with consequent susceptibility to a variety of edge & fragmentation effects and external pressures including encroachment, poaching, disease, diminishing genetic variation and the inability to migrate and so ameliorate the effects of drought and climate change.

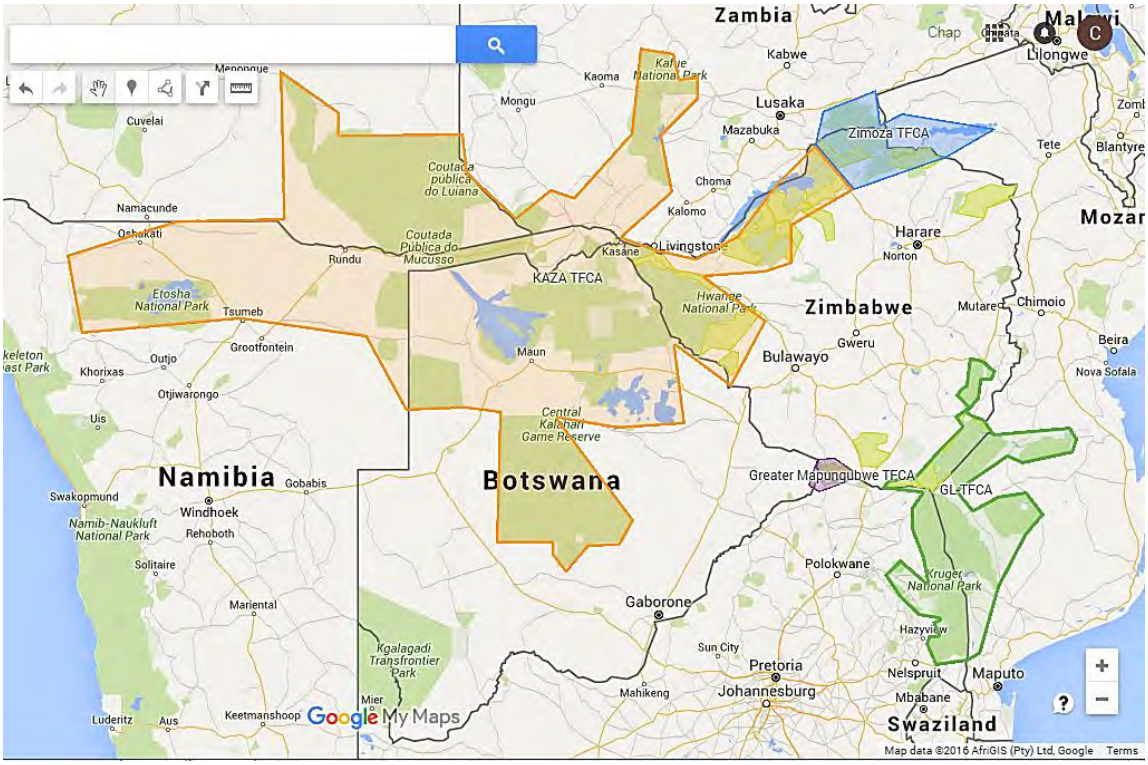


Figure 3: indicative map of the four major Trans-Frontier Conservation Area (TFCA) initiatives in which Zimbabwe is involved. These areas provide vital connectivity and contiguity between important conservation areas across international boundaries.

This principle of ecological and migratory connectivity lies at the heart of the trans-boundary conservation area (TFCA) initiative linking large protected areas across international boundaries (see map above) and providing the space for enormously important populations of wildlife – including for example:

i. The largest contiguous population of elephant in the Kavango-Zambezi (KAZA) TFCA - linking conservation areas in Zimbabwe, Botswana, Zambia, Namibia and Angola and spanning some 52 Million Ha. Many of the corridors within KAZA are provided by hunting areas on communal, private and state land which justifies wildlife and nature based enterprise as the primary land use.

ii. The second largest contiguous population of elephant and the largest populations of black and white rhino (including 3 of the remaining 10 IUCN key 1 populations of endangered black rhino) in the Great Limpopo TFCA (GL-TFCA) – linking important Protected Areas between Zimbabwe, Mozambique and South Africa and in which hunting areas provide vital corridors between Gonarezhou National Park in Zimbabwe and Kruger National Park in South Africa through the Sengwe Tchipise Corridor in Sengwe Communal Safari Area.

Without revenue from hunting, or alternative income to incentivise conservation, these corridors would be closed down and put to traditional crop and livestock production and already, the USFWL ban on imports of trophy hunted ivory is having a negative impact on the financial justification of wildlife based land use as the primary land use option in these areas – and if hunting is marginal then ecotourism is even more so in the context of the Zimbabwe tourist industry.

9.6. RHINO, LION AND ELEPHANT CONSERVATION IN ZIMBABWE: EXAMPLES OF HUNTING AS AN IMPORTANT AND EFFECTIVE CONSERVATION TOOL.

Despite private conservancies accounting for less than 10% of all conservation land in Zimbabwe, over 94% of all rhino in Zimbabwe reside on 3 private conservancies – including 3 of the last 10 IUCN Key 1 Populations of endangered black rhino remaining in the world today.

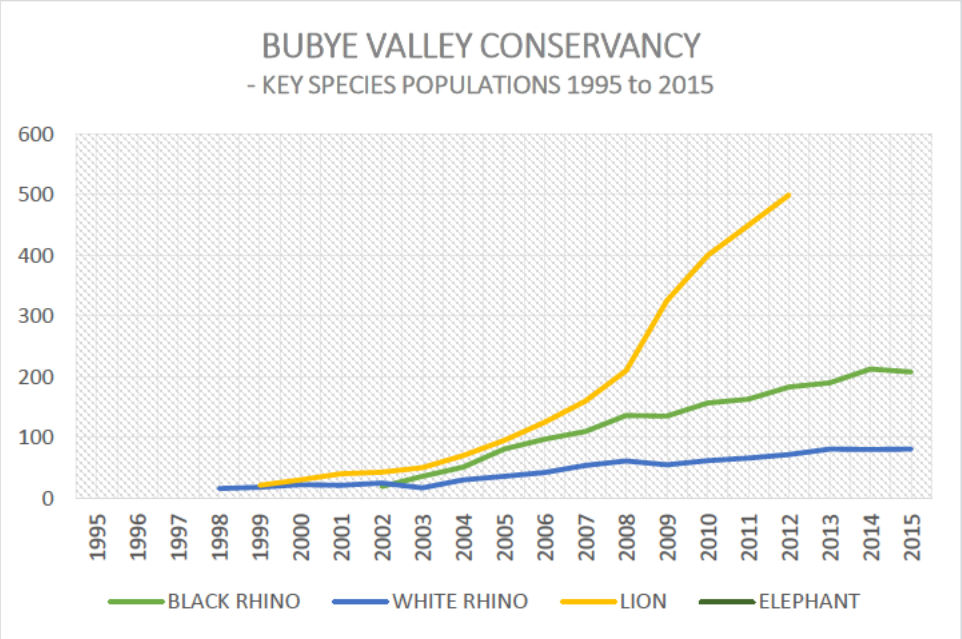
Aside from Malilangwe, the conservancies are reliant almost exclusively on well regulated and sustainable Safari Hunting to sustain their conservation activities. This includes protection of their rhino populations – despite the fact that the conservancies are not able to earn any revenue from rhino as it is not permitted to hunt rhino at all in Zimbabwe – and furthermore these animals ostensibly belong to the state even though they are hosted and protected on private land.

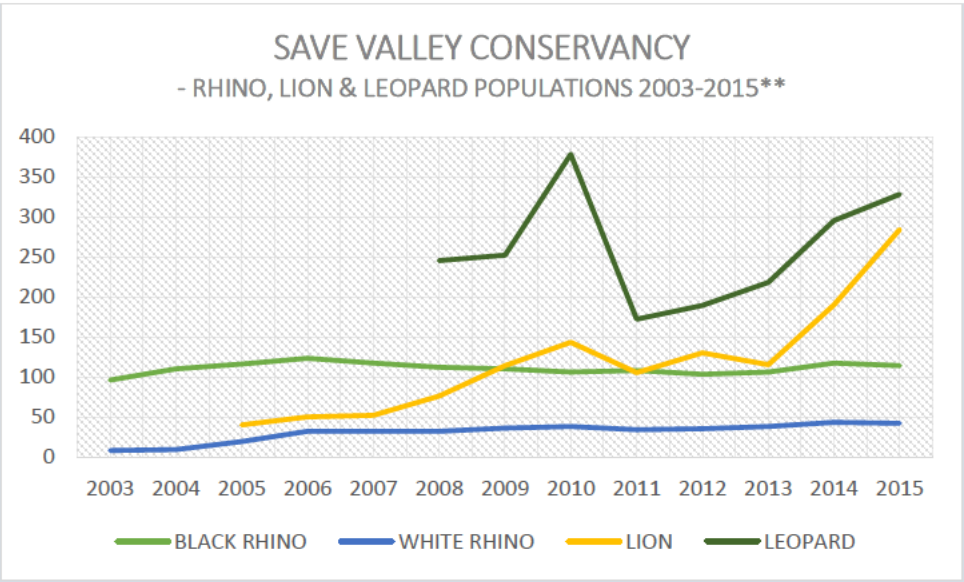
The private, community and state-owned hunting and conservation areas also provide protection for a full range of other endangered species that are not hunted by safari hunters – such as African Wild Dog, Cheetah, Roan Antelope and others which have benefited from the provision of conservation land, anti-poaching and other inputs provided by safari hunting. Savé Valley Conservancy has one of the highest densities of African Wild Dog in the wild.

Examples such as these support IUCN recognition of well-regulated safari hunting an important and legitimate conservation tool. Well regulated hunting is a massive industry and conservation tool in developed countries in North America and Europe – which illustrates that it is not hunting *per se* that is the problem but poor, non-transparent and non-science-based regulation.

CASE STUDY

Since establishment of Savé and Bubye Valley Conservancies in the 1990s, populations of elephant, lion, rhino and other wildlife have increased significantly on the back of hunting revenues. Between them SVC and BVC may host as much as 4% of the world's wild lion population and each hosts an IUCN key 1 population of endangered black rhino – of which only 10 such populations remain in the world.
Key species population trends are presented for BVC (18) and SVC (19) in the figures below.





**Population fluctuations on SVC have been occasioned primarily by poaching and loss of land area under the fast-track land reform - compounded by periodic drought and loss of contiguity with other wildlife areas in the GL-TFCA.

9.7. POPULATION MANAGEMENT & MITIGATION OF HUMAN WILDLIFE CONFLICT

As human populations have grown, wildlife populations have become increasingly restricted to the extent that natural migration, which would ordinarily alleviate the effects of local overpopulation and resource denudation, has been undermined.

It is common practice throughout the world, including Europe and USA, to use hunting and other lethal means of population control to mitigate human wildlife conflict and maintain ecological balance between land and vegetation resources, herbivores and carnivores.

The restriction of wildlife populations to maintain ecological balance is all the more important when dealing with very-high impact species such as elephant and lion. It is well-documented that lion tend to exceed their "carrying capacity" – which, in fenced reserves necessitates population management and in unfenced reserves, leads to spill-over and conflict with neighbouring land uses and, along with poaching and other impacts, contributes to the documented underperformance of lion populations in unfenced areas by comparison to fenced areas (20).

9.7.1. A COMMENT ON CONTRACEPTION AS A METHOD FOR POPULATION CONTROL IN FREE-RANGING WILDLIFE

The enormous technical and logistical challenges and, moreover, the growing evidence of appreciable bio-physiological, health, behavioural and social disruption caused, all preclude extensive use of contraception as a tool for effective management of large, free-ranging wildlife populations.

10. FINANCIAL CONSIDERATIONS

10.1. RELATIVE SIZE OF THE HUNTING INDUSTRY IN AFRICA

Commercial safari hunting occurs legally in most European Countries, in all North American Countries, in around half of the 54 countries in Africa, several countries in Asia and South America, Australia and New Zealand (21).

Continent-wide, the hunting industry in Africa is estimated to have a value of some US$200 million per annum (22) of which, at gross revenues of US$24 Million in 2015 (23), Zimbabwe accounts for some 12.5%. Despite being relatively small, this income is nonetheless vital in the absence of alternative revenues and support for conservation and wildlife based land use.

By comparison, the hunting industry in the United States, the largest in the world, had, in 2011, an estimated 13.7 Million hunters, spending a total of some 38.5 Billion dollars per annum, supporting 680,300 jobs and generating some US$11.8 Billion in tax revenues. (24)

10.1. RELATIVELY LOW-CLIENT THROUGH-FLOW AND CAPITAL OUTLAY

By comparison to eco-tourism, safari hunting operates on much higher income per tourist with much lower tourist through-flow and total bed-nights and also requires far less capital outlay for accommodation and hospitality infrastructure (16).

Not only are these extremely important considerations in the context of the poor socio-economic and political climate for investment and tourism in Zimbabwe, but also result in fewer disturbances, lower use of fossil fuels and GHG emissions and lower environmental impact than large eco-tourism developments (16).

10.2. RELATIVE RESILIENCE OF SAFARI HUNTING TO SOCIO-POLITICAL DISTURBANCES, SECURITY THREATS AND HEALTH RISKS.

Public health scares such as Ebola, terrorism, political unrest and social disturbances have had demonstrably serious impact on tourism traffic to different parts of Africa (17) and is especially true of non-consumptive ecotourism which is far more sensitive to such deterrents than is consumptive trophy hunting – with safari hunters being empirically more willing to venture into remote and relatively risky or unstable areas than eco-tourists.

It is also interesting to consider the impact of these issues on tourism within the context of the developed world's own culpability in underlying factors that cause socio-political disturbances, livelihood vulnerability and security threats in the first place, as well as the distorted public perception of security, political and health risks in Africa resulting from ignorance and compounded by sensationalist, non-contextual reporting by the media.

11. SUSTAINABLE UTILISATION: COMMUNITY LIVELIHOODS, USER RIGHTS AND STEWARDSHIP

The Zimbabwe Parks and Wildlife Act of 1975 [Chapter 20:14] confers Appropriate Authority (AA) status to legal occupiers of any land for the purpose of managing and utilization of the wildlife resources therein.

This legislation led first to the advent of game ranching and wildlife-based land use on private land which proved both profitable and sustainable and set the example for similar land-use changes to follow on community-owned land under the CAMPFIRE programme.

Under CAMPFIRE, net revenues paid by the hunting operator are apportioned between the Beneficiary Community, Local Authority and the CAMPFIRE Association.

11.1. CRITICISMS AGAINST LACK OF EQUITABLE COMMUNITY BENEFITS

Lack of equitable community benefit is a commonly cited criticism of safari hunting. This is a very valid and serious criticism but is as true for poorly regulated diamond mining, oil/gas exploration, timber harvesting and all other forms of natural resource exploitation.

It is also worth pointing out that community benefit is a buzz-phrase that has been closely associated with justification of hunting but is less closely linked to non-consumptive eco-tourism which, in many cases fail to translate revenues to meaningful community benefit simply because there is less awareness and pressure on them to do so – even though the impact of non-consumptive ecotourism on community access to their conservation land, stewardship and natural resource user-rights may be as significant or even greater than that of safari enterprises.

The issue is about governance, not hunting and emphasis has to be placed on improved resource management, governance, community stewardship and user rights rather than prohibition of hunting or extraction of any other natural or mineral resource.

11.2. ANNUAL CONSERVATION INCOME

According to the minutes of the AGM of the Safari Operators Association of Zimbabwe (SOAZ), gross National revenues from safari hunting amounted to some US$24 Million compared to gross earnings of US$102 Million generated by the non-consumptive tourism sector (both wildlife and non-wildlife-based) in 2015 (23).

11.2.1. CAMPFIRE INCOME 2014

In 2014, the Community Areas Management Programme for Indigenous Resources (CAMPFIRE) generated a total net hunting income of US$2,102,007 in 13 districts of Zimbabwe.

The hunting income to CAMPFIRE disaggregated by district as well as the portion contributed by elephant hunting is shown in Figure 4 below. Bubi district recorded the lowest hunting income of US$21,270 whilst Mbire district generated the highest income of US$519,893. In 2014, elephant hunting contributed some 54% of hunting revenues averaged over all 13 CAMPFIRE Districts.

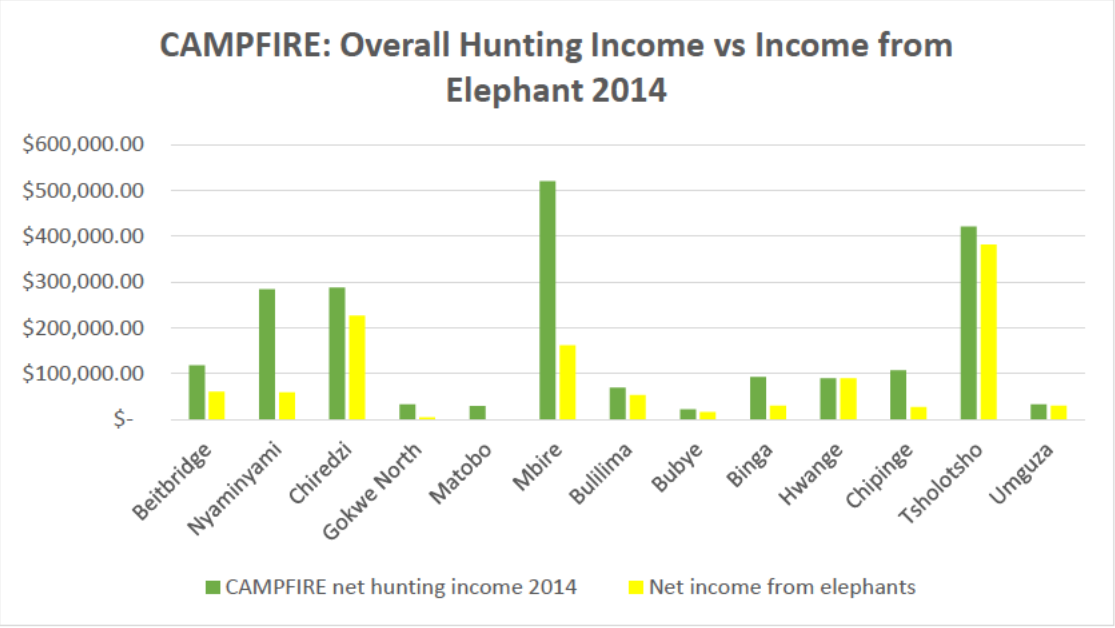


Figure 4: Overall CAMPFIRE revenue from hunting vs. income from elephant hunting in 2014.

Elephant hunting has increasingly made disproportionally high contribution to overall revenue generation in CAMPFIRE areas. This is mainly ascribed to the overall lack of species diversity in the majority of CAMPFIRE

areas, which is in turn due to lack of active management and protection. This lack of ecological diversity and over-reliance on elephant is a key weakness of CAMPFIRE and one that needs active redress through improved funding, management and diversification – both in terms of species conserved and hunted as well as through initiation of other, non-hunting enterprises which are compatible with biodiversity conservation. This issue has also meant that the 2014 USFWL ban on hunted ivory from Zimbabwe has had far reaching consequences on community revenues and conservation.

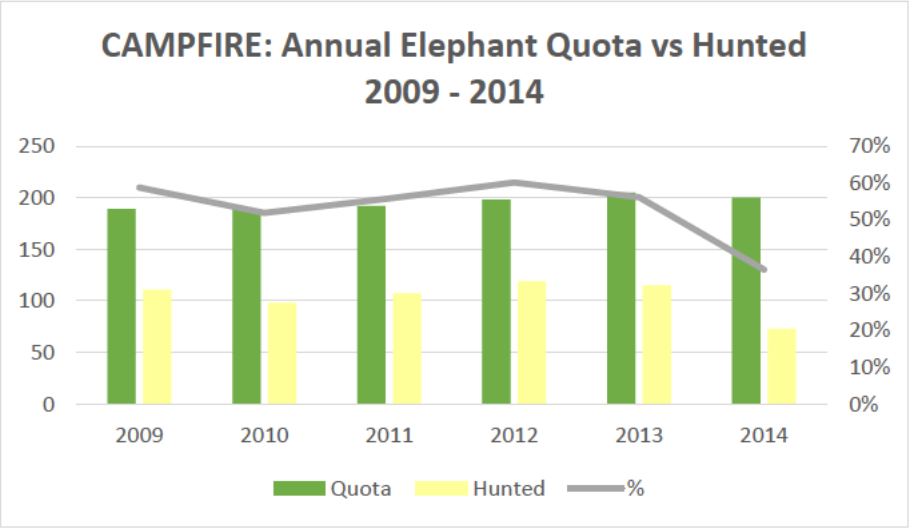
In Figure 4 above, the high revenue generation for Mbire District in combination with the relatively low proportion of income derived from elephant as a trophy species is strongly suggestive of a species-diversified CAMPFIRE model which is in turn suggestive of a comparatively well-managed and protected wildlife resource in that area. Indeed the area does in fact boast an array of very positive factors contributing to successful CBNRM - including visibly robust and transparent community based organisations enabled by good traditional leadership and governance from local authorities and supported by an innovative partnership with a proactive hunting outfitter prepared to invest in wildlife restocking, management and protection.

Table 2 below shows that elephant quotas have remained relatively steady over the period under consideration and that harvests have typically ranged between 52% and 60% of quota - with the exception of 2014 in which only 37% of the elephant quota was harvested.

Table 2: Summary of elephant hunting in CAMPFIRE Areas between 2009 and 2014.

ELEPHANT HUNTING IN CAMPFIRE AREAS: 2009 - 2014[2]						
	Quota	Hunted	%	HWC Reports	PAC	Poached
2009	189	111	59%	277	38	13
2010	189	98	52%	325	66	46
2011	192	107	56%	363	27	42
2012	198	119	60%	223	29	23
2013	205	115	56%	310	30	19
2014	200	73	37%	492	48	14
TOTALS	1173	623	53%	1990	238	157

With around 75% of elephant hunting clients originating in the USA, there is little doubt that this decrease in % harvest was precipitated primarily by the USFWL ban on import of safari-hunted ivory from Zimbabwe and Tanzania in that year.



The unintended consequences of unilateral trade bans are discussed elsewhere, but in the context of industry sustainability this issue has further illustrated the risk of having an undiversified product being sold to an

[2] Elephant quota, hunt, HWC, PAC and Poached data extracted from CAMPFIRE Workshop Proceedings 2014 (29)

undiversified market – leaving the industry and conservation funding exposed to external risks – including bans. In 2016 this has been further compounded by plunging oil prices and disposable income in the US so reducing US demand for other species as well.

KEY SPECIES - NATIONAL HUNTING OFFTAKES 2010-2015 (Source ZPWMA)							
Species	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	SUBTOT
Elephants	134	274	247	258	151	ND	1064
Leopards	219	173	194	241	222	108	1157
Crocodiles	ND	ND	91	53	ND	ND	144
Cheetah	3	1	1		1		6
Lions				29	42	47	118

In addition to addressing issues of ecological sustainability, governance and revenue distribution it is imperative that CAMPFIRE diversify revenue streams as a matter of urgency.

12. WHERE THE MONEY GOES – COSTS OF CONSERVATION.

Conservation in Africa is not cheap, especially in areas hosting species such as elephant, lion and rhino which are all highly valued by poachers and IWT syndicates and which require extensive ranges for breeding success and population growth.

Anti-poaching, manpower, water provision and infrastructure maintenance remain the most costly aspects of conservation and these costs vary between US$200 and US$1000 per km^2 depending on local conditions and species present.

CASE STUDY: THE FINANCES OF LION HUNTING AND RE-INVESTMENT IN THEIR CONSERVATION ON BUBYE VALLEY CONSERVANCY (18)

Break-down of income from a typical lion hunt on the Bubye Valley Conservancy:

- Lion Trophy fee: US$ 42,000
- Lion Hunt Daily rate: US$ 2,950 /day with a minimum lion hunt duration of 18 days equating to a total daily rate of US$ 53,100 per lion hunt.
- Additional costs including ZPWMA scouts to accompany the hunt, cost of observers, bait, other trophy species taken during the lion hunt, etc. amounting to an average of approximately US$ 6,500 per lion hunt.

Bubye Valley Conservancy - Lion Sport-Hunting Revenue Generated (2015):
((18 days x US$2,950 per day) + US$42,000 trophy fee + US$6,500 additional costs) x 12 lions per annum = US$ 1,219,200 representing 33.9% of total annual revenues (including post-hunt meat and hide sales).

All of the revenue generated from lion sport-hunting on the Bubye Valley Conservancy has gone back into the running costs of the Conservancy, including *inter alia*:

- Anti-poaching and fence monitoring and maintenance - approximately US$ 506,000 per annum,
- Research - approximately US$ 34,700 per annum (excluding client and sponsor donations), and
- Community support assistance of approximately US$ 210,000 per annum.

NOTE: No profit after costs has been declared, nor dividends taken by shareholders since the Bubye Valley Conservancy was formed in 1994. All revenue generated to date has been spent on running costs, improvements and restocking.

13. ALTERNATIVE REVENUE STREAMS

13.1. DIVERSIFICATION

It is acknowledged that notwithstanding all the evidence in favour of safari hunting as a conservation tool the industry is vulnerable to socio-political pressure and economic vagaries which can severely undermine the conservation initiatives that hunting supports.

In addition, ***hunting as a stand-alone enterprise is in many areas financially marginal*** – generating between $138-1,091/km^2 in gross income (2015 figures) (25) from which running costs, including anti-poaching, fees and profit are deducted – sometimes leaving little to cover costs of land and wildlife management and protection ranging between US$200 and US$1000/km^2 depending on local factors and species present.

It is therefore imperative that additional and diversified revenue streams are established for improved revenues and resilience of conservation in Africa. If hunting is "break-even" in covering necessary inputs for resource protection and management then "profit" needs to be found through **additional** (as opposed to alternative) revenue streams - rather than cutting costs and corners in resource management.

To reach adequacy in most cases, investment in management and protection of the resource base will require a combination of diversified revenue streams, payments for eco-services and conservation services and subsidies through philanthropic donations from the wider hunting and conservation community.

13.2. ECO-TOURISM AS AN ALTERNATIVE REVENUE STREAM

For reasons mentioned elsewhere, non-consumptive ecotourism can be a viable alternative to hunting, but only in a limited number of cases (1) as determined by global demand, local conditions, cost, ease and desirability of the destination amongst other factors.

Highly competitive eco-tourism requires ease of access, solid infrastructure, outstanding landscapes, high wildlife densities, political stability, lack of security and disease threats and good value for money. It also requires high throughput and high start-up costs. Many of these factors are absent in many developing states and it is under these circumstances that hunting becomes more important as a means of financing wilderness and biodiversity conservation.

Eco-tourism, which in Zimbabwe was at its zenith in the 1990s, has declined enormously in recent decades. The industry operates at well under 50% of operational capacity even though many establishments have either closed their doors or downscaled significantly. If eco-tourism, occupying approximately 25-30% of conservation land in Zimbabwe, cannot fill its current beds and potential then it certainly cannot be expected to replace hunting as the dominant income generator for conservation overnight.

Even in South Africa, which enjoys an overwhelming dominance of the tourism industry in Africa, much of the private wildlife estate and state PA's do not attract sufficient regular tourism to be viable.

While it is vital that Zimbabwe energetically promotes eco-tourism wherever possible, hunting increases the contexts in which wildlife is a competitive land use and the two industries are not mutually exclusive but can and should be complimentary so as to add value to wildlife across as broad an array of circumstances as possible.

13.3. WILDLIFE AND ECO-SERVICE OFF-SET CREDITS

Payment for eco-services (PES) such as carbon sequestration and off-set credits, wildlife corridor services and conservation incentive schemes including REDD+ projects, is an emergent concept with considerable potential to augment or even overtake hunting and other revenue streams as the primary means of funding sustainable conservation of wildlife and wilderness.

The main challenge is to grow the scope, scale and objective accountability of such schemes and to ensure that revenue flows will be reliable and sustainable over the long term.

14. FIRST WORLD VS. DEVELOPING WORLD BASE-VALUES

As so graphically depicted in the photo on the cover page of this document, the reality of living and coping with dangerous wildlife is far removed from the idealistic concepts of conservation that apply in the developed world.

It is totally inaccurate to assume that conservation and animal welfare ideologies of western societies are in any way reflected in those of impoverished communities in the developing world. In the context of a subsistence communal farmer, elephant, lion and other dangerous game are a serious threat to livelihoods and personal safety and wildlife in general represents a source of protein. In this context wildlife conservation is a burden and an opportunity cost and this equation changes only when communities are fully recognised as the rightful custodians, decision makers and stewards of their wildlife and natural resources and, moreover, are adequately remunerated through employment, development and financial rewards for conservation and tolerance of wildlife.

14.1. UNILATERALISM VS. CONSULTATION

It has been said, and not by us, that the proposed ban is an attack on the sovereign rights of African Peoples.

It is also increasingly said - by many of our fellow Zimbabweans of all backgrounds – that it is unfortunate that the EU or any other trade partner would choose to impose their ideology from afar without consulting with the very people who are most affected and who are dealing with the day to day problems of living and coping with wildlife.

This motion will in effect remove “user rights”, self-determination and stewardship-incentive from communities who will now see very little, if any, value in setting aside land for wildlife which will simply become a net liability – both financially and physically.

In this regard it is unfortunately true that 1st world decisions are often made with very little regard or understanding of 3rd world conditions and consequences.

It is also by no means the first time that conservation in Africa will suffer this insult. For example in the 1980s the Zimbabwean Veterinary Services were encouraged and supported (read “obliged”) by the EU to extirpate buffalo from much of their former range in order to satisfy overly protectionist phyto-sanitary barriers to international beef trade. The disastrous ecological effects of EU-endorsed game fencing to control foot-and-mouth disease (FMD) in Botswana and elsewhere in Africa is another very well documented example.

From colonial legacy to trade bans and barriers, Europe has a responsibility to Africa and to conservation on this continent and such responsibility requires just that – objective, consultative and collaborative responsibility.

14.2. AFRICAN WILDLIFE AS A GLOBAL ASSET

Africa has set aside vast PA’s, which, as illustrated above, represent much greater contributions to habitat and wildlife conservation in terms of % of land area under conservation than is the norm in most developed countries.

It has also been illustrated in this paper that conservation is costly and escalating exponentially, especially in the face of poaching driven by illegal demand for wildlife products. The simple fact is that developing countries in Africa are not able to meet the costs of conservation and wildlife management of these very large PA networks at the levels required to stave off immense poaching pressures and at levels to meet international

standards of best practice. Moreover, African wildlife and wilderness is a global asset and one which requires global effort and contribution if it is to be conserved.

It is estimated that Africa's PA's require approximately US$1 Billion per annum to meet their conservation and community development objectives of which they are perhaps realising about a quarter. The developed world, which has largely depleted its own wildlife and wilderness resources, needs to help. This is especially so in the context of vital eco-services and global wildlife assets provided to the world by third world PA's, but at present all steps seem to be taken to reduce Africa's ability to generate income from and for wildlife – without concomitant steps to increase external funding. In this regard, industrialised nations have never fulfilled agreements made at the 1992 Rio Summit to allocate US$2Billion a year in international conservation aid (26).

14.3. COUNTER-PRODUCTIVITY OF UNILATERAL BANS

Following the 2014 USFWL ban on importation of ivory from legally hunted elephant in Zimbabwe the market for elephant hunts by US citizens – who formerly accounted for between 75% and 85% of legal elephant hunting in Zimbabwe - has predictably declined, along with revenues.

Coinciding with an escalating demand for ivory and other animal products from the Far East, over the same period elephant poaching in the Zambezi Valley – a world heritage wilderness of outstanding importance and home to the globally-renowned Mana Pools National Park – has escalated exponentially.

It is not possible to say to what extent, if any, the ban has contributed to the escalation in poaching, but what is true is that the ban has certainly not averted the poaching and unsustainable loss of elephants and other species in this magnificent landscape.

What we do know, from actual financial data and employment records, is that hunting operators around Mana Pools National Park have had to cut back on their previous levels of anti-poaching manpower and effort as a result of reduced income – and this is at least partly attributable to the ban – through reduced number of elephant hunts being sold as well as reduction in price per hunt.

We also know that one of the unintended consequences of the ban was the prompt shift by a number of operators in marketing of elephant trophies to less discerning market less concerned with principles of fair-chase, ethics and sustainability.

As the industry pivots away from US (and potentially now EU) markets towards clientele from less discerning countries, this not only forgoes opportunity for leverage towards good governance and management but also reduces relevance of the US and the EU in the dialogue in favour of sound natural resource management and conservation in Africa.

In Kenya, safari hunting was banned completely in 1977. This deprived the National Parks and Protected Area network of important buffer areas and wildlife populations plummeted by 70% over the next decade. The hunting ban certainly did not mitigate the wholesale slaughter of wildlife or loss of conservation land.

In Botswana, cessation of safari hunting has resulted in many former hunting areas now lying idle (25) and neglected with some having been converted to livestock farming areas and, in the process, communities formerly reliant on hunting income have been disenfranchised.

Trade or hunting bans have not only proved counter-productive in Africa. Research in North America has shown that US trade bans for hunting of polar bears in Canada – in response to climate change and diminishing sea ice - has failed to decrease total harvests but has reduced revenue generation and the proportion of quotas taken by sport hunters from specific populations. The researchers found that "*consequently, the import ban impacted livelihoods of Arctic indigenous communities with negative conservation — reduced tolerance for dangerous fauna and affected local participation in shared management initiatives*" to the detriment of the conservation of this species (27).

As is the case in the emotive motion brought to the EU parliament – this latter example, seeks to use trade-bans to address non-trade challenges, being climate change in the case of the polar bear and poor regulation and habitat destruction in the case of many other hunting nations.

Rather than imposing unilateral bans – from which there is no realistic chance of reprieve and which effectively reduce revenues for conservation, it would be far more effective for developed countries to work with conservation stakeholders in the developing world in support of efforts to improve regulation and management of hunting, management and funding of hunting blocks and other conservation areas – understanding that African wildlife and wilderness are global assets requiring more to secure them than hunting can generate. In this it would of more beneficial for the US and the EU to provide financial and technical support and collaboration in re-building scientifically sustainable hunting programmes, monitoring and adaptive management systems, to assist in bolstering PA management and to identify and strengthen alternative revenue streams.

14.4. COMMENT ON "NON-DETRIMENT"

While we would agree that "non-detriment" on free-ranging wildlife populations is crucially important, the term as it is most frequently interpreted under CITES – which is that a given transaction will have no detrimental effect on the *survival* of the species concerned – we believe that it is of limited value without any dimension relating to the conservation of the species within context of the broader ecosystem.

For example, if "non-detriment" or "conservation success" is to be measured merely in terms of number of animals and population sustainability, then under this definition a canned-hunting lion farm containing 500 captive-bred lions on 500 hectares in South Africa is equivalent in its conservation value and "sustainability" to a population of 500 free-ranging wild lions on the 3,400,000 Hectare Bubye Valley Conservancy – which is clearly nonsense.

14.5. ACCOUNTABILITY OF LOBBYISTS AND PRESSURE GROUPS

The example cited in the Introduction – regarding the lack of follow-up from anti-hunting groups in response to Bubye Valley Conservancy's donation of 200 lions looking for a new home – is a classic case of not putting your money where your mouth is.

Unfortunately this is one of the main tragedies of this entire issue - that lobby groups, NGOs, officials and individuals – who raise huge amounts of money on the back of misinformed public sentiment and who are agitating to outlaw hunting without presenting a single financially sustainable alternative are gambling with a wildlife heritage, wilderness and natural resource that does not belong to them and for which they cannot be held truly accountable.

Once it is lost it will be lost for good, and it is us Africans who will be the losers.

15. CONCLUSION

The Ethics and Coordination Committee for Ethical and Sustainable Hunting in Zimbabwe continues to support the legal, controlled and sustainable consumptive utilization of wildlife in Zimbabwe as a revenue generation tool for the preservation of intact habitat and wilderness as the basis to ensuring that wildlife, including key species such as elephant, rhino, lion and leopard can continue to exist in the wild in Zimbabwe.

We are furthermore in agreement with the need to comply with international requirements of best conservation practice and findings of non-detriment but acknowledge our current inability to deliver in this regard. We therefor appeal, in the first instance for a grace period, and in the second instance, for technical and financial support and cooperation to assist the rehabilitation of cost effective, institutionally robust, scientifically rigorous, credible and accountable systems for sustainable management of hunting and conservation in Zimbabwe.

We urge the European Union to use openly available facts to formulate their polices in relation to wildlife conservation in Zimbabwe and to engage and work with Zimbabwe in its continued efforts in both private and public sectors to improve regulation and sustainability of conservation and to generate much needed revenue through both consumptive and non-consumptive tourism. The signing of this position paper would amount to an act of neo-colonialism and an attack on the sovereignty of Zimbabwe.

Banning safari hunting without providing an effective alternative source of revenue for the conservation of wildlife in hunting areas is not a clever solution to these problems because it leaves a void that is rapidly filled by destructive activities such as poaching, habitat destruction and human encroachment. It is far better to assist to strengthen and enforce the industry's regulatory and governing frameworks to achieve minimum standards of best international practice.

Decisions for restriction of hunting, if any, should not be indefinite without reasonable expectation of resumption of normal trade in time. They should also be highly specific and targeted to reform specific concerns; be based on sound scientific fact; be cognisant of adverse impacts on biodiversity and iconic species conservation; be cognisant of adverse impacts on community livelihoods; be based on consultation with affected range state governments, communities and conservation stakeholders; avoid undermining local approaches to conservation, and, moreover, should only be taken after identification and implementation of sustainable and fully funded alternatives backed up with requisite commitment to both technical and financial support.

The challenge for those who cannot, under any circumstances, tolerate trophy hunting on ethical grounds is to come up with an effective and practical alternative to generate the desperately needed revenue for the conservation of wildlife in hunting areas. However, despite many decades of anti-hunting sentiment, lobby groups have failed to come up with alternatives, possibly because no viable options exist, apart from philanthropy, for the marginal types of landscapes where trophy hunting is currently practiced. Philanthropy on a large scale may work, but experience has shown that most anti-hunting groups fall silent when asked to back their words with money, leaving hunting as the only, albeit imperfect, land-use option for wildlife areas that are unsuitable for ecotourism. Payments for eco-services and performance incentive schemes are promising but need to be more fully developed, more widely accepted and more adequately funded.

16. ACTION PLAN

1. Endorse and implement recommendations of the June 2015 Workshop for Review and Reform of Hunting in Zimbabwe.
2. Endorse and support the EU-funded CAMPFIRE Stakeholder's Review and ensure that the process is broadly consultative and reconciliatory with stakeholder communities and their Traditional Leadership.
   To this end it is agreed that the National Council of Chiefs will be represented on the Steering Committee of the CAMPFIRE and NR Steering Committee (in addition to representation on the ECC).
3. Constitute and mandate the Ethics and Coordination Committee for Ethical and Sustainable Hunting in Zimbabwe to:
   a. Draft and enforce an updated Code of Conduct and Best Hunting Practice.
   b. Establish and capacitate a National Secretariat for the ECC to undertake data collection, data management, annual reporting, communication, coordination, fund-raising, marketing and advocacy for the industry.
   c. Develop cost-effective, practical and scientifically robust tools for monitoring key parameters – trophy quality & ages, ecological trends, revenues, tourism, community dividends & development, wildlife management, law enforcement, etc.
   d. Establish Technical Committees in each of the 4 eco-regions – Zambezi, Sebungwe, Hwange & lowveld – to undertake:

i. Data Collection - Ecological, hunt, tourism, revenue, community – using simple scientifically designed methodologies
ii. Trophy Monitoring – age and quality
iii. Adaptive Science-based Quota Setting
iv. Draft and enforce locally appropriate by-laws
v. Operator selection, monitoring and evaluation

e. Undertake comprehensive data collection and management.
f. Publish annual reports and Non-Detriment Findings.
g. Inform adaptive science-based quota setting.
h. Undertake funding and fund-raising activities; coordinate communications and public relations; advocacy, marketing etc.

4. Review policies – such as SI 26 of 1998 - that are counterproductive to conservation and contradictory to the basic conservation principles and assumptions of the primary Parks and Wildlife Act.
5. Develop and implement NDF frameworks and systems for all outstanding CITES Appendix I and II species.
6. Develop a phased 5 and 10 year strategy for diversification and strengthening of a full array of NR-based revenue streams.
7. Develop and endorse a proposal under the Ethics and Coordination Committee seeking a grace period as well as technical and financial assistance in implementing the abovementioned reforms from the 11th EDF and other donors and trade partners.
8. Support and communicate positive developments and initiatives – including sanction brought against illegal or unethical behaviour or otherwise aimed at improved inclusivity management, accountability and sustainability of hunting and conservation in Zimbabwe.

References

1. **IUCN Sustainable Use and Livelihoods Specialist Group.** *A briefing paper for European Union decision-makeers regarding the proposed EU Parliament motion to prohibit imports of hunting trophies.* Gland : IUCN, 2016.

2. *Lion (Panthera leo) are declining rapidly across Africa, except in intensively managed areas.* **Bauer H, Chapron G, Nowell K, Henschel P, Funston P, Hunter LTB, Macdonald DW & C Packer.** 48, 2015, PNAS.org, Vol. 112, pp. 14894-14899.

3. **European Commission.** http://ec.europa.eu. [Online] March 10, 2016. http://ec.europa.eu/environment/nature/conservation/wildbirds/hunting/index_en.htm.

4. **US Fish & Wildlife Service.** www.fws.gov. *US Fish & Wildlife Service.* [Online] 10 March 2016. www.fws.gov/refuges/hunting/whyAllowed.html.

5. **IUCN SSC.** *IUCN SSC Guiding Principles on Trophy Hunting as a Conservation Tool.* Gland : IUCN SSC, 2012.

6. **Convention on Biological Diversity.** https://www.cbd.int/. [Online] 15 March 2016.

7. —. *Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity.* Montreal : Secretariat of the Convention on Biological Diversity, 2004.

8. *The Trophy Hunting of African Lions: Scale, Current Management Practices and Factors Undermining Sustainability.* **Linsey PA, Balme GA, Funston P, Henschel P, Hunter L, Madzikanda H, Midlane N, Nyirenda V.** 9, 2013, PLoS One online publication, Vol. 8, p. e73808.

9. **R, Maponde.** www.southerneye.co.zw. [Online] Southern Eye Newspaper, 20 October 2013. [Cited: 4 April 2016.] http://www.southerneye.co.zw/2013/10/20/hunger-turns-villagers-poachers/.

10. **Lodzi Hunters.** *2015 Concession Report - Tsholotsho South.* Bulawayo : Lodzi Hunters, 2015.

11. **European Environment Agency.** *The European Environment.* Copenhagen : European Environment Agency, 2015.

12. **Tusk Trust.** http://www.tusk.org. [Online] 16 March 2016. http://www.tusk.org/poaching-crisis/uk?gclid=Cj0KEQjw5Z63BRCLqqLtpc6dk7gBEiQA0OuhsKctEREJjWZZg1kWkVNYkKuTJzaIhXczenyYtu93wbQaAkJB8P8HAQ.

13. **UK government.** https://www.gov.uk/. [Online] 16 March 2016. https://www.gov.uk/government/topical-events/illegal-wildlife-trade-2014/about.

14. **Welsh, Bryan.** TIME Explains: the link between wildlife trafficking and terrorism. [Online] 2016. [Cited: 10 April 2016.] http://content.time.com/time/video/player/0,32068,2714920957001_2153708,00.html.

15. *Trophy Hunting in Africa: long term trends in antelope horn size.* **Crosmar WG, Loveridge AJ, Ndaimani H, Lebel S, Booth V, Cote SD, Fritz H.** 2013, Animal Conservation, Vol. 16, pp. 648-660.

16. *Trophy hunting and conservation in Africa: problems and one potential solution.* **Lindsey PA, Frank LG, Mathieson A, Romanach SS.** 2006, Conservation Biology, pp. 21:880-883.

17. *Potential of trophy hunting to create incentives for conservation in Africa where alternative wildlife-based land uses may not be viable.* **Lindsey PA, Alexander R, Frank LG, Mathieson A, Romanach SS.** 2006, Animal Conservation, pp. 9: 283-291.

18. **du Preez B, Groom R, Mufute O, Mandisodza-Chikerema R & Booth V.** *Sport-hunting and Lion (Panthera leo) conservation in Zimbabwe.* Harare : Zimbabwe Lion conservation and research group, 2016.

19. **Save Valley Conservancy (SVC).** *Wildlife Population Trends on the Save Valley Conservancy - 1998 to 2015.* Chiredzi : Save Valley Conservancy, 2016.

20. *Conserving large carnivores: Dollars and fence.* **C, Packer.** 2013, Ecology letters. Blackwell Publishing Ltd.

21. **(Editors), Booth VR & Chardonnet P.** *Guidelines for improving the administration of sustainable hunting in sub-Saharan Africa.* Harare : FAO, 2015.

22. *Trophy Hunting in Sub-Saharan Africa: Economic Scale and Conservation Significance.* **PA, Lindsey.** 2008, Best Practices in Sustainable Hunting, pp. 41-47.

23. *Exerpt from SAOZ AGM minutes.* **Zimbabwe Safari Operators Association of Zimbabwe (SOAZ).** Harare : s.n., 2016. SOAZ AGM minutes.

24. **Southwick Associates Report.** *Hunting in America: an economic force for conservation; REPORT for the National Shooting Sports Foundation and the Association of Fish & Wildlife Agencies.* Washington : Southwick Associates, 2013.

25. *Life after Cecil: channeling global outrage into funding for conservation in Africa.* **Lindsey PA, Balme GA, Funston PJ, Henschel & Hunter LTB.** na, 2015, Conservation letters - a Journal of the Society for Conservation Biology, Vol. na, pp. 1-6.

26. *Explaining global patterns of international aid for linked biodiversity conservation and development.* **DC, Miller.** 2014, World Development, Vol. 59, pp. 341-359.

27. *Unexepected and undesired conservation outcomes of wildlife trade bans - An emerging problem for stakeholders?* **Weber DS, Mandler T, Dyck M, Van Coeverden de Groot PJ, Lee DS, Clark DA.** 2015, Global Ecology and Conservation, Vol. 3, pp. 389-400.

28. **CAMPFIRE Association.** *Annual CAMPFIRE Income Report.* Harare : CAMPFIRE Association, 2014.

29. *Proceedings of the CAMPFIRE Stakeholder's Workshop: Towards the development of a new elephant management plan and policy. 17-18 Nov 2014.* **Gandiwa E, Jonga C and Mufuti O (editors).** Harare : CAMPFIRE Association, 2014.

Surveys of lions *Panthera leo* in protected areas in Zimbabwe yield disturbing results: what is driving the population collapse?

Rosemary J. Groom, Paul J. Funston and Roseline Mandisodza

Abstract The African lion *Panthera leo* is an iconic species but it has faced dramatic range reductions and possibly as few as 30,000 individuals remain in the wild. In the absence of detailed ground-based surveys, lion populations may be estimated using regression models based on prey biomass availability but these often overestimate lion densities as a result of a variety of compounding factors. Anthropogenic factors can be key drivers of lion population dynamics and in areas with high human impact lion numbers may be significantly lower than those predicted by prey biomass models. This was investigated in two protected areas in Zimbabwe, where lion population densities were found to be significantly lower than would have been predicted by prey-availability models. High hunting quotas either within or around the protected areas are the most likely cause of the low lion numbers, with quotas in some areas being as high as seven lions per 1,000 km^2 in some years. Other factors, including persecution, poisoning and problem animal control, as well as disease and competition with spotted hyaenas *Crocuta crocuta*, are also discussed.

Keywords African lion, call-up survey, edge effects, *Panthera leo*, prey-biomass models, snaring, trophy hunting, Zimbabwe

Introduction

African lions *Panthera leo* and spotted hyaenas *Crocuta crocuta* are two of the most iconic of Africa's large carnivores. Whereas spotted hyaenas are widely distributed throughout Africa, lions are now believed to number only 32,000–35,000 individuals, with only ten areas qualifying as lion strongholds (Riggio et al., 2013). The low number of lions is already cause for concern but the reality may be even more serious given that most estimates are based on educated guesses, often related to prey availability (Chardonnet, 2002; Bauer & van der Merwe, 2004; IUCN SSC Cat Specialist Group, 2006).

As the potential density of large carnivores is scaled with biomass of prey (Carbone & Gittleman, 2002), carnivore density can be estimated indirectly using regression models based on available prey biomass (Gros et al., 1996; Hayward et al., 2007). However, this rarely relates to real densities in many natural systems because of a number of largely anthropogenic factors. Thus using indirect methods has the potential to overestimate the number of large carnivores in an area (Kiffner et al., 2009; Croes et al., 2011). Relying on such models in the face of the financial, logistical and time constraints of conducting direct population surveys may result in unreliable estimates of population size (Ferreira & Funston, 2010).

For lion populations a variety of limiting factors have been identified (Kiffner et al., 2009), including habitat fragmentation, epizootic diseases (Kissui & Packer, 2004) and, most importantly, increasing human–lion conflict and associated persecution of lions (Woodroffe & Frank, 2005). Deaths in wire snares, illegal hunting, use of lethal means for problem animals, and prey losses as a result of the bushmeat trade can also affect populations (Lindsey et al., 2011), causing decline or local extinction of lions, even within protected areas (Woodroffe & Ginsberg, 1998). Trophy hunting can also contribute to declining lion numbers in protected areas, as has been illustrated in Hwange National Park, Zimbabwe (Loveridge et al., 2007). Conversely, trophy hunting can create incentives for the retention of land for wildlife and thus benefit conservation of lions (Lindsey et al., 2012).

Here we examine the situation in two protected areas in Zimbabwe, Gonarezhou National Park and the Tuli Safari Area. We used call-up surveys to obtain direct estimates of lion populations and compared actual lion densities with potential density estimates. Call-up stations are a popular technique for surveying lions and hyaenas (Smuts et al., 1977; Ogutu & Dublin, 1998; Mills et al., 2001; Ferreira & Funston, 2010). The calibrated technique described by Ferreira & Funston (2010) was used to estimate lion populations in both protected areas. We also present data on trophy hunting for lions for both areas and discuss to what extent hunting may have affected lion populations.

Rosemary J. Groom (Corresponding author) Department of Zoology, University of Johannesburg, PO Box 524, Auckland Park 2006, South Africa, and African Wildlife Conservation Fund, 10564 NW 57th St, Doral, Florida 33178, USA. E-mail rosemary@africanwildlifeconservationfund.org

Paul J. Funston Department of Nature Conservation, Tshwane University of Technology, Pretoria, South Africa

Roseline Mandisodza Zimbabwe Parks and Wildlife Management Authority, Harare, Zimbabwe

Received 20 June 2012. Revision requested 13 August 2012.
Accepted 19 October 2012. First published online 10 February 2014.

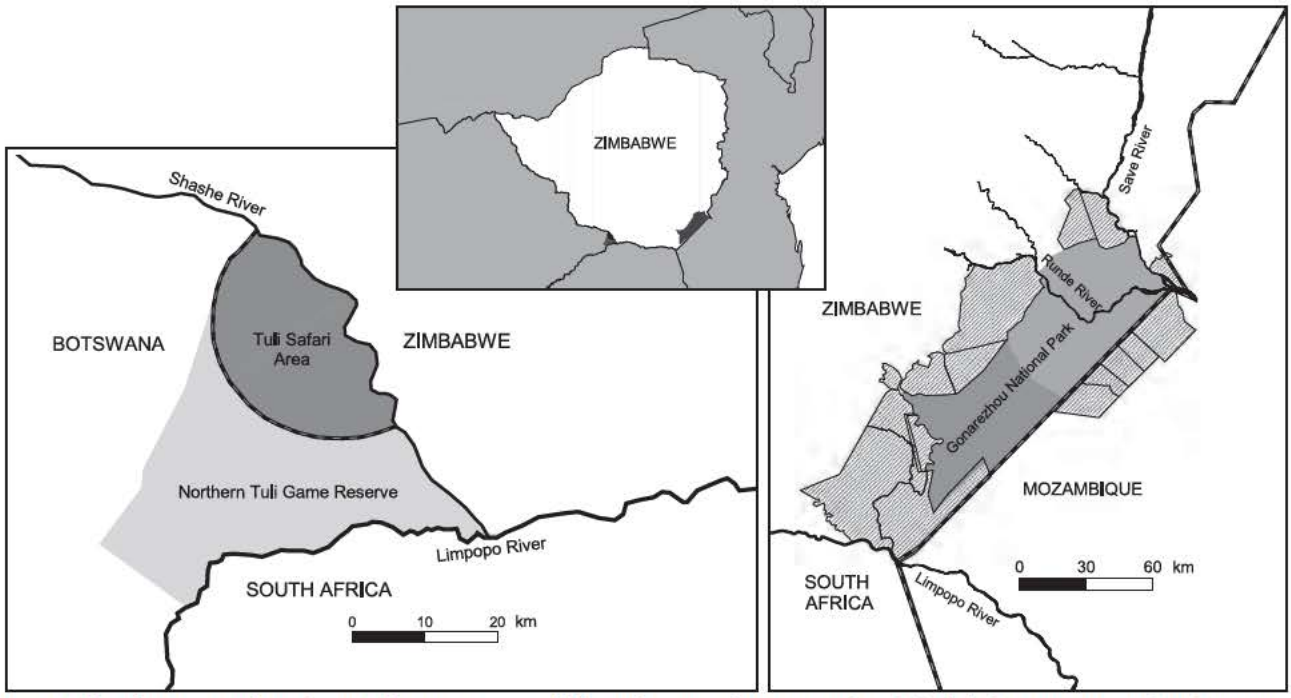


FIG. 1 Tuli Safari Area and Northern Tuli Game Reserve (left), and Gonarezhou National Park (right) showing surrounding hunting concessions (hatched areas). The black areas on the inset indicate the location of the two areas in Zimbabwe.

Study areas

Gonarezhou National Park (hereafter Gonarezhou) in south-east Zimbabwe comprises 4,963 km² and was gazetted as a national park in 1975. It borders Mozambique along its eastern edge and Kruger National Park in South Africa lies <50 km to the south-west. The biomass density of key herbivore species in Gonarezhou is only slightly lower than that in the similarly vegetated north-western part of Kruger (Ferreira & Funston, 2010: Fig. 1). Consumptive wildlife utilization is not allowed in the Park but is allowed in the surrounding hunting concessions (Fig. 1).

The 416 km² Tuli Safari Area (hereafter Tuli) is situated in the relatively low-lying savannahs of south-western Zimbabwe along the Shashe River. It borders the Northern Tuli Game Reserve in Botswana to the south (Fig. 1). Since 1958 Tuli has been a controlled hunting area, designated as a Safari Area in 1975 under the governance of the Zimbabwe Parks and Wildlife Management Authority. Consumptive use of wildlife is allowed in the Tuli Safari Area through trophy hunting regulated by the Management Authority.

Methods

Call-up survey

Call-up surveys were used to estimate lion and spotted hyaena populations in Tuli and Gonarezhou. Both surveys were conducted during the dark phase of the lunar cycle, in the winter months, during 11–14 July 2009 in Tuli and 3–18 August 2010 in Gonarezhou. We followed the methods used in Kruger by Ferreira & Funston (2010), using a minimum density of eight call-up stations per 1,000 km² to ensure sufficient sampling intensity. Thirty-nine completed stations sampled an area of 2,262 km² (45%) in Gonarezhou and eight stations sampled 100% of the area in Tuli. To ensure independence, stations were placed along roads, a minimum of 8 km apart in Tuli and 10 km apart in Gonarezhou (see Ferreira & Funston, 2010).

At each station the sound of an African buffalo *Syncerus caffer* calf in distress was broadcast continuously for 1 hour, using a 12 volt, 60 watt amplifier connected to two 4-ohm horn speakers, each with a 40 watt driver unit. The speakers were connected in series and placed c. 2.5 m above the ground (in Gonarezhou on the roof of the vehicle and in Tuli on a steel tripod), facing 180° from each other. The vocalizations were broadcast at full volume, with speakers rotated 180° every 15 minutes to get an all-round sound distribution. No bait was provided. Two observers sat in the back of the vehicle and one in the front seat. When any animal was heard approaching, a torch and/or a red-filtered spotlight were used to determine the number of individuals, group composition (age and sex) and time of arrival at the station. A minimum of two and a maximum of four stations were completed each night, starting just after dark and finishing no later than 2.00.

© 2014 Fauna & Flora International, *Oryx*, 48(3), 385 393

Ungulate surveys

Ungulate surveys were conducted using aerial counts, following the well-established procedures for aerial surveys of large African herbivores (Norton-Griffiths, 1978). No counts were available for Tuli and therefore we used estimates from a survey of the adjacent and contiguous Northern Tuli Game Reserve, Botswana (Fig. 1). This survey was flown in September 2008 and was a total count of the 720 km² Game Reserve using a fixed-wing aircraft (Selier, 2008). It was considered reasonable to extrapolate these results to the Tuli Safari Area because of its immediate proximity, similar vegetation and lack of any physical barrier between the two areas. The reliability of this extrapolation is considered further in the discussion, below. In Gonarezhou the aerial survey was a sample count, with a 20% sampling intensity, conducted in September 2009 using a fixed-wing aircraft. Full details are available in Dunham et al. (2010). Estimates were adjusted for undercounting according to Bothma et al. (1990).

Data on hunting of lions

There are 12 hunting concessions directly adjacent to Gonarezhou in Zimbabwe and five more on the Mozambican side (Fig. 1). In Zimbabwe nine of the concessions are state land: eight communal areas where the predominant activity is subsistence agriculture and where wildlife is utilized under the Communal Areas Management Plan for Indigenous Resources (CAMPFIRE), and one safari area (National Parks Estate). The remaining three concessions are classified as alienated land and include one private conservancy and two cooperative areas. Tuli itself is also Parks Estate, where hunting is permitted. Quota data for hunting of lions in Zimbabwe were provided by the Zimbabwe Parks and Wildlife Management Authority. Additional information was gathered from Rural District Council representatives and hunters.

Data analysis

Data from both surveys were analysed as per Ferreira & Funston (2010), taking into account survey effort, variability of response likelihoods, and probability of sampling the same individual more than once. Briefly, a fitted inverse sigmoid model on response data from Kruger predicts that lions respond up to 4.3 ± SE 0.9 km away from call-up stations, thus each station samples 57.7 km². Response probabilities suggest that the number of lions observed at a call-up station needs correction by a factor of 1.51 and 3.66 for groups with and without cubs, respectively (Ferreira & Funston, 2010).

Estimates of abundance of key ungulate species were calculated from the aerial surveys. Following Hayward et al. (2007) we converted these abundance estimates to biomass per km², using 75% of adult female body mass estimates from Stuart & Stuart (2000). Use of 75% of adult female body mass (following Schaller, 1972) is to account for subadults and young in the population. We considered African buffalo, eland *Taurotragus oryx*, giraffe *Giraffa camelopardalis*, wildebeest *Connochaetes taurinus*, zebra *Equus burchelli*, kudu *Tragelaphus strepsiceros* and impala *Aepyceros melampus* to be preferred lion prey species, following Radloff & du Toit (2004), Hayward & Kerley (2005) and Mbizah (2009) and based on our field observations. We then used the following equations to convert prey biomass into an estimate of lion density at carrying capacity

$$y = 10^{(\ 2.158+0.377x)}$$ Hayward et al. (2007)

where y is lion density (km ^{2}) and x is $\log_{10}$(prey biomass in kg km ^{2})

$$y = 0.010x^{0.878}$$ Loveridge & Canney (2009)

where y is lion density (per 100 km²) and x is prey biomass.

Resulting density estimates were multiplied by area to estimate the number of lions in each protected area that could theoretically be supported by the available prey biomass. For comparison, similar calculations were made for spotted hyaenas, following Hayward et al. (2007).

Results

Direct estimates of carnivore populations from surveys

In Gonarezhou lions were seen at only two (5%) of the 39 calling stations; one group of two females and one of eight individuals (total n = 10). This equates to a total population estimate of 33 lions (95% CI 28–39), which is consistent with the results of a spoor survey conducted in Gonarezhou in June 2010, which estimated 34 lions south of the Runde River, extrapolated to 44 in the whole Park (Groom, 2010). In Tuli, no lions responded physically or vocally to the calling stations, and no lion tracks were observed on the roads during 4 days of searching.

For spotted hyaenas the call-up survey in Gonarezhou estimated 400 individuals (95% CI 312–487), with 491 estimated from the spoor survey (Groom, 2010). In Tuli the call-up survey estimated 45 spotted hyaenas (95% CI 35–59).

Indirect lion population estimates from prey biomass availability

Using the calculations of Hayward et al. (2007), biomass density of preferred lion prey in Gonarezhou was calculated

TABLE 1 Summary of estimates of lion *Panthera leo* and spotted hyaena *Crocuta crocuta* populations for Gonarezhou National Park and the Tuli Safari Area (Fig. 1), using various methods.

	Survey estimates		Predictions from prey biomass		Comparison
	Spoor survey[1]	Call up survey	Hayward et al. (2007)	Loveridge & Canney (2009)	Using densities from north west Kruger[2]
Gonarezhou National Park					
Lions	44	33	357	115	248
Spotted hyaenas	491	400	354		
Tuli Safari Area					
Lions		0	40	21	31
Spotted hyaenas		45	66		

[1]Extrapolated from Groom (2010); spoor survey conducted May 2010 in Gonarezhou National Park
[2]Assuming a population density equivalent to that of a habitat with comparable prey biomass in Kruger National Park (Ferreira & Funston, 2010)

to be 494 kg km $^{-2}$, which could support 357 lions (7.2 per 100 km^2). Using the model of Loveridge & Canney (2009) this biomass could support 2.3 lions per 100 km^2 (115 lions). In the ecologically similar north-west section of Kruger National Park, where lion prey biomass is 643 kg km $^{-2}$, lion density was 5.0 per 100 km^2 (Ferreira & Funston, 2010). A similar prey density in Gonarezhou would result in 248 lions in the Park (Table 1).

In Tuli biomass density of preferred lion prey was estimated to be 1,217 kg km $^{-2}$ (through extrapolation from neighbouring Northern Tuli Game Reserve), suggesting the area could support a density of 10.1 lions per 100 km^2 (a total of 42 lions), using the Hayward et al. (2007) model. The Loveridge & Canney (2009) model estimates 21 lions in Tuli, and should the density of lions in Tuli be similar to those areas with similar prey biomass in Kruger (as per Ferreira & Funston, 2010) we would expect 31 lions (Table 1).

Our findings suggest that in Gonarezhou the lion population was at 16% of the mean predicted ecological carrying capacity (range 11–33%). As no lions were seen or heard in Tuli the estimated lion population was 0% of predicted ecological carrying capacity. For spotted hyaenas the Hayward et al. (2007) model predicts 354 individuals in Gonarezhou and 66 in Tuli, relatively similar figures to those estimated by the surveys (Table 1).

Trophy hunt quotas for lions

Hunting quotas in the early 2000s were high in both areas although there has been a significant decrease in quota allocation in recent years (Table 2). In Tuli, from 2005 to 2010, 11 lions were on quota, but only six were actually shot. Success rate in 2008 and 2009 was 0%, after which no lions were on quota. Historical figures for successful hunts for lions around Gonarezhou are not available but, since 2007, despite 29 lions on quota, only two were actually utilized (one as a problem animal control issue) and none have been taken since 2009.

The hunting concessions in Mozambique adjacent to Gonarezhou total 980 km^2. We do not have access to all long-term hunting quota figures but in 2009 there were at least seven male lions on quota in the reserves immediately bordering the eastern boundary of Gonarezhou (H. van der Westhuizen, pers. comm.).

Discussion

In both Gonarezhou and Tuli direct lion density estimates were considerably lower than the theoretical estimates, a finding not repeated for spotted hyaenas. Similar findings are presented by Croes et al. (2011) for northern Cameroon. Before discussing this it is important to evaluate potential biases, some of which could be inherent in the survey design. However, given their similar climatic and vegetation characteristics we see no reasons why the method used in Kruger (Ferreira & Funston, 2010) should not be applicable to the Zimbabwe study sites. The fact that lions were actively hunted in Tuli could also bias the lion response to call-up there. However, lions were not hunted in Tuli using sound recordings or from a vehicle, thus limiting the potential for negative association. Moreover, the complete lack of lion spoor in Tuli, and infrequent reports by rangers of a total of no more than four lions suggest that these results are credible. In Gonarezhou our call-up results correlated closely with spoor survey results (Groom, 2010) and other, anecdotal, evidence. Thus we are reasonably confident that our estimates of lion and spotted hyaena abundance are accurate.

It could be argued that the extrapolation of ungulate estimates from the Northern Tuli Game Reserve may have overestimated ungulate biomass in the Tuli Safari Area. This could be a result of trophy hunting and possibly higher poaching levels in Tuli. However, spotted hyaena numbers were close to the predicted density, and although they forage widely and predate livestock, it is unlikely that the recorded numbers could be sustained without sufficient natural prey.

© 2014 Fauna & Flora International, *Oryx*, 48(3), 385 393

TABLE 2 Lion quota figures, including both male and female lions, for the twelve hunting concessions in Zimbabwe adjacent to Gonarezhou National Park, and in Tuli Safari Area (where only male lions were on quota) for 2001 to 2011 (data from Roseline Chikerema Mandisodza, Zimbabwe Parks and Wildlife Management Authority sport hunting quotas, 2000 2011 records).

Name of property	Area type*	01	02	03	04	05	06	07	08	09	10	11	Total
Gonarezhou National Park (males)													
Malipati Safari Area	SA	1	1	1	1	1	1	1	1	1	0	0	9
Sengwe Area 1	CF	1	1	1	1	1	1	1	1	1	0	0	9
Sengwe Area 2	CF					0	0	0	1	1	0	0	2
Malipati Communal	CF							0	0	0	0	0	0
Naivasha	CF	3	3	2	2	0	0	0	1	1	0	0	12
Chibwedziva	CF	1	1	1	1	0	0	0	1	1	1	1	8
Chizvirizvi	CF	0	0	0	0	0	0	0	0	0	0	0	0
Chitsa	CF	2	2	2	2	0	0	0	0	1	1	1	11
Mahenya/Mutandahwe	CF	1	1	1	1	1	1	1	1	1	0	0	9
Gonakudzingwa Area 1	CO				0	0	0	0	0	1	0	0	1
Gonakudzingwa Area 2	CO						1	1	0	1	0	0	3
Malilangwe Reserve	PR	0	0	0	0	2	2	2	1	1	1	1	10
Total		9	9	8	8	5	6	6	7	10	3	3	74
Gonarezhou National Park (females)													
Naivasha	CF	1	1	1	1	1	0	0	0	0	0	0	5
Chibwedziva	CF	1	1	1	1	0	0	0	0	0	0	0	4
Total		2	2	2	2	1	0	0	0	0	0	0	9
Tuli Safari Area	SA	1	1	1	2	2	3	3	2	1	0	0	16

*SA, safari area; CF, CAMPFIRE area; CO, cooperative; PR, private conservancy

Hunting records for Tuli for 2005–2010 indicate a consistently high trophy quota and hunt success rate for key lion prey species. Thus we are confident that the ungulate abundance estimates were relatively accurate.

Another consideration is that potential predator densities based solely on prey biomass data are not always realistic, especially in areas with highly skewed prey distributions. For example, in Gonarezhou permanent water is restricted to the major river systems and a few perennial pans, which are where the majority of ungulates are concentrated in winter (see maps in Dunham et al., 2010). Thus, while there may be sufficient numbers of prey it is possible that their seasonal distribution may restrict the potential number of lion territories (Packer et al., 2005). However, even in more arid systems lions occupy territories that are seemingly little influenced by water distribution (Funston, 2011).

Thus, even if our lion estimates were biased by any of these factors, the differences between the predicted and estimated lion numbers are so extreme that we are confident that lions are currently well below their potential densities in both areas, having experienced a population collapse at some time in the past. This, combined with spotted hyaena densities approximating potential densities, suggests that prey biomass was not the driver of low lion abundance in these areas. This is further supported by the fact that estimates of densities of other carnivore species in Gonarezhou (R. Groom, unpubl. data) were similar to predicted densities; e.g. for leopards *Panthera pardus* (159 leopards from the spoor survey, using the equation of Funston et al. (2010), compared with 121 predicted from the Hayward et al. (2007) model) and for African wild dogs *Lycaon pictus* (c. 80 wild dogs from direct monitoring compared with 72 predicted by the model).

After reviewing the literature for other potential drivers of low lion abundance we conclude that these could include intra-guild competition with spotted hyaenas, diseases or anthropogenic influences. Both areas had a relatively high density of spotted hyaenas (8.1–10.8 per 100 km^2). However, there is no firm evidence suggesting that hyaenas affect lion populations (Hayward & Kerley, 2008), although they may compete with them for carcasses (Cooper, 1991).

Disease can severely affect lion populations (Kissui & Packer, 2004; Cleaveland et al., 2005) but there was no evidence of any disease in the lions in either reserve and there were no reports of sick, thin or weak lions and no unexplained carcasses. Although bovine tuberculosis has been noted in lions in nearby Kruger (De Vos et al., 2001; Michel et al., 2006; Keet et al., 2010), it is mainly restricted to southern Kruger (Rodwell et al., 2000) and at present there is no evidence of it affecting either African buffalo (Cross et al., 2009) or lion populations (Ferreira & Funston, 2010) there.

Thus we do not ascribe the suppression of lion numbers to disease and conclude that the population collapse was most likely driven by anthropogenic influences.

We surmised that these could include unsustainably high trophy hunting quotas within Tuli and in the concessions around Gonarezhou, illegal killing of lions (including shooting, poisoning and snaring) both in and outside these areas, and high levels of lethal problem animal control.

In assessing the impact of trophy hunting we consider that although Gonarezhou is a protected area with no legal utilization of lions, hunting of lions is allowed in all concessions areas adjacent to the Park. The majority of these are CAMPFIRE areas and most of the lions hunted originate from the Park (RJG, pers. obs.). Quotas are generally proposed by the landowners or CAMPFIRE or council representatives and approved by the Parks and Wildlife Management Authority, which has typically based the allocation at least partly on estimates of the number of lions in the Park. Prior to our recent population surveys these were considerably overestimated. Between 2001 and 2011 a total of 74 male and nine female lions were on quota in the Zimbabwe hunting concessions adjacent to Gonarezhou. However, there have been no females on quota since 2006, and only six males since 2009, after recognition of the low lion numbers in the Park and decreasing trophy size. No lions have been hunted in these concessions since 2009. In the 980 km^2 of hunting area adjacent to Gonarezhou in Mozambique the 2009 quota of seven male lions was 14 times higher than the general recommendation of 0.5 lions per 1,000 km^2 (Packer et al., 2011).

Similarly high quotas were set for the much smaller Tuli Safari Area, with a total of 16 male lions on quota between 2000 and 2009, with three on quota in each of 2006 and 2007. This is a high number for an area of only 416 km^2 and would no doubt have had a major impact on the lion population, despite no females being hunted. A moratorium on hunting of lions in Tuli was imposed in 2010 and 2011 because of this.

Significant edge effects in Gonarezhou may have been induced by hunters drawing lions out of the Park with carcass baits placed near the Park boundaries, as has been reported elsewhere (Loveridge et al., 2007). The primary problem with this is the concomitant territorial vacuum that draws lions from further inside protected areas, which increases their vulnerability to hunting and increases infanticide rates in boundary prides (Loveridge et al., 2007). The extent of these effects depends on the size and shape of the protected area and the home range dynamics of its lions. Gonarezhou, although relatively large, is long and thin, greatly increasing its boundary length to surface area ratio and thus its vulnerability to edge effects (Woodroffe & Ginsberg, 1998). Furthermore, given the relatively low prey density in the Park, lion home ranges are likely to be large. Even in Hwange National Park Loveridge et al. (2009) found that lion home ranges there typically covered several hundred km^2. It is thus likely that in Gonarezhou almost all lion prides would have home ranges that include boundary areas of the Park, exposing them to the risks outlined above. Although not the only factor, excessive trophy hunting combined with significant edge effects suggests that hunting has probably had a strong negative effect on lion abundance in both reserves.

These effects are also potentially exacerbated by both illegal killing and problem animal control. Within and outside both reserves lions were illegally killed for skins, caught in snares and also probably affected by the poisoning events recorded for other species (H. van der Westhuizen, pers. comm.; Snyman, 2011). Lions are often accidentally caught in wire snares set for other species (Lindsey et al., 2011) and are especially vulnerable because they are attracted to carcasses in snare-lines. In Hwange National Park 11.8% of recorded lion mortality was because of snaring (Loveridge et al., 2007). Generally, however, these sources of mortality are difficult to measure accurately as evidence of illegal killing is often concealed (Loveridge et al., 2007) but anecdotal evidence suggests they may be considerable.

Another important cause of lion mortality in Gonarezhou was the destruction of lions considered to be problem animals. Problem animal control incidences are poorly recorded and the responsibility is often handed over to hunting operators, with apparently little record-keeping (RJG, pers. obs.). However, we acquired records of at least 18 lions being shot as problem animals between 1993 and 2009 around the southern half of Gonarezhou. In many cases the sex of the lion killed was not recorded but at least five of them were females and one was a cub. This is likely to affect the population negatively, as regular removal of even small numbers of reproductive females can expose a population to decline (Van Vuuren et al., 2005). Moreover, as reproductive success is closely related to pride size, and prides of three or more adult females are significantly more successful at rearing cubs than smaller prides (Packer et al., 1988), removal of adult females may result in lower cub survival. Since 2009 there has been virtually no lethal problem animal control for lions around Gonarezhou, although lions are still reported to be killing livestock and there is evidence that communities poison them. Exact figures are unknown but presumed to be higher than recorded.

There is a growing recognition that efforts must be made to reduce conflict between carnivores and local communities. These include education and outreach efforts, training in predator-friendly livestock management practices, and increasing community benefits from wildlife resources. Additionally, effective law enforcement is critical, and appropriate penalties for illegal killing of carnivores need to be enforced. Effective anti-poaching efforts to reduce deaths in snares, reduction of unnecessary lethal problem animal control, and enhanced cooperation with relevant authorities in neighbouring countries for effective cross-border law enforcement are also crucial.

© 2014 Fauna & Flora International, *Oryx*, 48(3), 385 393

There are also several interventions that could be considered to reduce the edge effects of hunting, including banning the use of baits on park boundaries, monitoring trophy ages, with appropriate penalties for harvesting underage animals (Whitman et al., 2004), establishing buffer zones where lion hunting is excluded along park boundaries (Loveridge et al., 2007), and ensuring quotas are realistic and based on robust population estimates and/or limiting quotas based on the area of the hunting concession (Packer et al., 2011). If the guideline of 0.5 lions per 1,000 km² (Packer et al., 2011) were enforced this would preclude lion hunting in Tuli and probably reduce the hunting around Gonarezhou to sustainable levels, as long as this guideline was followed in Mozambique as well as in Zimbabwe.

Our results suggest that where carnivore populations are subject to anthropogenic influences, densities derived from prey biomass equations tend to be overestimated and should be treated with caution, even for protected areas. The low lion populations in both of the studied protected areas in Zimbabwe are largely attributable to the net effect of various anthropogenic influences, primarily previously excessive trophy hunting and indiscriminate problem animal control, with additional influences of poaching and persecution. Given the widespread and strikingly similar problems in many other areas (Ogutu et al., 2005; Woodroffe & Frank, 2005; Kiffner et al., 2009; Packer et al., 2009; Tumenta et al., 2010) and for other species (Balme et al., 2010), it is critical that effective strategies are designed and implemented to reduce these negative impacts. Trophy hunting for lions is a valuable management and conservation tool but needs much stricter regulation, especially in and around relatively small and/or isolated protected areas.

Acknowledgements

Work in Gonarezhou National Park was carried out under permit number 23(1)(c)(ii)23/2010 from the Zimbabwe Parks and Wildlife Management Authority (ZPWMA). ZPWMA and the Research Council of Zimbabwe are thanked for permission to conduct the research. ZPWMA staff in Gonarezhou National Park and Tuli Safari Area are thanked for their help and support, specifically Dr Norman Monks, Julius Shimbani, Edson Gandiwa and Patience Gandiwa. We are grateful to Hugo and Elsabe van der Westhuizen from Frankfurt Zoological Society for logistical support in Gonarezhou. The survey in Gonarezhou was funded by Frankfurt Zoological Society, National Geographic Conservation Trust and Rufford Small Grants Foundation. The Tshwane University of Technology and Conservation Force are thanked for financial support of the Tuli Safari Area survey.

References

Balme, G.A., Slotow, R. & Hunter, L.T.B. (2010) Edge effects and the impact of non protected areas in carnivore conservation: leopards in the Phinda Mkhuze Complex, South Africa. *Animal Conservation*, 13, 315 323.

Bauer, H. & van der Merwe, S. (2004) Inventory of free ranging lions *Panthera leo* in Africa. *Oryx*, 38, 26 31.

Bothma, J.d.P., Peel, M.S.J., Petit, S. & Grossman, D. (1990) Evaluating the accuracy of some commonly used game counting methods. *South African Journal of Wildlife Research*, 20, 26 32.

Carbone, C. & Gittleman, J.L. (2002) A common rule for the scaling of carnivore density. *Science*, 295, 2273 2276.

Chardonnet, P. (2002) *Conservation of the African Lion: Contribution to a Status Survey*. International Foundation for the Conservation of Wildlife, Paris, France, and Conservation Force, Metairie, USA.

Cleaveland, S., Mlengeya, T., Kazwala, R.R., Michel, A., Kaare, M.T., Jones, L. et al. (2005) Tuberculosis in Tanzanian wildlife. *Journal of Wildlife Diseases*, 41, 446 453.

Cooper, S.M. (1991) Optimal hunting group size: the need for lions to defend their kills against loss to spotted hyaenas. *African Journal of Ecology*, 29, 130 136.

Croes, B.M., Funston, P.J., Rasmussen, G., Buij, R., Saleh, A., Tumenta, P.N. & de Iongh, H.H. (2011) The impact of trophy hunting on lions (*Panthera leo*) and other large carnivores in the Bénoué Complex, northern Cameroon. *Biological Conservation*, 144, 3064 3072.

Cross, P.C., Heisey, D. M., Bowers, J. A., Hay, C. T., Wolhuter, J., Buss, P. et al. (2009) Disease, predation and demography: assessing the impacts of bovine tuberculosis on African buffalo by monitoring at individual and population levels. *Journal of Applied Ecology*, 46, 467 475.

De Vos, V., Bengis, R.G., Kriek, N.P., Michel, A., Keet, D.F., Raath, J.P. & Huchzermeyer, H.F.K.A. (2001) The epidemiology of tuberculosis in free ranging African buffalo (*Syncerus caffer*) in the Kruger National Park, South Africa. *Onderstepoort Journal of Veterinary Research*, 68, 119 130.

Dunham, K.M., van der Westhuizen, E., van der Westhuizen, H. & Gandiwa, E. (2010) Aerial survey of elephants and other large herbivores in Gonarezhou National Park (Zimbabwe), Zinave National Park (Mozambique) and surrounds: 2009. In *Gonarezhou Conservation Project*. Parks and Wildlife Management Authority and Frankfurt Zoological Society, Gonarezhou National Park, Chiredzi, Zimbabwe.

Ferreira, S.M. & Funston, P.J. (2010) Estimating lion population variables: prey and disease effects in Kruger National Park, South Africa. *Wildlife Research*, 37, 194 206.

Funston, P.J. (2011) Population characteristics of lions (*Panthera leo*) in the Kgalagadi Transfrontier Park. *South African Journal of Wildlife Research*, 41, 1 10.

Funston, P.J., Frank, L., Stephens, T., Davidson, Z., Loveridge, A.J., Macdonald, D. et al. (2010) Substrate and species constraints on the use of track incidences to estimate African large carnivore abundance. *Journal of Zoology*, 281, 56 65.

Groom, R.J. (2010) *Carnivore Densities in the Gonarezhou National Park. Results of the May 2010 Spoor Survey*. African Wildlife Conservation Fund, unpublished report. Gonarezhou National Park, Chiredzi, Zimbabwe.

Gros, P.M., Kelly, M.J. & Caro, T.M. (1996) Estimating carnivore densities for conservation purposes: indirect methods compared to baseline demographic data. *Oikos*, 77, 197 206.

Hayward, M.W. & Kerley, G.I.H. (2005) Prey preferences of the lion (*Panthera leo*). *Journal of the Zoological Society of London*, 267, 309 322.

Hayward, M.W. & Kerley, G.I.H. (2008) Prey preferences and dietary overlap amongst Africa's large predators. *South African Journal of Wildlife Research*, 38, 93 108.

Hayward, M.W., O'Brien, J. & Kerley, G.I.H. (2007) Carrying capacity of large African predators: predictions and tests. *Biological Conservation*, 139, 219 229.

IUCN SSC Cat Specialist Group (2006) *Regional Conservation Strategy for the Lion* Panthera leo *in Eastern and Southern Africa*. IUCN SSC Cat Specialist Group, Gland, Switzerland. Http://www.catsg.org/catsgportal/bulletin board/05 strategies/Lion%20Conserv%20Strat%20E&S%20Africa%202006.pdf [accessed 6 December 2013].

Keet, D.F., Michel, A.L., Bengis, R.G., Becker, P., van Dyk, D.S., van Vuuren, M. et al. (2010) Intradermal tuberculin testing of wild African lions (*Panthera leo*) naturally exposed to infection with *Mycobacterium bovis*. *Veterinary Microbiology*, 144, 384 391.

Kiffner, C., Meyer, B., Muhlenberg, M. & Waltert, M. (2009) Plenty of prey, few predators: what limits lions *Panthera leo* in Katavi National Park, western Tanzania? *Oikos*, 41, 52 59.

Kissui, B.M. & Packer, C. (2004) Top down population regulation of a top predator: lions in the Ngorongoro Crater. *Proceedings of the Royal Society of London*, 271, 1867 1874.

Lindsey, P.A., Balme, G.A., Booth, V.R. & Midlane, N. (2012) The significance of African lions for the financial viability of trophy hunting and the maintenance of wild land. *PLoS ONE*, 7, e29332.

Lindsey, P.A., Romanach, S., Tambling, C., Chartier, K. & Groom, R.J. (2011) Ecological and financial impacts of illegal bushmeat trade in Zimbabwe. *Oryx*, 45, 96 111.

Loveridge, A.J. & Canney, S. (2009) *African Lion Distribution Modelling Project: Final Report*. Born Free Foundation, Horsham, UK.

Loveridge, A.J., Searle, A.W., Murindagomo, F. & Macdonald, D.W. (2007) The impact of sport hunting on the population dynamics of an African lion population in a protected area. *Biological Conservation*, 134, 548 558.

Loveridge, A.J., Valeix, M., Davidson, Z., Murindagomo, F., Fritz, H. & Macdonald, D.W. (2009) Changes in home range size of African lions in relation to pride size and prey biomass in a semi arid savanna. *Ecography*, 32, 953 962.

Mbizah, M.M. (2009) *Diet choice of African wild dog (*Lycaon pictus*) and competition with other large carnivores in Savé Valley Conservancy, South East Lowveld, Zimbabwe*. MSc thesis. University of Zimbabwe, Harare, Zimbabwe.

Michel, A.L., Bengis, R.G., Keet, D.F., Hofmeyr, M., de Klerk, L. M., Cross, P.C. et al. (2006) Wildlife tuberculosis in South African conservation areas: implications and challenges. *Veterinary Microbiology*, 112, 91 100.

Mills, M.G.L., Juritz, J.M. & Zucchini, W. (2001) Estimating the size of spotted hyaena (*Crocuta crocuta*) populations through playback recordings allowing for non response. *Animal Conservation*, 4, 335 343.

Norton Griffiths, M. (1978) *Counting Animals*. 2nd edition. African Wildlife Leadership Foundation, Nairobi, Kenya.

Ogutu, J.O., Bhola, N. & Reid, R. (2005) The effects of pastoralism and protection on the density and distribution of carnivores and their prey in the Mara ecosystem, Kenya. *Journal of Zoology, London*, 265, 281 293.

Ogutu, J.O. & Dublin, H.T. (1998) The response of lions and spotted hyaenas to sound playbacks as a technique for estimating population size. *African Journal of Ecology*, 36, 83 95.

Packer, C., Brink, H., Kissui, B.M., Maliti, H., Kushnir, H. & Caro, T.M. (2011) Effects of trophy hunting on lion and leopard populations in Tanzania. *Conservation Biology*, 25, 142 153.

Packer, C., Herbst, L., Pusey, A.E., Bygott, J.D., Hanby, J.P., Cairns, S.J. & Mulder, M.B. (1988) Reproductive success of lions. In *Reproductive Success* (ed. T.H. Clutton Brock), pp. 363 383. University of Chicago Press, Chicago, USA.

Packer, C., Hilborn, R., Mosser, A., Kissui, B., Borner, M., Hopcraft, G. et al. (2005) Ecological change, group territoriality, and population dynamics in Serengeti lions. *Science*, 307, 390 393.

Packer, C., Kosmala, M., Cooley, H.S., Brink, H., Pintea, L., Garshelis, D. et al. (2009) Sport hunting, predator control and conservation of large carnivores. *PLoS One*, 4, e5941.

Radloff, F.G.T. & du Toit, J.T. (2004) Large predators and their prey in a southern African savanna: a predator's size determines its prey size range. *Journal of Animal Ecology*, 73, 410 423.

Riggio, J., Jacobson, A., Dollar, L., Bauer, H., Becker, M., Dickman, A. et al. (2013) The size of savannah Africa: a lion's view. *Biodiversity & Conservation*, 22, 17 35.

Rodwell, T.C., Kriek, N.P., Bengis, R.G., Whyte, I.J., Viljoen, P.C., DeVos, V. & Boyce, W.M. (2000) Prevalence of bovine tuberculosis in African buffalo at Kruger National Park. *Journal of Wildlife Diseases*, 37, 258 264.

Schaller, G.B. (1972) *The Serengeti Lion: A Study of Predator prey Relations*. University of Chicago Press, Chicago, USA.

Selier, J. (2008) *Report on the Aerial Game Census of the Northern Tuli Game Reserve, Botswana*. Mashatu Game Reserve, Botswana.

Smuts, G.L., Whyte, I.J. & Dearlove, T.W. (1977) A mass capture technique for lions. *East African Wildlife Journal*, 15, 81 87.

Snyman, A. (2011) *Lion* (Panthera leo) *Social Organization in a Human affected Landscape*. Tshwane University of Technology, Pretoria, South Africa.

Stuart, C.T. & Stuart, T. (2000) *Field Guide to the Larger Mammals of Africa*. Struik Publishers, Cape Town, South Africa.

Tumenta, P.N., Kok, J.S., van Rijssel, J.C., Buij, R., Croes, B.M., Funston, P.J. et al. (2010) Threat of rapid extermination of the lion (*Panthera leo leo*) in Waza National Park, Northern Cameroon. *African Journal of Ecology*, 48, 888 894.

Van Vuuren, J.H., Hermann, E. & Funston, P.J. (2005) Lions in the Kgalagadi Transfrontier Park: modelling the effect of human caused mortality. *International Transactions in Operational Research*, 12, 145 171.

Whitman, K., Starfield, A. M., Quadling, H. S. & Packer, C. (2004) Sustainable trophy hunting of African lions. *Nature*, 428, 175 178.

Woodroffe, R. & Frank, L. (2005) Lethal control of African lion (*Panthera leo*): local and regional population impacts. *Animal Conservation*, 8, 91 98.

Woodroffe, R. & Ginsberg, J. (1998) Edge effects and the extinction of populations inside protected areas. *Science*, 280, 2126 2128.

Biographical sketches

Rosemary Groom works in southern Africa on large carnivore conservation, undertaking research and action to preserve habitat and species at regional scales. She currently works in Zimbabwe on transboundary African wild dog and lion conservation issues. Paul Funston focuses much of his research effort on the behavioural

© 2014 Fauna & Flora International, *Oryx*, 48(3), 385 393

ecology and conservation biology of African lions. Lion populations threatened by anthropogenic factors motivate his travels and research activities throughout Africa, and he is involved in a long term study on the effects of bovine tuberculosis on lions in the Kruger National Park. Roseline Chikerema Mandisodza has been involved in and contributed to the ZPWMA lion, cheetah and wild dog management plans and recently in the drafting of the national captive bred lion policy.

BUBYE VALLEY CONSERVANCY LION RESEARCH REPORT

Dr Byron du Preez [Oxford]
2016-01-12

INTRODUCTION

The United States Fish and Wildlife Service (USFWS) have recently evaluated the conservation status of the lion *Panthera leo* with particular regard to sport-hunting (http://www.fws.gov/endangered/what-we-do/lion.html – accessed 2015-01-08). The results of this evaluation have led to the formal protection of two subspecies under the Endangered Species Act, classifying *P. l. leo* as endangered and *P. l. melanochaita* as threatened. Together these subspecies apparently represent all of the lions in Africa (Barnett et al. 2014).

Sport-hunting is a legal activity that is both sanctioned and carefully controlled by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The USFWS found that the sport-hunting of *P. l. melanochaita* "if well managed, may provide a benefit to the subspecies" (http://www.fws.gov/endangered/what-we-do/lion.html – accessed 2015-01-08). Here we aim to explore this statement further and present data from a long-term *in situ* lion research project.

Please note that this is a preliminary report that just focuses on the Bubye Valley Conservancy in Zimbabwe. A more comprehensive report regarding the status of Zimbabwe's lion populations is currently being produced in collaboration with Dr Andrew Loveridge of Hwange National Park, Dr Rosemary Groom of the Save Valley Conservancy, Dr Peter Lindsey of Panthera, and Roseline Mandisodza-Chikerema of the Zimbabwe Parks and Wildlife Management Authority (ZPWMA), and of course Dr Byron du Preez of the Bubye Valley Conservancy.

LIONS *PANTHERA LEO* AND SPORT-HUNTING

The IUCN Red List have recently reclassified lions as Vulnerable (remaining as such since 1996; IUCN 2015), estimating that there are between 20,000 and 30,000 free-ranging lions left (Bauer et al. 2015) in less than 25% of their historic range (IUCN 2006). However, this generalised classification does not take into account an apparent conservation dichotomy: sample subpopulations of lions in Botswana, Namibia, South Africa and Zimbabwe have in fact increased overall (Bauer et al. 2015). Lions were historically present throughout Africa, some of Europe, the Middle East and Asia (Bauer and Van Der Merwe 2004), but current conservation strongholds remain only in parts of eastern and southern Africa (Brassine and Parker 2012; Nowell and Jackson 1996).

Lions are uniquely social felids, forming coalitions of up to nine males associated with female prides that may consist of 20 individuals or more (Macdonald et al. 2010; Schaller 1972). In the 1990's, lions were successfully (in terms of high reproductive and survival rates) reintroduced into private areas in parts of their former range (Miller and Funston

2014). However, this population growth rate inevitably led to the potential problem of overabundance (Funston 2008) and low genetic diversity (Trinkel et al. 2010), with both of these issues requiring active and intensive management (Hunter et al. 2007), and ultimately reducing the conservation value of these lion populations (Miller and Funston 2014). The ability to translocate lions originally facilitated the relief of overpopulation, but as the available areas for relocations were used up, sport-hunting and euthanasia have subsequently become the main methods of lion population control (Miller and Funston 2014).

The lion is the apex predator wherever it occurs (Macdonald et al. 2010), and is an ideal conservation umbrella; being large, charismatic and easily observable (e.g. Williams et al. 2000). The lion is important to commercial wildlife ventures, which risk losing significant market share where they cannot offer them to clients (Lindsey et al. 2007). The lion is thus prioritised in conservation, and their charisma exploited to attract tourists and raise the funds required in ensuring that wildlife areas remain viable (Lindsey et al. 2007). Lions are also a particularly valuable species in the sport-hunting industry, rivalled only in demand by buffalo *Syncerus caffer* and leopard *Panthera pardus* (Creel and Creel 1997). Lions are therefore prevalent in private wildlife areas (Packer et al. 2013), where their populations can achieve exponential growth rates given the protection and resources afforded by well-managed operations (Miller and Funston 2014).

There is more land area in Africa conserved for hunting than there is in all of Africa's formally protected areas combined: approximately 1.4 million km^2, which exceeds the total area covered by national parks by 22% (Lindsey et al. 2007). For wildlife conservation to be successful outside of national parks, these areas must be self-sufficient and able to generate sufficient revenue to cover the considerable costs of protecting the habitat and wildlife therein (Lindsey et al. 2006).

Hunting quotas are sanctioned by CITES on the basis that sport-hunting does not endanger the ultimate survival of the population. The positive aspects of sport-hunting as a conservation tool include a focus on males and a low percentage off-take; neither of which generally jeopardise populations, and also suggest that hunting could play a role in endangered species conservation (Leader-Williams et al. 2005).

An adaptive quota management system for lion hunting based on the ages of lions hunted was agreed on in July 2013 in Harare, Zimbabwe, during a meeting hosted by the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) and the independent non-governmental conservation organisation Panthera. The points system is summarised in Table 1.

Table 1. Points allocated to hunting blocks arising from the harvest of lions of different ages under different quota regimes

	≥6 years	No trophy	5 years old	4 years old	<4 years	Failure to submit hunt

						return/incomplete hunt returns
For quotas of 3/more	4	3	3	2	-3	0
For quotas of 2	4	3	3	2	0	0
For quotas of 1	6	3	3	2	0	0
Quota setting process	These points are added up and divided by 3 to yield the quota for next year					

During 2013, operators were requested to submit hunt returns and photos as a trial run to get the system up and running. In 2014 operators were requested to do the same but were informed that the age of the lions hunted in 2014 would determine their lion quotas in 2015. The 2015 lion hunt results would thus also determine the 2016 quota.

THE BUBYE VALLEY CONSERVANCY

After originally being eradicated by cattle ranchers in the area, 13 lions were reintroduced to the Bubye Valley Conservancy in 1999, and four young males broke into the Conservancy that same year. From the original 17 animals present in 1999, the Bubye Valley Conservancy lion population was estimated at approximately 280 individuals in 2009 when robust population surveys were initiated by a team from the University of Oxford Wildlife Conservation Research Unit (WildCRU), and this population has continued to grow. Today it is estimated that there are over 500 lions on the Bubye Valley Conservancy.

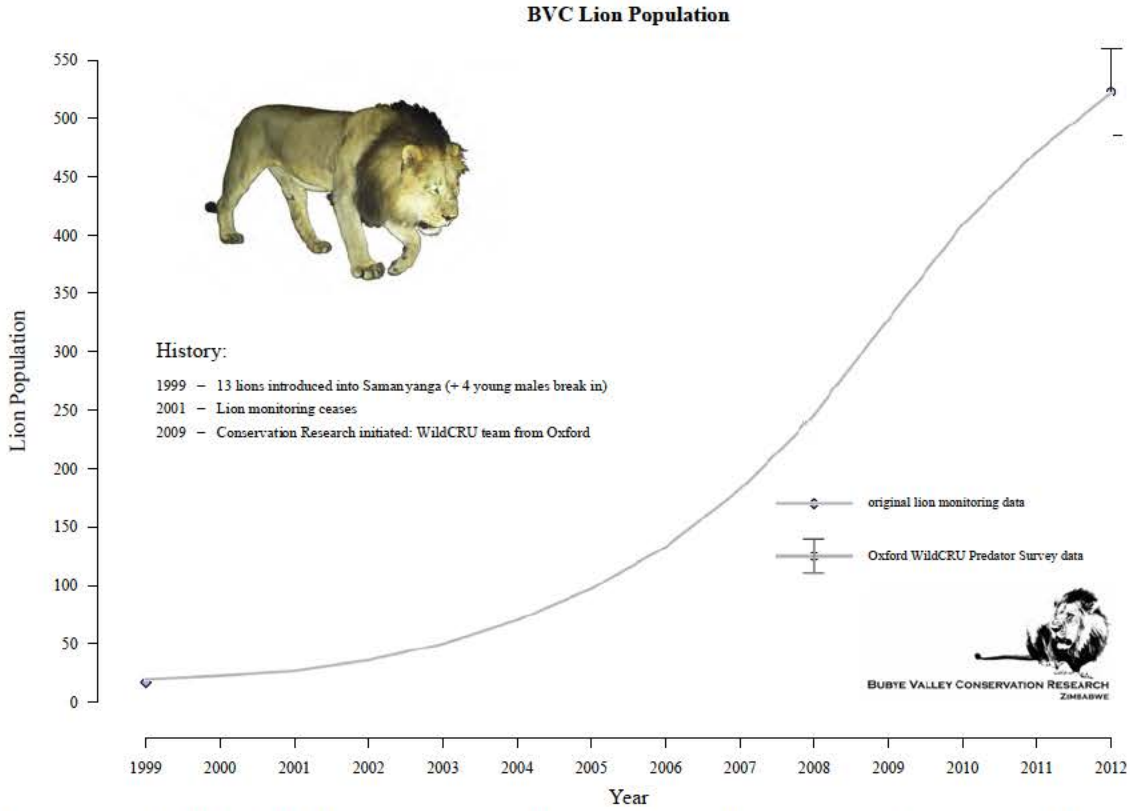


Figure 1: The Bubye Valley Conservancy lion population has increased exponentially since the original reintroduction of the species to the conservancy in 1999.

The exponentially increasing Bubye Valley Conservancy lion population currently exists at one of the highest densities in Africa (~0.190 lions km^{-2}: du Preez et al. 2015), greater than that of the Serengeti, Tanzania (0.100 lions km^{-2}: Pusey and Packer 1987; Spong 2002), Selous, Tanzania (0.080 – 0.130 lions km^{-2}: Creel and Creel 1996, 1997), Kruger National Park, South Africa (0.096 – 0.112 lions km^{-2}: Mills 1995), and Hwange National Park, Zimbabwe (0.027 lions km^{-2}: Loveridge et al. 2007). This equates to the largest contiguous lion population in Zimbabwe.

The Bubye Valley Conservancy offsets the cost of lion predation on its wildlife via sport-hunting of the species. In 2014, the lion hunting quota allocated to the Bubye Valley Conservancy by ZPWMA was 10 individuals. Based the fact that the entire quota was harvested and maximum points were scored for each individual trophy (more than six years in age), the allocated quota was raised to 13 lions for 2015. Only 12/13 lions were hunted in 2015 due to a late cancellation; nevertheless eight lions over six years old and four lions of five years old were harvested and the resultant points justifying a quota of 15 lions for 2016. Note that while the lion hunting quota for Zimbabwe has been voluntarily reduced by a national steering committee, the Bubye Valley Conservancy lion hunting quota has been successively raised twice based on hunt success and age of lions hunted under the *national adaptive quota management system*.

DISCUSSION

The saturation of lions in wildlife areas on both state and private land is positive for their future conservation security; but it is also critical to that of incidentally conserved endangered species, such as both species of rhinoceros (*Diceros bicornis* [black] and *Ceratotherium simum* [white]) on private wildlife conservancies in Zimbabwe (Lindsey et al. 2009; Suzuki 2001), which benefit from the same resources and protection that are incentivised and provided by the revenue generated from sport-hunting. The Bubye Valley Conservancy now boasts the world's third largest black rhinoceros population (N. Anderson [Lowveld Rhino Trust], pers. comm.). This remarkable achievement is an incidental conservation benefit derived entirely from trophy hunting activities – there are no photographic tourists visiting the Bubye Valley Conservancy, and these rhinos are not hunted. Having rhinos on the land therefore generates no revenue – and in fact there is a significant cost associated with protecting these animals. This expense is covered by the revenue generated by sport-hunting, with additional donations from the clients, and the habitat for the rhino is also preserved by maintaining the land as a conservation area, as opposed to converting it into agricultural or grazing land for example. The Bubye Valley Conservancy lion population has increased from an original 17 individuals in 1999 to over 500 in 2015 – not despite hunting, but because of the incentive provided by sport-hunting for their protection.

However, the high densities of lion populations achieved within commercial wildlife areas have the potential for intense intraguild persecution. Lions are aggressively competitive, and have been linked to reductions in cheetah (e.g. Durant 1998, 2000; Laurenson 1995) and wild dog (e.g. Creel 2001; Creel and Creel 1996; Vucetich and Creel 1999) densities, both of which face local extinction where lion abundance, and the respective level of persecution, is high. Excessive lion density may also result in population declines of ungulate prey (e.g. Wegge et al. 2009). It is vital to holistic conservation that wildlife managers can understand and deal with the level of impact that lions exert on other species; particularly those that are elusive difficult to observe, and which face decline if not carefully monitored. To this end, a conservation research initiative in partnership with WildCRU was established on the Bubye Valley Conservancy in 1999.

Based on the number of kills made (du Preez et al. *in prep*.) and the current value of the meat (K. Leathem, *pers. comm*.), the Bubye Valley Conservancy lion population consumes hundreds of thousands of dollars worth of prey each year. These lions are mainly tolerated because of their ability to generate the revenue that helps to offset this expense – although it is estimated that economically it is still not worth keeping the lions whose cost outweighs their value (Funston et al. 2013). If lion hunting were to be banned, based on the economics involved it would become unviable to continue managing the Bubye Valley Conservancy as a wildlife area in its current form, and lions would either have to be re-exterminated (or at least severely reduced via culling), or what is the largest privately owned wildlife area in the world would be converted back into a cattle ranching area (K. Leathem, *pers. comm*.). This is the reality of any business, in that it needs to cover costs and pay staff and cannot run at a loss for luxury of conservation. Childs (1993) states “A refusal to treat wildlife in the same way as other resources and maintenance of centralised protectionist management

prejudices its survival. Only by raising its commercial value will wildlife be able to compete for space on the scarce African landscape. Trade bans which detract from wildlife's commercial value prejudice its chances of survival in the long term."

The USFWS state "Well-managed conservation programs use trophy hunting revenues to sustain lion conservation, research and anti-poaching activities" (http://www.fws.gov/endangered/what-we-do/lion.html – accessed 2015-01-08). The Bubye Valley Conservancy meets each one of these points: clearly contributing to lion conservation with Zimbabwe's largest contiguous population; a long-term conservation research partnership with WildCRU; and with a self-funded anti-poaching unit that protects the world's third largest rhino population (the largest on private land).

The success of the Bubye Valley Conservancy, in terms of both its hunted lion and non-hunted rhino populations, provides the incentive for other areas in the country to sustainably manage their wildlife resource. Although the USFWS understandably categorises lion conservation by country rather than individual properties, the Bubye Valley Conservancy currently and deservedly hunts nearly a third of the total Zimbabwean lion quota. This sport-hunting does not negatively affect the lion population, which remains in positive growth despite the off-take.

RIFA SAFARI AREA – PRO SAFARIS AFRICA

Lion - *Panthera Leo*

Louis Muller

25th January 2016

Rifa Safari Area

Rifa forms part of the Hurungwe Safaris area in the north east of Zimbabwe in the upper Zambezi Valley. The escarpment is the southern boundary and therefore is in the Zambezi valley. Rifa is 615 km2 (Dunham & Mackie 2015)

Rifa boundaries Makuti Safari area to its South, Zambia to its West and North. Nyakasanga Safarir area is located between Mana Pools National Park and Rifa and is Rifa's Eastern Boundary.

Adaptive Lion Quota

Rifa has good prey base for Lion with the following population estimates:

2015	Ground Estimates
Buffalo	646
Lion	68
Hippo	300
Kudu	346
Eland	81
Impala	1829
Bushbuck	139
Hyena	285
Warthog	169
Waterbuck	41
Zebra	68
Sable	0

Population estimates are done with daily game sighting reports done by Professional Hunters and Game scouts.

Lion population is estimated at 68 as of August 2015. This is done with camera traps and spoor count done during the season.

Rifa Safari Area quota has been as follows since Pro Safaris has been the Lease holder

Lion Quota

	2008	2009	2010	2011	2012	2013	2014	2015
Approved Quota	2	2	2	2	2	2	2	2
Quota Taken	2	2	2	2	2	2	0	2

The aged based program was introduced 1ST January 2014, where Lions of 5 years or older are to be harvested. In 2014 season the Professional hunters did not feel that they had any Lion males on bait that they could comfortably call 5 years or older. The decision was made by the operator to not take the risk in fear of losing on tag for the following season.

In 2015 both Lions on quota were harvested as PH's became better in ageing and more importantly, Lions matured and numbers increased. The Lions were aged at the annual Lion ageing workshop conducted by ZPWMA and Panthera represented by Dr. P. Lindsey. Both Lions were aged at 5 years old, however Dr. Lindsey indicated that one was on the cusp of 5-6 years. The quota will remain at 2 for 2016.

Human-Lion Conflict

Rifa safari area is surrounded by safari areas and the Zambezi River. Lion – Human conflict is limited to the Border town of Chirundu. The only incident was in 2012 when a woman was killed by a Lioness. The lioness was killed.

Hunting as conservation and Lion contribution

	% of Turnover	
	2014	2015
Turnover	100%	
Elephant contribution	21%	
Lion contribution	12%	
Salaries	19%	
ZPWMA	39%	
Anti-poaching	6%	
Conservation	6%	
Cost Of Sales	6%	
Operating Costs	15%	
Meat	2%	

ZPWMA receive 39% of gross. From this they fund ZPWMA but also their own anti-poaching teams.

6% of gross is spent on anti-poaching funded by the operator to have his own anti-poaching unit, over above the ZPWMA anti-poaching teams. All efforts are co-ordinated by our team. Since there are no communities surrounding Rifa, there is minimal meat poaching. However due to a 48Km Zambezi River border with Zambia, Elephant poaching is rampant. This is due to ease of crossing back across and international border with little persecution. Meat poaching from Zambians is however simply not worth the risk vs the reward. Ivory, however is.

The conservation programs listed at 6% of gross are, water points installation, pipeline maintenance, water pumping, de-silting of water pans and donations in equipment to ZPWMA anti-poaching units.

Wages are at 19% and we employ 14 staff, 10 anti-poaching scouts, 3 Professional hunters, 6 trackers with an average of 5 dependants to each person. Total of 165 dependants. We also have a training program of training 2 staff members each year for a PH license.

Further meat in a Safari area belongs to the operator since there is no community. The meat is used as ration for staff and anti-poaching patrols including ZPWMA Rangers. Each person gets allocated 2kg meat every 6 days. Apart from our staff there will be a minimum of 2 sticks (3 Rangers) in Rifa at

any given time. Totalling to about : 4137kg Meat. Further we donate meat for state functions in order to prevent ZPWMA shooting animals for these functions. This meat comes to about 1000kg p. annum. Lastly all left over meat is donated to the Children's Home (Orphanage) in Karoi. This amounts to about 1000kg p. annum. The total value of meat not sold but rather donated comes to about US$12,250. This would amount to 2% of gross income.

Lion hunts contribute about 12% of total Gross. They are sold on 18 -28 day safaris. Due to not contributing a significant amount of days to the hunting calendar, the loss of Lion hunting will not really have an impact on our Cost of sales. Further operating costs are fixed and so are wages. The loss of Lion hunting would therefore have a 12% loss in gross, however it would leave the operator the choice to lose the existing 9% profit margin, or cut the existing 12% spending on conservation.

Either way, the outcome would have a detrimental effect to the conservation of Rifa Safari area.

USA vs Other markets

Since Pro Safaris has secured the lease in 2008, 12 Lions have been harvested. 9 have been sold to USA hunters vs 3 from other countries. This is 75% of our Lion hunting market. USA hunters is therefore a significant contributor and therefore creates demand far outweighing supply. We estimate we would have to drop our price by a minimum of 30%. This would mean Lion contribution to gross would drop to 8.4%.

This means conservation funding would be cut by 36%.

Rifa Safari area has a small quota on all species. Lion therefore is a major contributor to the conservation of Elephant and the habitat to all species. Even if we have to find other markets, the Loss of the US Hunters will have a major negative impact on the survival of the viability of this area as a wildlife area.

Sport-Hunting and Lion *Panthera leo* Conservation in Zimbabwe

Dr Byron du Preez[†1], Dr Rosemary Groom[‡2], Olivia Mufute[§3] and Roseline Mandisodza-Chikerema[¶3]

[1]Bubye Valley Conservation Research Initiative
[2]African Wildlife Conservation Fund
[3]Zimbabwe Parks and Wildlife Management Authority

January 31, 2016



*
† byron.d.dupreez@gmail.com
‡ rosemary@africanwildlifeconservationfund.org
§ omufute@zimparks.co.zw
¶ mandisodzar@gmail.com

Contents

Summary of Steps Taken by Zimbabwe to Improve the Management of Lion Sport-Hunting **3**

Summary of Lion Sport-Hunting's Contribution to Conservation **3**

Introduction **3**

Lions – *Panthera leo* **5**

Conservation and Sport-Hunting **8**

Zimbabwe's Adaptive Lion Quota Management System **8**
Results of the Adaptive Lion Quota Management System 9
Human-Lion Conflict 11

The Bubye Valley Conservancy **12**
History of the Bubye Valley Conservancy 12
Bubye Valley Conservancy Community Support 12
Bubye Valley Conservancy Lion Monitoring and Management 13
Bubye Valley Conservancy Lion Hunting 13

The Savé Valley Conservancy **16**
History of the Savé Valley Conservancy 16
Savé Valley Conservancy Community Support and Anti-Poaching 17
Savé Valley Conservancy Lion Monitoring and Management 17
Savé Valley Conservancy Lion Hunting 18

The Pros and Cons of Conserving Lions **20**

**Where the Money Goes:
The Finances of Lion Sport-Hunting
and Reinvestment in their Conservation** **22**

Discussion **23**

Conclusion **25**

References **26**

Summary of Steps Taken by Zimbabwe to Improve the Management of Lion Sport-Hunting

i – Banning of all lioness hunting in Zimbabwe
ii – Hunting moratoria around the Gonarezhou and Hwange National Parks
iii – Removal of fixed hunting quotas
iv – Age restrictions on sport-hunted lions
v – Scientifically-based adaptive quota management system

Summary of Lion Sport-Hunting's Contribution to Conservation

i – Lion sport-hunting contributes 33.9% to 42.4% of total revenue on private land
ii – Lion sport-hunting generates up to US$ 557 km^{-2}
iii – Anti-poaching (in particular that of rhinoceroses) costs ∼US$ 216 km^{-2}

Introduction

The United States Fish and Wildlife Service (USFWS) have recently evaluated the conservation status of the lion *Panthera leo* with particular regard to sport-hunting (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). The results of this evaluation have led to the formal protection of two subspecies under the Endangered Species Act, classifying *P. l. leo* as endangered and *P. l. melanochaita* as threatened. Together these subspecies apparently represent all of the lions in Africa (Barnett et al. 2014).

Sport-hunting is a legal activity in which the international import/export of trophies is both sanctioned and carefully controlled by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The USFWS found that the sport-hunting of *P. l. melanochaita* "*if well managed, may provide a benefit to the subspecies*" (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). Here we explore this statement further, and present data from three long-term *in situ* lion research projects; the Bubye Valley Conservation Research Initiative, Savé Val-

ley Conservancy Research, and the Hwange Lion Research Project.

The data presented in this report clearly illustrates the positive conservation benefit that well-managed trophy hunting of lions can have for the species, as well as the importance of hunting in maintaining the wildlife in an area; addressing Point 5 on page 3 of the Federal Fish and Wildlife Permit Application Form (Form 3-200-20) [i.e. "*Please be aware that the U.S. Fish and Wildlife Service must make a finding that your activities will enhance or benefit wild populations of the species involved. If you have any information that could support this finding (e.g., population status or trend data; how the funds from license/trophy fees will be spent; what portion of the hunting fee will support conservation), please submit such information on a separate page with your application*"].



Figure 1: The lions pictured here, known as Winston (*standing*) and Geronimo (*lying*), were both collared in March 2012 when they were the dominant males in the Matombosa area and have been continuously monitored ever since as part of the on-going long-term WildCRU Bubye Valley Conservation Research Initiative. In November 2015 Geronimo, who was approximately 9 years old, died after succumbing to injuries sustained from fighting with another male. Winston, also 9 years old, has since lost his dominant status, lost his territory to two 4.5 year old males, become nomadic and avoids contact with other males. As of this report being written, the recent litter of cubs that both Winston and Geronimo sired are still alive.

Most importantly, since July 2013 there has been a continuous self-imposed internal reform of the lion hunting industry in Zimbabwe that is actively participated in and supported by all of the relevant stakeholders, including; the Zimbabwe Parks and Wildlife Management Authority (ZPWMA), non-governmental organisations, professional hunters, safari operators, scientists and researchers.

Here we discuss the results of this process in terms of robust evidence regarding the sustainability and self-regulation of lion hunting in Zimbabwe.



Figure 2: Winston and Geronimo's cubs.

Lions – *Panthera leo*

The IUCN Red List have recently reclassified lions as Vulnerable (remaining as such since 1996; IUCN 2015), estimating that there are between 20,000 and 30,000 free-ranging lions left (Bauer et al. 2015a) in less than 25% of their historic range (IUCN 2006). However, this generalised classification does not take into account an apparent conservation dichotomy: sample subpopulations of lions in Botswana, Namibia, South Africa and Zimbabwe have in fact increased overall (Bauer et al. 2015a). Lions were historically present throughout Africa, some of Europe, the Middle East and Asia (Bauer and Van Der Merwe 2004), but current conservation strongholds remain only in parts of eastern

and southern Africa (Brassine and Parker 2012; Nowell and Jackson 1996). The current lion population estimate for Zimbabwe's major lion areas is approximately 2,600 individuals [Hwange-Matetsi Complex: 750, South Eastern Lowveld: 350, Gonarezhou National Park: 60, Malilangwe: 37, Savé Valley Conservancy: 284, Bubye Valley Conservancy: 500, Mid-Zambezi Valley Complex: 600], though the actual number would be larger if there were data available for the countries minor lion areas that are yet to be surveyed] (ZPWMA 2015).

The lion is a uniquely social felid, forming coalitions of up to nine males associated with one or more female prides that may consist of more than 20 individuals (Macdonald et al. 2010; Schaller 1972). Lions are infamously infanticidal (Schaller 1972), where males will kill unrelated cubs so as to bring the female into oestrus and present an opportunity to sire their own litter, which is often used as an argument against sport-hunting of the species (e.g. Packer et al. 2010), where it is feared that the removal of dominant males causes cub mortality that eventually results in lowered population recruitment and survival (Packer et al. 2009). Infanticide, however, does not result from sport-hunting when age-appropriate males, past their prime and no longer territorial or with dependent cubs, are harvested (Whitman et al. 2004). Moreover, the fission-fusion nature of lion society (Mosser and Packer 2009; Pusey and Packer 1987) means that infanticide may still occur when the dominant males are simply not present there and then to defend their cubs (B. du Preez, pers. obs.).

In the 1990's, lions were successfully reintroduced into private areas in parts of their former range, where they achieved high reproductive and survival rates (Miller and Funston 2014). However, the resultant population growth inevitably led to the potential problem of overabundance (Funston 2008) and low genetic diversity (Trinkel et al. 2010), with both of these issues requiring active and intensive management (Hunter et al. 2007) and ultimately reducing the conservation value of these lion populations (Miller and Funston 2014). The ability to translocate lions originally facilitated the relief of overpopulation, but as the available areas for relocations were used up, sport-hunting and euthanasia have subsequently become the main methods of lion population control (Miller and Funston 2014).

The lion is the apex predator wherever it occurs (Macdonald et al. 2010), and is an ideal conservation umbrella; being large, charismatic and easily observable (e.g. Williams et al. 2000). Lions are important to commercial wildlife ventures, which risk losing significant market share where they cannot offer them to clients (Lindsey et al. 2007), and are thus prioritised in conservation; exploiting their charisma to attract tourists and raise the funds required in ensuring that wildlife areas remain viable. The lion is also a particularly valuable species in the sport-hunting industry, rivalled only in demand by buffalo *Syncerus caffer* and leopard *Panthera pardus* (Creel and Creel 1997), and are therefore prevalent in private wildlife areas (Packer et al. 2013) where their populations can achieve exponential growth rates given the protection and resources afforded by well-managed operations (Smuts et al. 1978; Loveridge et al. 2007b; Kettles and Slotow 2009; Miller and Funston 2014).

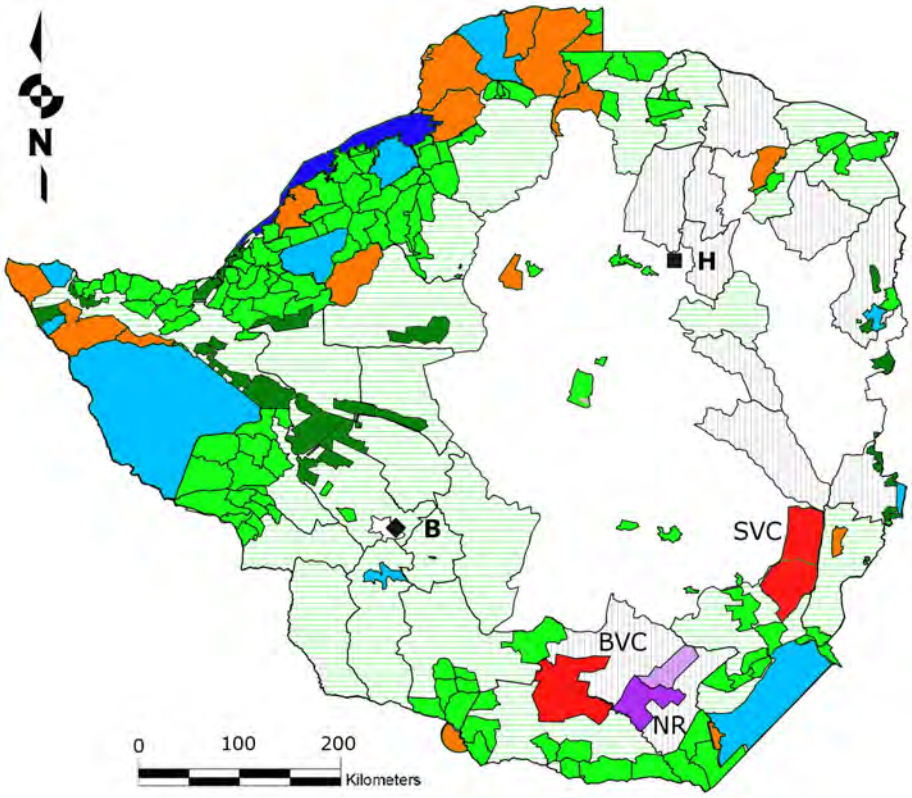


Figure 3: Map of Zimbabwe's main wildlife areas: [*i*] National Parks are represented in light blue; [*ii*] Safari areas are represented in orange; [*iii*] Forestry areas are represented in dark green; [*iv*] Community and Private wildlife areas are represented in light green; [*v*] Communal Land (CAMPFIRE Areas) in which sport-hunting may occur is represented by light green horizontal stripes; [*vi*] Communal Land in which sport-hunting does not occur is represented by grey vertical stripes. [*vii*] The Bubye Valley [BVC] and Savé Valley [SVC] Conservancies are represented in red. [*viii*]The Nuanetsi Ranch [NR] on which sport-hunting takes place is represented in dark purple (light purple represents the Nuanetsi Ranch cattle area); [*ix*] Lake Kariba is represented in dark blue. Harare (the capital city) is represented by a black square and letter '**H**'. Bulawayo is represented by a black diamond and letter '**B**'. Sport-hunting may occur in areas: *ii*, *iii*, *iv*, *v*, *vii* & *viii*

The ability of lions to rapidly increase in abundance is an aspect of their ecology that is often overlooked. Lion populations can achieve exponential growth rates (Miller and Funston 2015; Groom and Watermeyer 2015; du Preez et al. in prep.), and the problems associated with high lion densities fast present themselves and require significant investment in their solution (Hunter et al. 2007; Kettles and Slotow 2009; Loveridge et al. 2007; Packer et al. 2013; Smuts 1978). Whilst unregulated sport-hunting of lions (in particular that of dominant males and pride females) may result in population declines (e.g. Packer et al. 2010; Packer et al. 2009), restricting offtake to only males over

a certain age (i.e. have already bred and/or are no longer dominant) has no impact on lion population persistence, irrespective of quota size (Whitman et al. 2004). Such is the situation currently facing both the Bubye Valley and Savé Valley Conservancies, where the lion populations continue to grow despite sport-hunting and increasing quotas. Whilst sport-hunting may not alleviate over-population in these areas, it does somewhat offset the cost of keeping lions. Culling of lions may be the only realistic option for controlling numbers in larger areas, as the use of contraceptives is likely to be inefficient and expensive. Because of fears about public sentiment associated with sport-hunting, it has now become common practice for managers to cull excess lions in more than 45 wildlife areas in South Africa to which lions have been introduced, and which resulted in the wasteful destruction of about 200 lions in 2012 (Miller and Funston 2014).

Conservation and Sport-Hunting

There is more land area in Africa conserved for hunting than there is in all of Africa's formally protected areas combined: approximately 1.4 million km^2, which exceeds the total area covered by national parks by 22% (Lindsey et al. 2007). For wildlife conservation to be successful outside of national parks, these areas must be self-sufficient and able to generate sufficient revenue to cover the considerable costs of protecting the habitat and wildlife therein (Lindsey et al. 2006). Indeed, conservation would benefit from an incentive to utilise land for wildlife rather than the alternatives of livestock grazing, agriculture, and deforestation.

The international trade of lions, including trophies, is controlled by a strict CITES licensing system on the basis that this trade does not endanger the ultimate survival of the population (https://www.cites.org/eng/disc/how.php [accessed 2015-01-19]). The positive aspects of sport-hunting as a conservation tool include a focus on males and a low percentage off-take; neither of which generally jeopardise populations, and also suggest that hunting could play a role in population recovery (Leader-Williams et al. 2005).

The recommendation of setting uniform harvest limits, e.g. 1 lion 2,000 km^{-2} (Lindsey et al. 2012; Packer et al. 2010), may be overly simplistic, affect the economics of wildlife based landscape use, and disincentivise investment in conservation (Lindsey et al. 2007). A more practical approach to sustainably setting realistic lion sport-hunting quotas could involve using a positive/negative feedback method that calculates a fluid quota per area based on the previous season's performance. Such an adaptive quota management system has already been implemented in Zimbabwe.

Zimbabwe's Adaptive Lion Quota Management System

An adaptive quota management system for lion hunting based on the ages of lions hunted was agreed on in July 2013 in Harare, Zimbabwe, during a meeting hosted by the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) and an independent non-governmental conservation organisation. The points system is summarised in Table 1.

Table 1: *Points allocated to hunting blocks arising from the harvest of lions of different ages*

	≥ 6 years	No trophy	5 years old	4 years old	< 4 years	Failure to submit return, or incomplete return
For quotas of ≥3	4	3	3	2	-3	0
For quotas of 2	4	3	3	2	0	0
For quotas of 1	6	3	3	2	0	0
Resultant quota	*These points are added up and divided by 3 to yield the quota for next year*					

During 2013, operators were requested to submit hunt returns and photos as a trial run to get the system up and running. In 2014 operators were requested to do the same but were informed that the age of the lions hunted in 2014 would determine their lion quotas in 2015. The 2015 lion hunt results would thus also determine the 2016 quota.

Results of the Adaptive Lion Quota Management System

In 2015 there was a marked increase in the age of lions hunted in Zimbabwe as a whole. Notably, only one lion of <4 years of age was hunted and the large majority of lions were 5 years or older (Figure 4). In 2013, only 28% of the lions hunted were 5 years or older, in 2014 that figure had risen to 49% and in 2015 to 77.3% (Figure 5). The proportion of lions hunted that were less that 5 years of age dropped overall between 2013 and 2015 (Figure 6). For this achievement, credit is due to the hunting community for showing greater selectivity of harvest. A word of caution however, is that the majority of lions hunted were on the cusp of 5 - 6 years of age and were not older than six years. Restricting hunting to individuals that are at least six (and preferably older) is desirable from a biological perspective due to the reduced risk of the loss of pride males and infanticide of cubs associated with the harvest of such individuals (Whitman et al. 2004).

In 2015 the Zimbabwe national lion hunting quota was set at 85 lions. Of this 85, only 39 were hunted in 2015, and based on the resultant score from aging the trophies, and the fact that operators chose not to hunt lions of inadequate age (see Figures 4, 5 & 6), the recommended quota for 2016 was set at 75 [Harare 2015-11-11]. (The Rural District Council areas in which lions occur are currently exempted from the age restrictions, as was agreed upon at the 2013 lion management meeting in Harare, as a means of ensuring that impoverished communities obtain the opportunity to benefit from the presence of lions, recognising the potential negative impacts the species has on the livelihoods of livestock farmers).

Using these figures and estimating the average value of a lion safari at approximately US$ 80,000 then a 50% offtake (35 lions) would generate US$ 2,800,000 annually. If management costs are approximately \$150 km^{-2} (V. Booth, pers. comm.), then the lion safaris alone can support 18,600 km^{-2} of wildlife habitat in Zimbabwe.

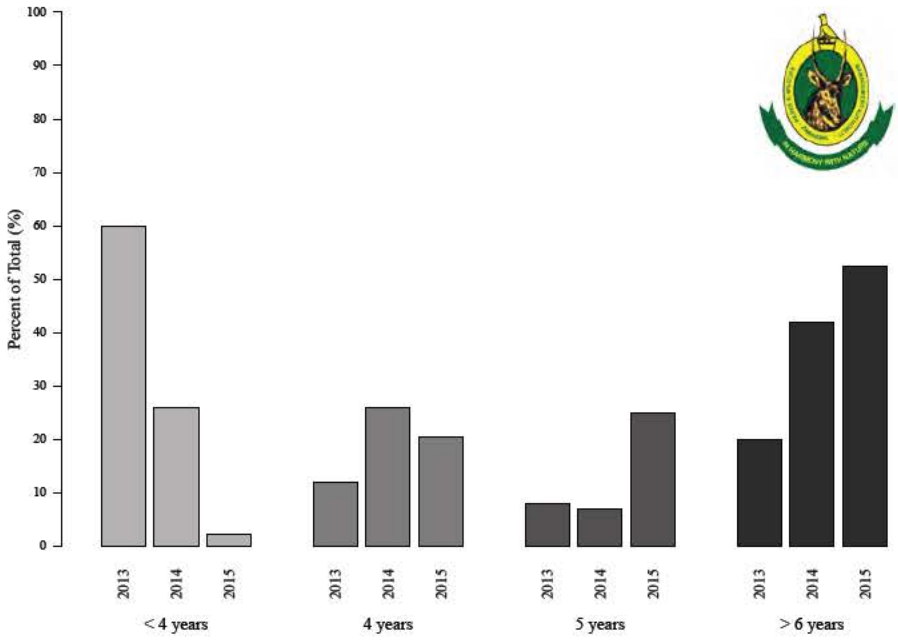


Figure 4: The percentage of lions hunted in each age class in 2013, 2014 and 2015 in Zimbabwe.

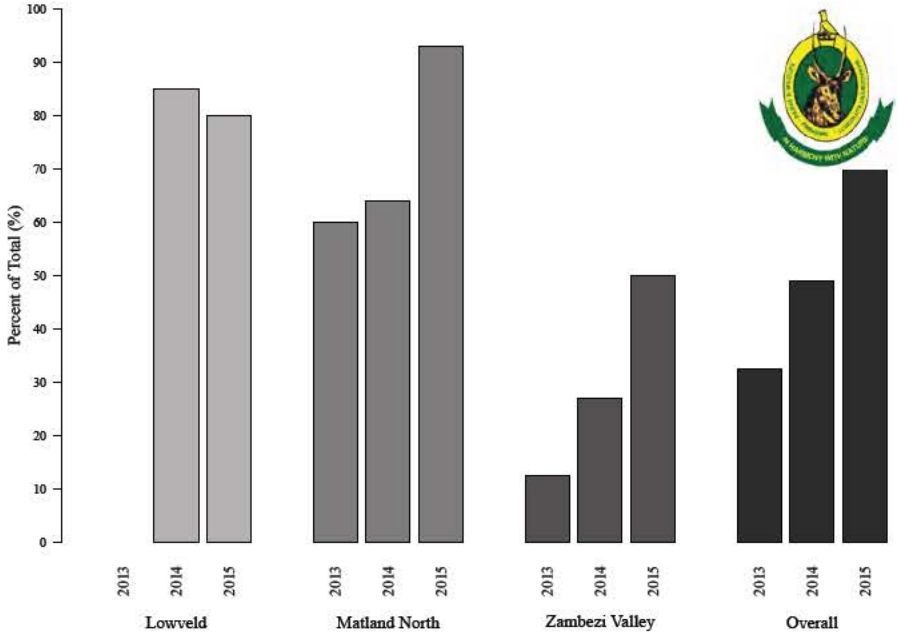


Figure 5: The proportion of lions hunted that were 5 years or older in the three main lion-hunting areas of Zimbabwe.

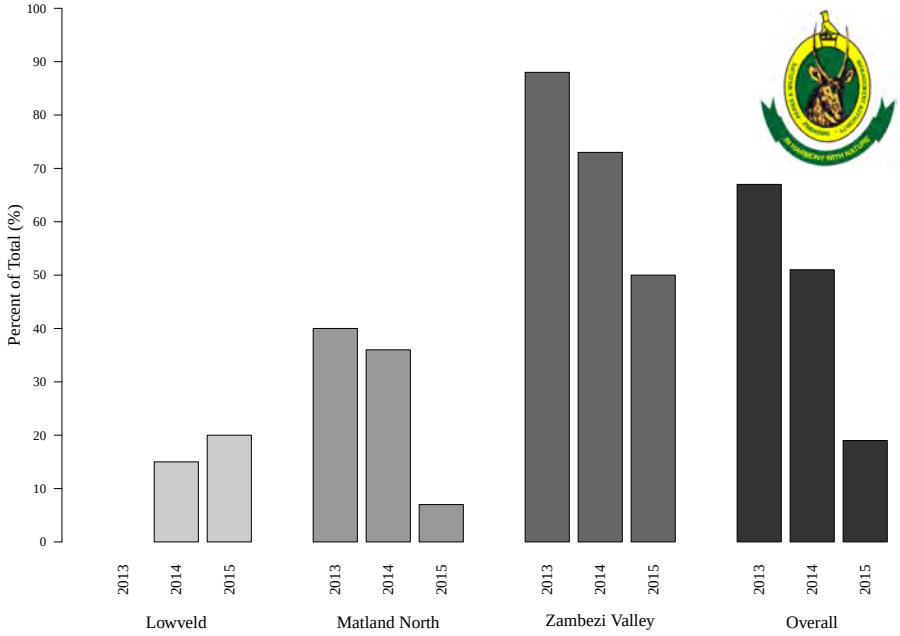


Figure 6: The proportion of lions hunted that were less than 5 years of age in the three main lion-hunting areas of Zimbabwe.

Table 2: *Human and Lion Conflict (2009 - 2011) in Zimbabwe, including human mortality caused by lion (CAMPFIRE Association, 2012)*

District	Total incidents	Livestock killed	*People Injured*	*People Killed*
Hurungwe	5	1	*2*	*2*
Chiredzi	25	136	*0*	*0*
Mbire	5	7	*0*	*5*
Binga	9	39	*0*	*0*
Total	**44**	**183**	***2***	***7***

Human-Lion Conflict

The lion is a flagship species and powerful symbol of Africa; yet living with lions poses hardships for many communities (e.g. Table 2). In some areas, the lion is a major predator on domestic livestock, inevitably leading to conflicts with local herders. Both sides suffer in this situation.

Outside of protected areas, the lion's prey base is much reduced, which results in relatively greater chance of encountering livestock. Co-existence of lions with people may be enhanced by giving value to lions through tourism and hunting promoted in communal lands under the Communal Area Management Programme for Indigenous Resources (CAMPFIRE). This hunting contributes to the conservation of lions via the financial revenue generated, which is ploughed back into conservation of the resource and empowers local communities to invest in their own rural development programs.

The Bubye Valley Conservancy

History of the Bubye Valley Conservancy

Towards the end of the nineteenth century, the Liebig's Extract of Meat Company (LEMCO) founded an extensive cattle ranch in the Zimbabwean lowveld, to the detriment of the indigenous wildlife that was initially eliminated because of competition for grazing with the livestock, as well as a risk of disease transmission from buffalo and wildebeest *Connochaetes taurinus*. As their natural prey base became depleted, the predators were subsequently persecuted when they began to prey on the livestock. Some wildlife persisted in small pockets of remote habitat, however lion, elephant *Loxodonta africana*, buffalo and rhinoceros *Diceros bicornis* [black] & *Ceratotherium simum* [white] were all completely eradicated. A monoculture of cattle dominated the landscape and impacted on the environment for the better part of a century.

Then, in 1992, Zimbabwe suffered one of the worst droughts on record, a relatively short time after the devastating one of 1983 that LEMCO was still trying to recover from. The frequency and severity of the droughts effectively reduced confidence in the economic viability of cattle ranching in the area, and the Bubye Valley Conservancy was subsequently founded in 1994 with the realisation that endemic wildlife, which are better adapted than livestock to cope with the local climate, could be successfully commercialised (Child 1988; Bond 1993).

The conversion from cattle ranching back to a wildlife area was neither straightforward nor cheap, requiring a significant initial investment and annual running costs. In just 20 years of operation the Bubye Valley Conservancy now protects the world's third largest black rhinoceros population, one of Zimbabwe's largest lion populations, a large and increasing elephant population, and abundant game.

Sport-hunting is an essential step in converting areas that were previously dedicated to livestock farming into non-consumptive tourism areas (Child 1993), and was fundamental to the formation of Bubye Valley Conservancy and allowing the wildlife populations to recover. The Samanyanga area of the Bubye Valley Conservancy, probably the most scenic section, was originally set aside for non-consumptive photographic tourism, but made an annual loss for several years, before, largely due to Zimbabwe's land reform program and resultant instability in the country, it was reverted back to sport-hunting as the only practical and economically viable option (K. Leathem, pers. comm.). Sustainable sport-hunting provides the sole economic incentive to continue operating the Bubye Valley Conservancy as a wildlife conservation area.

Bubye Valley Conservancy Community Support

The Bubye Valley Conservancy donates over 45 tonnes of meat from sport-hunting to the local communities each year. This meat donation is worth over US$ 100,000 per year, and the communities are free to decide how they use it. In addition to this, the Conservancy also supports several schools, clinics, and community projects in the three surrounding districts of Mwenezi, Maranda and Jopempe. The local community thus

sees a direct benefit from the wildlife on the Bubye Valley Conservancy, but is also empowered by job opportunities created both with these special projects, as well as on the Conservancy. A summary of the Bubye Valley Conservancy community support effort between 2011 and 2015 is provided in Table 4.

Bubye Valley Conservancy Lion Monitoring and Management

After originally being eradicated by cattle ranchers in the area, 13 lions were reintroduced to the Bubye Valley Conservancy in 1999, and four young males broke into the Conservancy that same year. From the original 17 animals present in 1999, the Bubye Valley Conservancy lion population was estimated at approximately 280 individuals in 2009 when robust population surveys were initiated by a research team from the University of Oxford Wildlife Conservation Research Unit (WildCRU), and this population has continued to grow. Today it is estimated that there are over 500 lions on the Bubye Valley Conservancy (du Preez et al. 2015). The exponentially increasing Bubye Valley Conservancy lion population currently exists at one of the highest densities in Africa (∼0.187 lions km^{-2}: du Preez et al. 2015; Figure 7), greater than that of the Serengeti, Tanzania (0.100 lions km^{-2}: Pusey and Packer 1987; Spong 2002), Selous, Tanzania (0.080 - 0.130 lions km^{-2}: Creel and Creel 1996, 1997), Kruger National Park, South Africa (0.096 - 0.112 lions km^{-2}: Mills 1995), and Hwange National Park, Zimbabwe (0.027 lions km^{-2}: Loveridge et al. 2007). This equates to one of the largest contiguous lion populations in Zimbabwe.

Bubye Valley Conservancy Lion Hunting

The Bubye Valley Conservancy offsets the cost of lion predation on its wildlife via sport-hunting of the species, and which began in 2002. In 2014, the lion hunting quota allocated to the Bubye Valley Conservancy by ZPWMA was 10 individuals. Based on the fact that the entire quota was harvested and that maximum points were scored for each individual trophy (more than six years in age), the allocated quota was raised to 13 lions for 2015. Only 12 out of 13 lions were hunted in 2015 due to a late cancellation; nevertheless eight lions over six years old and four lions of five years old were harvested and the resultant points justifying a quota of 15 lions for 2016.

Table 3: *The Bubye Valley Conservancy annual lion hunting quota and offtake from 2002 to 2015.*

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Approved quota	1	2	3	2	2	2	3	3	5	8	12	10	10	13
Quota taken	1	2	3	2	2	2	2	3	5	8	12	10	10	12
Percentage success	100	100	100	100	100	100	67	100	100	100	100	100	100	92

Note that while the lion hunting quota for Zimbabwe has been voluntarily reduced by the national steering committee, the Bubye Valley Conservancy lion hunting quota has been successively raised twice based on both hunt success and age of lions hunted and the resultant points scored under the national adaptive quota management system (Table 3).

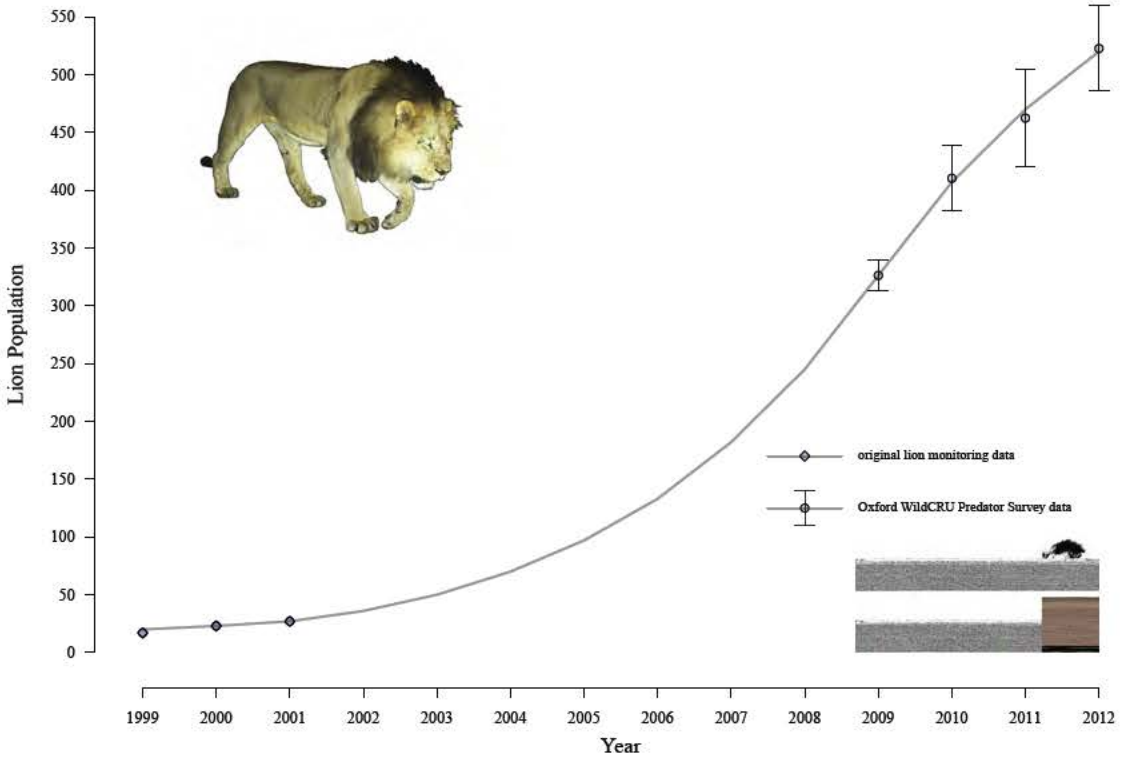


Figure 7: The Bubye Valley Conservancy lion population has grown exponentially since the reintroduction of lions in 1999. Diamonds represent the known lion abundance from monitoring of the original individuals introduced; Points indicate lion abundance calculated from spoor transect analyses; error bars represent the standard error of the mean.

Table 4: *Summary of the Bubye Valley Conservancy support to the surrounding local communities (2011 - 2015)*

Boreholes:	- 1 x Jompembi Village 2 - 1 x Penemene - 1 x Jompembi Village 4 - 1 x Nyimani village (Mwenezi) - 1 x Driehoek School - 1 x Mgaladhivha School - 2 x Mtetengwe to supply water to the clinic site - 2 new bush pumps (complete) purchased and installed at Village 2 & Village 3 and troughs built at both sites *Drinking trough for cattle built at Village 2 borehole* *All boreholes equiped with new bushpumps, piping and cylinders* *Boreholes at Village 3, Mtetengwe, Mdzwiti, Vumani and Penemene and Makado Police post repaired and maintained* *All new piping and pumps etc. are supplied by BVC*
Buildings:	- Mtetengwe Clinic's main building built - 3 x F13 staff houses built *Clinic and House fenced - everything funded and built by BVC* *The clinic is a standard large Government clinic - male & female wards + maternity ward and outpatients* *Storerooms, offices etc. also built* *All houses and buildings are electrified, painted and supplied with running water* - Mtetengwe School school office block and staff room built and painted *All classroom windows repaired and the schools second borehole repaired.* - Secure engine house was built at the second borehole site - Borehole equipped with BH15S mono pump unit driven by a rebuilt Lister LT 1 engine - 5000 litre header tank and stand errected - new 5000 litre header tank purchased and fitted - pipeline laid to connect the borehole to the clinic - another pipeline connected to the same borehole to supply the Mtetengwe school with fresh water - New coldroom and refrigeration unit purchased and fitted at the Lutumba butchery *Part of aid program to get the Beit Bridge RDC self funding projects up and running* - New coldroom and refrigeration unit was purchased and fitted at the Rutenga butchery *Part of aid program to get the Mwenezi RDC self funding projects up and running*
Meat Donations:	- BVC donates meat on a regularly basis to the Mwenezi Orphange - Numerous donations of meat were made to support school sports days & speech nights/prize giving events *Both Beit Bridge & Mwenezi districts* - 1600 kgs of meat has been donated each month since July 2011 to a Maranda trust *Administered by Chiefs andlocal headmen* *Excess meat sold and funds used for community projects* *Classroom roof replaced at Vhongwe school* *4 new classroom blocks constructed at other schools using funds from these monthly allocations* - 1000 kgs of meat per month is been donated to Beit Bridge communities since April 2014 - 1000 kgs of meat per month is been donated to Mwenezi communities since August 2013
Miscellaneous:	- Sports uniforms for the Penemene school team purchased ($2600) *Sports uniforms required for inter-schools sports* - Transport the soccor teams representing Mgaladivha, Jompembi and Tongwe *To Lutumba for the inter-school competitions* - 2 sets of soccer goal posts & 2 sets of Netball poles were made for Mgaladivha School *New soccer field graded by BVC* - 2m security fencing supplied to Penemene School - Second hand door and window frames donated to Mapiri school (ex Mazunga School) - 1 new 3 1/2 " rod pump cylinder was purchased and fitted to the Vumhani borehole *All repairs to b/holes in the Vumhani area are done by BVC* - 26 bags of cement were donated to Mgaladivha School - Fencing donated to the Mgaladivha School - Supplied 10 x 5/8" mono shafts for the Botalele Clinic (Maranda) borehole - Water supply to Mlelezi Clinic - 400 m pipeline laid to supply the Nyimani Villarge's cattle with water *3.5 m drinking trough build for this same project* - 60 bags cement donated to the Welkom for repairs to a dam wall - 6 loads of riversand and 20 cement donated to Vumani Preschool - Various school renovations in both the Beit Bridge and Maranda areas
Current Projects:	- Construction of a School admin block at Mgaladhivha School - Supply of 24 loads of riversand to Mdzwiti School (value $1200) - All roofing materials supplied to Mdzwiti School - Supply roofing materials, cement, all window and door frames for Vumani Preschool

The Savé Valley Conservancy

History of the Savé Valley Conservancy

The Savé Valley was a wildlife-rich wilderness until the early 1900's, when the first cattle ranching initiatives started in the area. The establishment of Devuli Ranch and Angus Ranch in 1920 paved the way for seven decades of commercial cattle ranching in the area we know today as the Savé Valley Conservancy. Roads were cut, fences erected and an everlasting 'battle' ensued against the wildlife, especially against all predators.

The large predators, especially lions, were virtually eradicated (Pole 1999). However, by the late 1980's, declining range productivity, depressions and droughts forced the landowners to consider alternative options. Around that time, empirical evidence of the competitive advantage of wildlife over livestock began to emerge (Child 1988; Bond 1993), especially in arid areas (Jansen et al 1992; Cumming 1993), and wildlife was finally given serious consideration as a viable land use option.

In 1989, a proposal was drawn up (du Toit 1989) to turn what was then the Sabi Valley Intensive Conservation Area into a wildlife conservancy. The plan was to create a single large wildlife area, especially for the re-establishment of endangered species and overexploited species, with cattle remaining the primary income generator. The Savé Valley Conservancy was constitutionally inaugurated in June 1991, and following the severe 1991/1992 drought, wildlife ranching became the primary land-use. At the time this was the largest private wildlife conservancy in the world (3,410 km^2).

The conservancy members then restocked the wildlife, removed all internal fencing, erected a common perimeter fence and developed effective security systems. A double, electrified, veterinary-approved fence was completed in 1995, and the following decade saw a massive investment in wildlife re-stocking and security systems.

Sport-hunting was essential for the successful transition of the conservancy from cattle to wildlife. During the early years, wildlife densities were low, resulting in poor potential for ecotourism, and hunting generated the income needed to erect the fence, re-stock game, and improve security, especially because of the significant numbers of black rhinoceros now found there. Gradually, some of the ranchers shifted more into ecotourism. One property, Senuko Ranch, completed a 16 bed up-market lodge with a view of marketing non-consumptive safaris, offering game drives and bush walks and specializing in rhino walks and African wild dog *Lycaon pictus* den visits. Lodge occupancy rose from 0% in 1996 to 62% by the end of 1999.

However, the Zimbabwean land reform program, which was initiated in February 2000, soon made a strong negative impression in the international community, and resulted in travel bans and warning from most of Zimbabwe's source markets. This, together with the political instability meant that the wildlife industry and ecotourism industry collapsed over-night: sport-hunting became the only economically viable land use option, and has remained the only tangible source of income to the landowners of the Savé Valley Conservancy. In the case of the Senuko Lodge, for example, the land reform program resulted in a 98% cancellation of

the confirmed bookings. After four years of seeking alternative markets, the lodge could achieve no higher than 17% occupancy, and in 2005 moved back into a hunting-based operation.

A more direct impact of the land reform program for the Savé Valley Conservancy was the loss of 33% of the area of the conservancy to invading subsistence farmers (Lindsey et al 2008). The loss of land was catastrophic and the related pressure from wire snare poaching was extreme. In the following eight years (2001 to 2009), 10,520 illegal hunting incidences were recorded, 84,396 wire snares were removed and at least 6,454 wild animals killed (Lindsey et al. 2011).

Savé Valley Conservancy Community Support and Anti-Poaching

In 2012, conservancy members provided over US$ 100,000 worth of support to adjacent villages or farmers in the resettled areas. Assistance included drilling boreholes, maintaining boreholes, dredging of dams, assisting with building projects in clinics and schools, assisting with repairs, maintenance and materials at schools, education initiatives, school field trips, provision of computer equipment in schools, craft programs and regular donations of meat.

Moreover, the conservancy recently entered into a mutually dependent agreement with the Chiefs representing the communities surrounding the Savé Valley Conservancy. The agreement links the communities to the Natural Resource Utilisation that occurs through the business operation of the conservancy and opens up opportunities for the local indigenous populations to share in any wealth creation. This agreement strengthens relations between the conservancy and the surrounding local communities and creates an environment that helps to protect, conserve and sustain the natural assets of the area. The hunting tourism of the conservancy is currently the only form of income by which the surrounding communities can benefit. Revenues from trophy lion hunting constitute a significant portion of inflow and thus an important part of the community benefits. Any reduction would seriously jeopardise the growth of this infant positive relationship and community empowerment initiative.

The Savé Valley Conservancy is thus pioneering private-community partnerships in Zimbabwe, and trade restrictions on lion trophies will indirectly adversely affect these already seriously impoverished communities through a reduction in available income to share with communities. This is very likely to have a knock on impact on the lions themselves with a significantly reduced tolerance and an increase in retaliatory poisoning of lions for livestock predation. Without a demonstration of income from lions, the political pressure from the surrounding communities to remove them from the conservancy altogether will be a challenge to resist.

Savé Valley Conservancy Lion Monitoring and Management

After the Conservancy was formed, and persecution stopped, lions, mainly males, recolonized the area and their numbers started to increase in the late 1990's / early 2000's. Few lionesses were observed until 2003, when small family groups and male-female pairs were seen, and by 2004 - 2005 there were some reports of cubs. During this period 13

lions were also reintroduced into the Savé Valley Conservancy. After an initial lag phase the lion population on the Savé Valley Conservancy has increased dramatically and at present is growing exponentially (Figure 8; Groom and Watermeyer 2015).

Monitoring of the lion population began in 1999 (Pole 1999) with track index or call-up surveys being conducted sporadically until 2006. From 2007 to present, annual conservancy-wide track index surveys have been conducted using a standardized methodology (Groom and Watermeyer 2015). The resulting population estimates were verified in 2011 by a baited lion call-up survey and a collation of managers' estimates, all of which provided similar results.

Prey availability models (Hayward et al. 2007) suggest that the carrying capacity for the lion population in the Savé Valley Conservancy is approximately 271 lions. The population estimate for 2015 was 284 lions, suggesting lions have reached their ecological carrying capacity, even whilst being responsibly hunted.

A professional lion management plan was commissioned by the conservancy in 2011 (Funston 2011), to provide the Savé Valley Conservancy members with a science-based plan to help them ethically and sustainably manage their lion population. This plan specifically advocates the use of hunting as a conservation management tool. It also demonstrates willingness by the conservancy to guide their lion management based on science and advice from professionals.

Savé Valley Conservancy Lion Hunting

Lions have been hunted in the Savé Valley Conservancy since 2002, although that was largely for removal of problem animals. Hunting began properly in 2005 with quotas increasing annually to a maximum of seven per year from 2009 onwards (Table 5), with the quota being raised to ten for 2016 based on trophy ages.

Despite offtakes of lions through sport-hunting, the lion population has continued to increase in the Conservancy. The revenue generated from hunting lions has enabled landowners to invest in proper land management, anti-poaching, water provision and fence maintenance, all of which benefit the lion population (especially as lions seem to be vulnerable to being caught in wire snares; Becker et al 2013; R. Groom, pers. obs.).

Table 5: *The Savé Valley Conservancy annual lion hunting quota and offtake from 2002 to 2015.*

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Approved quota	5	5	1	3	3	4	6	7	7	7	4	2	3	5
Quota taken	1	0	1	3	3	3	3	6	5	3	4	1	3	5
Percentage success	20	0	100	100	100	75	50	86	71	43	100	50	100	100

Sport-hunting of lions brings considerable revenue to the Conservancy, revenue that is vital for the continued functioning of the area for wildlife conservation. Without the costs of lions being offset by the income from sport-hunting, landowners cannot reasonably be expected to tolerate such high lion densities, and their numbers would have to be reduced significantly.

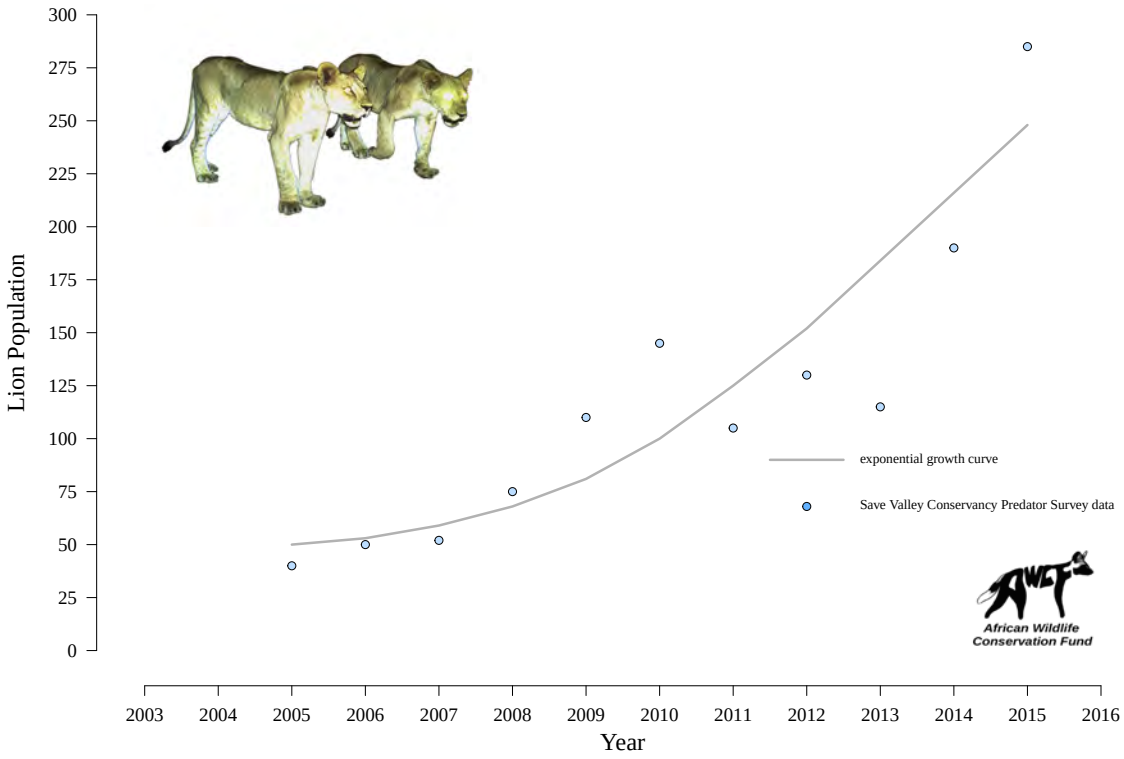


Figure 8: The Savé Valley Conservancy lion population, like that of the Bubye Valley Conservancy, has grown exponentially. Points indicate estimated lion abundance calculated from field surveys; the line represents the exponential growth curve.

The Pros and Cons of Conserving Lions

The saturation of lions in wildlife areas on both state and private land is positive for their future conservation security; but it is also critical to that of incidentally conserved endangered species, such as both species of rhinoceros on private wildlife conservancies in Zimbabwe (Lindsey et al. 2009; Suzuki 2001), which benefit from the same resources and protection that are incentivised and provided by the revenue generated from sport-hunting. The Bubye Valley Conservancy now boasts the world's third largest black rhinoceros population (N. Anderson [Lowveld Rhino Trust], pers. comm.), which is classified as Key 1 by the African Rhino Specialist Group and means that this population is considered key to the overall survival of the species. The Savé Valley Conservancy has the second largest black rhinoceros population in Zimbabwe after Bubye. These are not coincidences. These rhinoceros (and other endangered species, such as wild dog) strongholds are the result of the incidental conservation benefits derived entirely from sport-hunting activities - there are no photographic tourists visiting either the Bubye Valley or Savé Valley Conservancies, and the rhinoceros are not hunted. Having rhinoceros on the land therefore generates no revenue - and in fact there is a significant cost associated with protecting these animals; US$ 590,000 (not including incentive and reward bonuses donated for these purposes) was spent on anti-poaching by the Bubye Valley Conservancy during 2015 (K. Leathem, pers. comm.), and US$ 546,000 is spent annually on anti-poaching by the Savé Valley Conservancy (Lindsey et al. 2012). This expense is covered mainly by the revenue generated by sport-hunting with additional donations from the clients; and most importantly, the habitat for the rhinoceros is preserved by maintaining the land as a conservation area, as opposed to converting it into agricultural or grazing land for example.

However, the high densities of lion populations achieved within commercial wildlife areas have the potential for intense intraguild persecution. Lions are aggressively competitive, and research on the relationship between lions and leopards has shown that high densities of lions can negatively affect leopard population density, demographic structure, cub survival, and spatial ecology down to even the step-wise decisions that leopards make regarding habitat use and behaviour based on both the actual and potential risk of encountering lions (du Preez 2014; du Preez 2015). Leopards are a generalist species that are able to cope with persecution by adapting their behaviour and ecological niche, and even they suffer under a burgeoning lion population; ecological specialists and endangered species, such as cheetah *Acinonyx jubatus* and wild dog, do not fare nearly as well under such intense competitive pressure. In fact, competition with lions has been directly linked to reductions in cheetah (e.g. Durant 1998, 2000; Laurenson 1995) and wild dog (e.g. Creel 2001; Creel and Creel 1996; Vucetich and Creel 1999) densities, both of which face local extinction where lion abundance, and the respective level of persecution, is high. Excessive lion densities may also result in population declines of ungulate prey (e.g. Wegge et al. 2009). It is vital to holistic conservation that wildlife managers can understand and deal with the level of impact that lions exert on other species; particularly those that

are elusive difficult to observe, and which face decline if not carefully monitored. To this end, a conservation research initiative in partnership with WildCRU was established on the Bubye Valley Conservancy in 2009, and research conducted on the Savé Valley Conservancy since 2007.

Based on the number of kills made (du Preez et al. in prep.) and the current value of the meat (K. Leathem, pers. comm.), the Bubye Valley Conservancy lion population consumes hundreds of thousands of dollars worth of prey each year. These lions are mainly tolerated because of their ability to generate the revenue that helps to offset this expense - although it is estimated that economically it is still not worth keeping the lions whose cost outweighs their value (Funston et al. 2013).

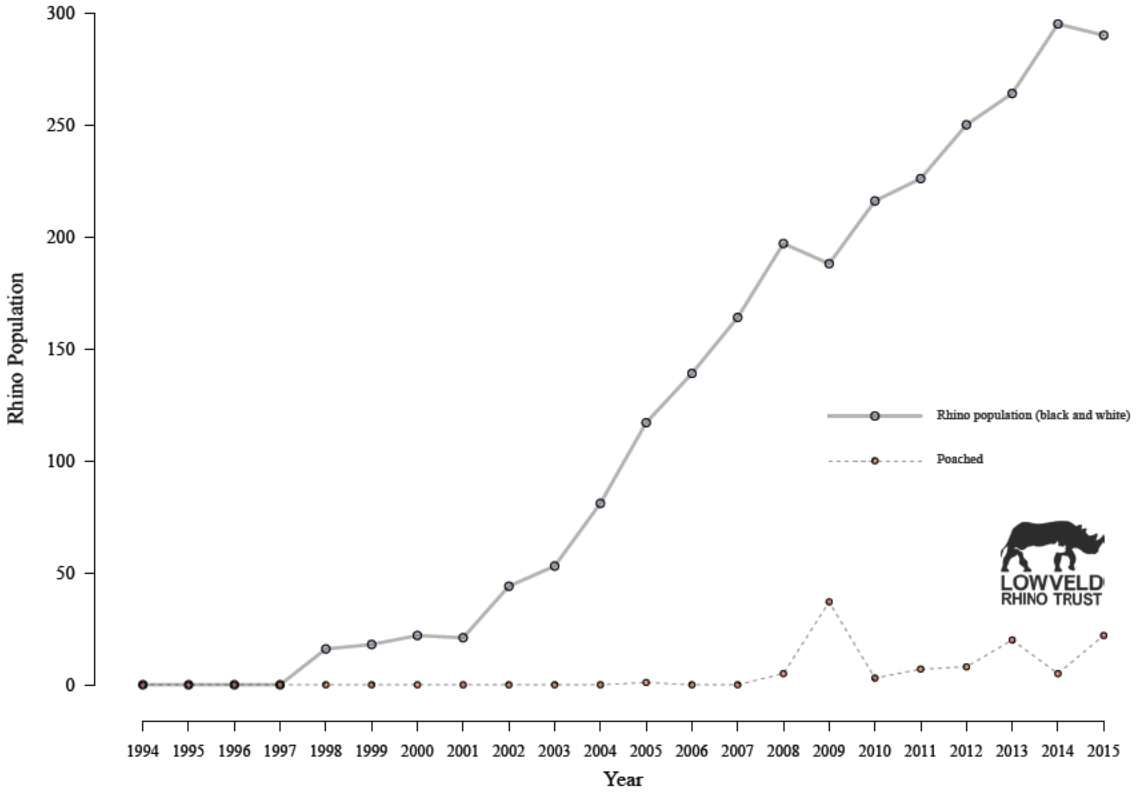


Figure 9: The Bubye Valley Conservancy black rhino population is rated as Key 1 by the African Rhino Specialist Group which means that the population is considered key to the overall survival of the species.

Where the Money Goes: The Finances of Lion Sport-Hunting and Reinvestment in their Conservation

Break-down of the finances involved in a typical lion hunt on the Bubye Valley Conservancy:

Lion Trophy fee: US$ 42,000
Lion Hunt Daily rate: US$ 2,950 day^{-1}
(Minimum lion hunt duration: 18 days [*total daily rate of US$ 53,100 lion hunt^{-1}*])

Additional costs include:
ZPWMA scout
Observers
Bait used
Other trophy species taken during the lion hunt, etc.
[*These additional costs average approximately US$ 6,500 lion hunt^{-1}*]

Bubye Valley Conservancy - Lion Sport-Hunting Revenue Generated (2015):

((18 days × 2,950 day^{-1}) + 42,000 trophy fee + 6,500 additional costs) × 12 lions
= **US$ 1,219,200**

Lion sport-hunting therefore represents approximately 33.9% of the Bubye Valley Conservancy's total annual revenue generation (which includes post-hunt meat and hide sales).

All of the revenue generated from lion sport-hunting on the Bubye Valley Conservancy has gone back into the running costs of the Conservancy, which is all part of conservation, and which includes: anti-poaching and fence monitoring and maintenance (approximately US$ 506,000 year^{-1}), research (approximately US$ 34,700 year^{-1} not including client and sponsor donations), and community support assistance (approximately US$ 210,000 year^{-1}).

[*No profit after costs has been declared, nor dividends taken by shareholders, since the Bubye Valley Conservancy was formed in 1994. All revenue generated to date has been spent on running costs, improvements and restocking.*]

Discussion

Here we have shown that since their reintroduction after historical eradication, both the Bubye Valley and Savé Valley Conservancies' lion populations have increased exponentially - not despite sport-hunting, but because of sport-hunting and the incentive it provides for protection.

The success of the Bubye Valley and Savé Valley Conservancies, in terms of both of their hunted lion and non-hunted rhinoceros populations, may also provide the motivation for other areas in the country to sustainably manage their wildlife resource. A case in point is the Nuanetsi Ranch, a wildlife area that is also a legacy of failed cattle ranching, located almost directly between the Bubye Valley and Savé Valley Conservancies in Zimbabwe (Figure 3). At present there is a single lion on the Nuanetsi Ranch but management is not able to justify introducing more due to the current uncertainty over the future of lion hunting (B. Lees-May [Nuanetsi Ranch Conservator], pers. comm.). The Nuanetsi Ranch is a wildlife area of 1,489 km^2, and could conceivably sustainably hold between 201 and 278 lions (based on the most recently estimated lion densities of the Savé Valley [0.135 lions km^{-2}; Groom and Watermeyer 2015]; and Bubye Valley [0.187 lions km^{-2}; du Preez et al. 2015] Conservancies respectively). However, the Nuanetsi Ranch has invested in building up an abundant wildlife population, which is sport-hunted, and the management will not risk losing a significant amount of valuable game, that could otherwise be sold as trophies or meat, to a species from which it can not recuperate lost revenue, and instead that requires further investment in control measures (B. Lees-May [Nuanetsi Ranch Conservator], pers. comm.).

Between 2005 and 2015 the United States market has represented 70.4% of the total Zimbabwean lion sport-hunting industry (http://trade.cites.org/en/cites_trade/ [accessed 2015-01-19]), though in reality it constituted over 90% for both the Bubye Valley and Savé Valley Conservancies. If this market was effectively lost due an inability of prospective clients to import their trophies, based on the economics involved it would become unviable to continue managing the Bubye Valley Conservancy as a wildlife area in its current form, and lions would either have to be re-exterminated, or at least severely reduced via culling; or else what is the largest privately owned wildlife area in the world would be converted back into a cattle ranching area (K. Leathem, pers. comm.). This is the reality of any business, in that it needs to cover costs and pay staff and cannot run at a loss for luxury of conservation. Child (1993) states "*A refusal to treat wildlife in the same way as other resources and maintenance of centralised protectionist management prejudices its survival. Only by raising its commercial value will wildlife be able to compete for space on the scarce African landscape. Trade bans which detract from wildlife's commercial value prejudice its chances of survival in the long term*".

Although the USFWS understandably categorises lion conservation by country for simplicity, rather than individual properties, the Bubye Valley and Savé Valley Conservancies currently and deservedly hunt more than a third of the total Zimbabwean lion quota between them. Here we have shown that this sport-hunting does not negatively affect the lion population, which remains in positive growth despite off-take. In addition

to this, other areas, such as the Nuanetsi Ranch, could be incentivised to invest in lion conservation if the ability to sustainably utilise the lions as a resource was guaranteed.

The USFWS identified five primary factors that threaten lion survival in the wild, namely: habitat loss; loss of prey; retaliatory killing due to increased human-lion conflicts; inadequate regulatory mechanisms; and weak management of protected areas (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). Each and every point on this list, which notably does not include sport-hunting, supports the fact that incentivising tolerance for lions through sustainable use would enhance the species' overall survival.

As responsible conservationists, we are not arguing against tight regulation of sport-hunting, especially with regard to sensitive species such as lions, and we support the need for transparency and accountability within the industry. However, this reform is a process being driven from within, as any indiscretion is an affront on all stakeholders. For example, long-term lion monitoring by WildCRU in Hwange National Park (HNP), Matabeleland North, Zimbabwe, documented a 'vacuum effect' and reduction in male lion density in the Park as a result of sport-hunting in the surrounding areas (Loveridge et al. 2007). A result of this research was the recommendation that ZPWMA implement a hunting moratorium in western Zimbabwe, which was accepted and enforced from 2005 to 2008 (Davidson 2009). Subsequent monitoring of the HNP lion population showed that the perturbation effects caused by sport-hunting were reversed during the moratorium, and sport-hunting was reinstated at a reduced, more sustainable quota (Davidson 2009). This example demonstrates both the relationship between independent researchers and ZP-WMA, and that the research assists ZP-WMA in robust decision making. This study has also shown that the lion population was able to recover quickly, and that a blanket-ban would have been as unnecessary as it would have been detrimental to overall lion conservation in the country.

In addition to the self-imposed hunting moratorium in the Matabeleland North district, Zimbabwe has voluntarily stopped sport-hunting of any lioness. The fixed-quota concept, in which hunting quotas had to be paid for upfront before the hunting season even began, and which was resultantly attributed to poor quality trophies and young animals being hunted, has also been abandoned. The adaptive quota management system for lion hunting based on the ages of lions hunted has been accepted and embraced by all stakeholders. This adaptive quota management system has not only led to a reduced national lion hunting quota, but has also resulted in a significant increase in the age of harvested lions to a level that is considered to have minimal ecological impact, being old individuals that are no longer contributing to the gene pool nor protecting cubs.

The IUCN Red List lion conservation status has remained unchanged for 20 years even in the face of Africa's ever-changing landscape. Despite fears that lion abundance is decreasing overall, in southern Africa it is in fact increasing (Bauer et al. 2015b).

Conclusion

Given the evidence presented, the arguments against sport-hunting would appear to be based more in emotion than logic and reality (e.g. Lindsey et al. 2015). Conservation, however, is not about individuals within populations, but the overall populations themselves. Sustainable sport-hunting of lions is just that: *sustainable* - and ironically, without it, the lions themselves become unsustainable. Conservation objectives need to be balanced with both social and economic factors if they are to be achieved.

The USFWS states "Well-managed conservation programs use trophy hunting revenues to sustain lion conservation, research and anti-poaching activitie" (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). The Bubye Valley and Savé Valley Conservancies both fully meet each one of these conditions: clearly contributing to lion conservation in Zimbabwe; having long-term conservation research programs; and self-funded anti-poaching units.

The histories regarding the formation of both the Bubye Valley and Savé Valley Conservancies were both presented in this report, despite being remarkably similar; the point being that lion conservation in both areas, and many others, has the same fate either way. The Bubye Valley and Savé Valley Conservancies are both excellent examples of focussed and determined efforts to make wildlife based land use viable in an otherwise cattle dominated landscape. However, the fact remains that the cost of having lions, both ecologically and financially, is high. Simply increasing the abundance of one species at the expense of another cannot be considered a conservation success.

References

Barnett, R., Yamaguchi, N., Shapiro, B., Ho, S.Y., Barnes, I., Sabin, R., Werdelin, L., Cuisin, J., Larson, G., 2014. Revealing the maternal demographic history of Panthera leo using ancient DNA and a spatially explicit genealogical analysis. Bmc Evolutionary Biology 14.

Bauer, H., Chapron, G., Nowell, K., Henschel, P., Funston, P., Hunter, L., Macdonald, D., Packer, C., 2015a. Lion (Panthera leo) populations are declining rapidly across Africa, except in intensively managed areas. Proceedings of the National Academy of Sciences of the United States of America-Biological Sciences 10.

Bauer, H., Packer, C., Funston, P.F., Henschel, P., Nowell, K., 2015b. Panthera leo. The IUCN Red List of Threatened Species 2015.

Bauer, H., Van Der Merwe, S., 2004. Inventory of free-ranging lions Panthera leo in Africa. Oryx 38, 26-31.

Becker, M., McRobb, R., Watson, F., Droge, E., Kanyembo, B., Murdoch, J., Kakumbi, C., 2013. Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. Biological Conservation 158, 26-36.

Bond, I., 1993. The economics of wildlife and landuse in Zimbabwe: An examination of current knowledge and issues. WWF Multispecies Project Paper No 36, Worldwide Fund for Nature, Harare, Zimbabwe.

Brassine, M.C., Parker, D.M., 2012. Does the presence of large predators affect the diet of a mesopredator? African Journal of Ecology 50, 243-246.

Child, B., 1988. The role of wildlife utilization in the sustainable economic development of semi-arid rangelands in Zimbabwe. D.Phil. Thesis, University of Oxford, Oxford, UK.

Child, B., 1993. Using wildlife as a development tool in Zimbabwe.

Creel, S., 2001. Four factors modifying the effect of competition on carnivore population dynamics as illustrated by African wild dogs. Conservation Biology 15, 271-274.

Creel, S., Creel, N.M., 1996. Limitation of African wild dogs by competition with larger carnivores. Conservation Biology 10, 526-538.

Creel, S., Creel, N.M., 1997. Lion density and population structure in the Selous Game Reserve: Evaluation of hunting quotas and offtake. African Journal of Ecology 35, 83-93.

Cumming, D.H.M., 1993. Multi-species systems: Progress, prospects and challenges in sustaining range animal production and biodiversity in East and southern Africa. In Proceedings VII World Conference on Animal Production, Edmonton, Alberta, Canada

Davidson, Z., 2009. Lion ecology and socio-spatial impacts of trophy hunting in Zimbabwe. D.Phil. Thesis, University of Oxford, Oxford, UK.

du Preez, B., Hart, T., Loveridge, A.J., Macdonald, D.W., 2015. Impact of risk on animal behaviour and habitat transition probabilities. Animal Behaviour 100, 22-37.

du Preez, B.D., 2014. The impact of intraguild competition with lion Panthera leo on leopard Panthera pardus behavioural ecology. D.Phil. Thesis, University of Oxford, Oxford, UK.

du Toit, R., 1989. Proposal for Savé Valley Conservancy. Unpublished report for the Intensive Conservation Areas Committee, October 1989, Harare, Zimbabwe

Durant, S.M., 1998. Competition refuges and coexistence: an example from Serengeti carnivores. Journal of Animal Ecology 67, 370-386.

Durant, S.M., 2000. Living with the enemy: avoidance of hyenas and lions by cheetahs in the Serengeti. Behavioral Ecology 11, 624-632.

Funston, P.J., 2008. Conservation and management of lions in Southern Africa: status, threats, utilization and the restoration option, In Management and conservation of large carnivores

in West and Central Africa. eds B. Croes, H.H. Delongh, H. Bauer, pp. 109-131. Leiden, Institute of Environmental Sciences.

Funston, P.J., 2011. The Savé Valley Conservancy Lion Management Plan, 2011. Report for the Savé Valley Conservancy.

Funston, P.J., Groom, R.J., Lindsey, P.A., 2013. Insights into the Management of Large Carnivores for Profitable Wildlife-Based Land Uses in African Savannas. Plos One 8.

Groom, R.J., P., W.J., 2015. Carnivore densities in the Savé Valley Conservancy: 2015. Report for the Savé Valley Conservancy.

Hayward, M.W., O'Brein, J., Kerley, G.I.H., 2007. Carrying capacity of large African predators: predictions and tests. Biological Conservation 139, 219-229.

Hunter, L.T.B., Pretorius, K., Carlisle, L.C., Rickelton, M., Walker, C., Slotow, R., Skinner, J.D., 2007. Restoring lions Panthera leo to northern KwaZulu-Natal, South Africa: short-term biological and technical success but equivocal long-term conservation. Oryx 41, 196-204.

IUCN, 2006. Conservation strategy for the lion in eastern and southern Africa. IUCN SSC Cat Specialist Group, Gland, Switzerland and Cambridge, UK.

IUCN, 2015. The IUCN Red List of Threatened Species. Version 2015-4.

Jansen, D.J., Child, B., Bond, I., 1992. Cattle, wildlife, both or neither: Results of a financial and economic survey of commercial ranches in southern Zimbabwe. WWF Multispecies Project Paper No 27, Worldwide Fund for Nature, Harare, Zimbabwe.

Kettles, R., Slotow, R., 2009. Management of free-ranging lions on an enclosed game reserve. South African Journal of Wildlife Research 39, 23-33.

Laurenson, M.K., Wielebnowski, N., Caro, T.M., 1995. Extrinsic Factors and Juvenile Mortality in Cheetahs. Conservation Biology 9, 1329-1331.

Leader-Williams, N., Milledge, S., Adcock, K., Brooks, M., Conway, A., Knight, M., Mainka, S., Martin, E.B., Teferi, T., 2005. Trophy hunting of black rhino Diceros bicornis: Proposals to ensure is future sustainability. Journal of International Wildlife Law & Policy and Politics 8, 1-11.

Lindsey, P., du Toit, R., Pole, A., Romanach, S., 2008. Savé Valley Conservancy: a large scale African experiment in cooperative wildlife management. Chapter 11, pages 163-184 in B. Child, H. Suich and A. Spenceley, "Evolution and innovation in wildlife conservation in southern Africa." Earthscan, London.

Lindsey, P.A., Alexander, R., Frank, L.G., Mathieson, A., Romanach, S.S., 2006. Potential of trophy hunting to create incentives for wildlife conservation in Africa where alternative wildlife-based land uses may not be viable. Animal Conservation 9, 283-291.

Lindsey, P.A., Balme, G.A., Booth, V.R., Midlane, N., 2012. The Significance of African Lions for the Financial Viability of Trophy Hunting and the Maintenance of Wild Land. Plos One 7.

Lindsey, P.A., Balme, G.A., Funston, P.J., Henschel, P.H., Hunter, L.T.B., 2015. Life after Cecil: channelling global outrage into funding for conservation in Africa. Conservation Letters 0, 1-6.

Lindsey, P.A., Balme, G.A., Booth, V.R., Midlane, N., 2012. The Significance of African Lions for the Financial Viability of Trophy Hunting and the Maintenance of Wild Land. Plos One 7.

Lindsey, P.A., Romanach, S.S., Davies-Mostert, H.T., 2009. The importance of conservancies for enhancing the value of game ranch land for large mammal conservation in southern Africa. Journal of Zoology 277, 99-105.

Lindsey, P.A., Romanach, S.S., Tambling, C.J., Chartier, K., Groom, R., 2011. Ecological and financial impacts of illegal bushmeat trade in Zimbabwe. Oryx 45, 96-111.

Lindsey, P.A., Roulet, P.A., Romanach, S.S., 2007. Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. Biological Conservation 134, 455-469.

Loveridge, A.J., Searle, A.W., Murindagomo, F., Macdonald, D.W., 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation 134, 548-558.

Macdonald, D.W., Loveridge, A.J., Nowell, K., 2010. Dramatis personae: an introduction to the wild felids, In Biology and Conservation of Wild Felids. eds D.W. Macdonald, A.J. Loveridge, pp. 3-58. Oxford University Press Inc., New York, United States.

Miller, S.M., Funston, P.J., 2014. Rapid growth rates of lion (Panthera leo) populations in small, fenced reserves in South Africa: a management dilemma. South African Journal of Wildlife Research 43, 1-13.

Mills, M.G.L., 1995. Notes on wild dog Lycaon pictus and lion Panthera leo population trends during a drought in the Kruger National Park. Koedoe 38, 95-99.

Mosser, A., Packer, C., 2009. Group territoriality and the benefits of sociality in the African lion, Panthera leo. Animal Behaviour 78, 359-370.

Nowell, K., Jackson, P., 1996. Leopard, Panthera pardus, In Wild Cats: Status Survey and Conservation Action Plan. p. 406. IUCN, Switzerland.

Packer, C., Brink, H., Kissui, B.M., Maliti, H., Kushnir, H., Caro, T., 2010. Effects of Trophy Hunting on Lion and Leopard Populations in Tanzania. Conservation Biology 25, 142-153.

Packer, C., Kosmala, M., Cooley, H.S., Brink, H., Pintea, L., Garshelis, D., Purchase, G., Strauss, M., Swanson, A., Balme, G., Hunter, L., Nowell, K., 2009. Sport Hunting, Predator Control and Conservation of Large Carnivores. Plos One 4.

Packer, C., Loveridge, A., Canney, S., Caro, T., Garnett, S.T., Pfeifer, M., Zander, K.K., Swanson, A., MacNulty, D., Balme, G., Bauer, H., Begg, C.M., Begg, K.S., Bhalla, S., Bissett, C., Bodasing, T., Brink, H., Burger, A., Burton, A.C., Clegg, B., Dell, S., Delsink, A., Dickerson, T., Dloniak, S.M., Druce, D., Frank, L., Funston, P., Gichohi, N., Groom, R., Hanekom, C., Heath, B., Hunter, L., DeIongh, H.H., Joubert, C.J., Kasiki, S.M., Kissui, B., Knocker, W., Leathem, B., Lindsey, P.A., Maclennan, S.D., McNutt, J.W., Miller, S.M., Naylor, S., Nel, P., Ng'weno, C., Nicholls, K., Ogutu, J.O., Okot-Omoya, E., Patterson, B.D., Plumptre, A., Salerno, J., Skinner, K., Slotow, R., Sogbohossou, E.A., Stratford, K.J., Winterbach, C., Winterbach, H., Polasky, S., 2013. Conserving large carnivores: dollars and fence. Ecol Lett 16, 635-641.

Pole, A., 1999. The behaviour and ecology of African wild dogs, Lycaon pictus, in an environment with reduced competitor density. PhD thesis, University of Aberdeen, Aberdeen, Scotland.

Pusey, A.E., Packer, C., 1987. The Evolution of Sex-Biased Dispersal in Lions. Behaviour 101, 275-310.

Schaller, G.B., 1972. The Serengeti Lion: A Study of Predator-Prey Relations. University of Chicago Press.

Smuts, G.L., 1978. Effects of Population Reduction on Travels and Reproduction of Lions in Kruger National Park. Carnivore 1, 61 - 72.

Spong, G., 2002. Space use in lions, Panthera leo, in the Selous Game Reserve: social and ecological factors. Behavioral Ecology and Sociobiology 52, 303-307.

Suzuki, Y., 2001. Drifting Rhinos and Fluid Properties: The Turn to Wildlife Production in Western Zimbabwe. Journal of Agrarian Change 1, 600-625.

Trinkel, M., Funston, P., Hofmeyr, M., Hofmeyr, D., Dell, S., Packer, C., Slotow, R., 2010. Inbreeding and density-dependent population growth in a small, isolated lion population. Animal Conservation 13, 374-382.

Vucetich, J.A., Creel, S., 1999. Ecological interactions, social organization, and extinction risk in African wild dogs. Conservation Biology 13, 1172-1182.

Wegge, P., Odden, M., Pokharel, C.P., Storaas, T., 2009. Predator-prey relationships and responses of ungulates and their predators to the establishment of protected areas: A case study of tigers, leopards and their prey in Bardia National Park, Nepal. Biological Conservation 142, 189-202.

Whitman, K., Starfield, A.M., Quadling, H.S., Packer, C., 2004. Sustainable trophy hunting of African lions. Nature 428, 175-178.

Williams, P.H., Burgess, N.D., Rahbek, C., 2000. Flagship species, ecological complementary and conserving the diversity of mammals and birds in sub-Saharan Africa (vol 3, part 3, pg 258, 2000). Animal Conservation 3, 365-365.

ZPWMA, 2015. Conservation Status of the African Lion (Panthera leo) in Zimbabwe. Unpublished Report for the USFWS.

Barry, Anna <anna_barry@fws.gov>

Conservation Status of African Lion in Zimbabwe

3 messages

Barry, Anna <anna_barry@fws.gov> Thu, Jun 30, 2016 at 10:24 AM
To: snyasha@zimparks.co.zw
Cc: Tim Vannorman <tim_vannorman@fws.gov>

Dear Mr. Simukai Nyasha,

Again we wish to thank you for the information your office provided us regarding the status of lions in Zimbabwe. Tim asked me to contact you regarding a report mentioned in the "Study of the Contribution of Sustainable Trophy Hunting to the Management and Conservation of Lion in Zimbabwe" (see attached). In that document, it is mentioned that a report will be finalized during May 2016. If this report was prepared and finalized, we ask that you please send us a copy.

Thank you for all assistance in this matter.

Sincerely,

Anna Barry
Senior Biologist
USFWS/Division of Management Authority
Branch of Permits, MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803
1-800-358-2104, ext. 1976 or 703-358-1976
Fax: 703-358-2281
E-mail: Anna_Barry@fws.gov

Please be aware that we process application on a first come first serve basis and due to the number of applications we receive some delays are unavoidable.

Application Forms 3-200 (http://www.fws.gov/forms/display.cfm?number1=200) were revised and available May 2014. Please ensure the application that you complete expires 05/31/2017 (found on upper right hand corner of page 1) to avoid the application being returned. We do not accept applications via fax or e-mail.

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

Lion..pdf
238K

Simukai Nyasha <snyasha@zimparks.co.zw> Wed, Jul 6, 2016 at 5:11 AM
To: "Barry, Anna" <anna_barry@fws.gov>
Cc: Tim Vannorman <tim_vannorman@fws.gov>

Dear Anna Barry

Apologies for the late response, I was out of office. The study you are referring to is s underway. Basically the study is meant to to demonstrate that the lion popula in Zimbabwe is being managed sustainably for benefit of both the species and local c e are hoping to conclude it before end of July. We will definitely sent you a copy once the study is finalised.

Regards

Simuk**ai Ny**asha

Interna ven er

Cell: +263-772 678 351

From: Barry, Anna [mailto:anna_barry@fws.gov]
Sent: Thursday, June 30, 2016 4:25 PM
To: snyasha@zimparks.co.zw
Cc: Tim V annorman@fws.gov>
Subject: Conserva atus of African Lion in Zimbabwe

Dear Mr. Simukai Nyasha,

Again we wish to thank you for the information your office provided us regarding the status of lions in Zimbabwe. Tim asked me to contact you regarding a report mentioned in the "Study of the Contribution of Sustainable Trophy Hunting to the Management and Conservation of Lion in Zimbabwe" (see attached). In that document, it is mentioned that a report will be finalized during May 2016. If this report was prepared and finalized, we ask that you please send us a copy.

Thank you for all assistance in this matter.

Sincerely,

Anna Barry

Senior Biologist

USFWS/Division of Management Authority

Branch of Permits, MS: IA

5275 Leesburg Pike

Falls Church, VA 22041-3803

1-800-358-2104, ext. 1976 or 703-358-1976

Fax: 703-358-2281

E-mail: Anna_Barry@fws.gov

Please be aware that we process application on a first come first serve basis and due to the number of applications we receive some delays are unavoidable.

Application Forms 3-200 (http://www.fws.gov/forms/display.cfm?number1=200) were revised and available May 2014. Please ensure the application that you complete expires 05/31/2017 (found on upper right hand corner of page 1) to avoid the application being returned. We do not accept applications via fax or e-mail.

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

Barry, Anna <anna_barry@fws.gov> Thu, Jul 7, 2016 at 10:06 AM
To: Simukai Nyasha <snyasha@zimparks.co.zw>

Dear Simukai Nyasha,

Thank you for responding so quickly and we are looking forward to receiving the document.

Sincerely,

Anna Barry
Senior Biologist
USFWS/Division of Management Authority
Branch of Permits, MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803
1-800-358-2104, ext. 1976 or 703-358-1976
Fax: 703-358-2281
E-mail: Anna_Barry@fws.gov

Please be aware that we process application on a first come first serve basis and due to the number of applications we receive some delays are unavoidable.

Application Forms 3-200 (http://www.fws.gov/forms/display.cfm?number1=200) were revised and available May 2014. Please ensure the application that you complete expires 05/31/2017 (found on upper right hand corner of page 1) to avoid the application being returned. We do not accept applications via fax or e-mail.

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!



[Quoted text hidden]

BRIEFING PAPER
April 2016

Informing decisions on trophy hunting

A Briefing Paper for European Union Decision-makers regarding potential plans for restriction of imports of hunting trophies

For more information, please contact:

Dan Challender
IUCN Species Programme
dan.challender@iucn.org

Rosie Cooney
IUCN CEESP/SSC Sustainable Use and Livelihoods Specialist Group
rosie.cooney@iucn.org



SUMMARY

Trophy hunting is currently the subject of intense debate, with moves at various levels to end or restrict it, including through bans on carriage or import of trophies. In the European Parliament, a group of Members have called for signing of a Written Declaration calling: "to examine the possibility of restricting all import of trophies into the EU, to ensure proper implementation of the rules by Member States, and to persuade countries that are issuing permits to trophy hunters without due consideration for the impacts of trophy hunting on conservation and animal welfare to discontinue this practice".

This paper seeks to inform discussions on this Declaration and other relevant discussions in the European Union on restriction of imports of hunting trophies.

Trophy hunting is hunting of animals with specific desired characteristics (such as large antlers), and overlaps with widely practiced hunting for meat. It is clear that there have been, and continue to be, cases of poorly conducted and poorly regulated hunting both beyond and within the European Union. While "Cecil the Lion" is perhaps the most highly publicised controversial case, there are examples of weak governance, corruption, lack of transparency, excessive quotas, illegal hunting, poor monitoring and other problems in a number of countries. This poor practice requires urgent action and reform.

However, legal, well regulated trophy hunting programmes can – and do – play an important role in delivering benefits for both wildlife conservation and for the livelihoods and wellbeing of indigenous and local communities living with wildlife.

RECOMMENDATIONS

To avoid significant negative impacts on species populations, habitat conservation, poaching levels, and the rights and livelihoods of indigenous and local communities, IUCN calls on the European Parliament, Council and Commission to ensure that any decisions that could restrict or end trophy hunting programmes:

i. are based on careful and sound analysis and understanding of the particular role that trophy hunting programmes are playing in relation to conservation efforts at all levels in source countries, including their contribution to livelihoods in specific affected communities;

ii. are based on meaningful and equitable consultation with affected range state governments and indigenous peoples and local communities and do not undermine local approaches to conservation;

iii. are taken only after exploration of other options to engage with relevant countries to change poor practice and promote improved standards of governance and management of hunting;

iv. are taken only after identification and implementation of feasible, fully funded and sustainable alternatives to hunting that respect indigenous and local community rights and livelihoods and deliver equal or greater incentives for conservation over the long term.

SUMMARY *continued*

Habitat loss and degradation is the primary driver of declines in populations of terrestrial species. Demographic change and corresponding demands for land for development are increasing in biodiversity-rich parts of the globe, exacerbating this pressure on wildlife and making the need for viable conservation incentives more urgent.

Well managed trophy hunting, which takes place in many parts of the world, can and does generate critically needed incentives and revenue for government, private and community landowners to maintain and restore wildlife as a land use and to carry out conservation actions (including anti-poaching interventions). It can return much needed income, jobs, and other important economic and social benefits to indigenous and local communities in places where these benefits are often scarce. In many parts of the world indigenous and local communities have chosen to use trophy hunting as a strategy for conservation of their wildlife and to improve sustainable livelihoods.

In many parts of the world indigenous and local communities have chosen to use trophy hunting as a strategy for conservation of their wildlife and to improve sustainable livelihoods

Time-limited, targeted conditional moratoria – particularly if accompanied by support for on-the ground management reform – may be useful tools in driving improvements in hunting practice. Such moratoria could focus on particular countries or species. But blanket bans or restrictions affect both good and bad hunting practices. They are a blunt instrument that risks undermining important benefits for both conservation and local livelihoods, thus exacerbating rather than addressing the prevailing major threats of habitat loss and poaching.

Rather than bans on trophy hunting, poor practices (within the EU or in other countries) could be improved by sustained engagement with and support for responsible national agencies to improve governance frameworks and on-the-ground management.

Or, if decisions to ban or restrict trophy hunting are taken, there is a need to identify and implement in advance viable alternative long-term sources of livelihood support and conservation incentives.

While tourism can be a one viable alternative in a limited number of cases, it requires access, infrastructure, guaranteed wildlife viewing opportunities and political stability – all conditions that are missing in many of the places where trophy hunting is working. But tourism and hunting can be complementary land uses in many areas, with both activities – when regulated by effective protocols – contributing to making wildlife a viable land use.

IUCN stands ready to assist European decision-makers in better understanding the role of trophy hunting in conservation and livelihoods and is actively pursuing a major research exercise to enable this.

BACKGROUND

What is at stake?

Trophy hunting is currently the subject of intense debate and polarised positions, with controversy and deep concern over the practice of trophy hunting, its ethical basis, and its impacts. It is clear that there have been, and continue to be, cases of poorly conducted and poorly regulated hunting, with Cecil the Lion perhaps the most highly publicised example of this.

Intense scrutiny of hunting due to these bad examples has been associated with many confusions (and sometimes misinformation) about the nature of hunting, including:

- trophy hunting is the same as “canned” hunting;
- trophy hunting is illegal;
- trophy hunting is driving declines of iconic species, particularly large African mammals like elephant, rhino and lion;
- trophy hunting could readily be replaced by photographic tourism.

None of these statements is correct.

Concerns over hunting, sometimes driven by these confusions, have sparked calls at various levels directed at ending or limiting trophy hunting, typically by restricting the national level licensing of hunting or the transport or import of hunting trophies.

In the European Union (EU), a group of Members of the European Parliament (MEPs) have called for the signing of a Declaration to ban import of trophies into the EU (European Parliament 2016). This paper seeks to inform discussions on this Declaration.

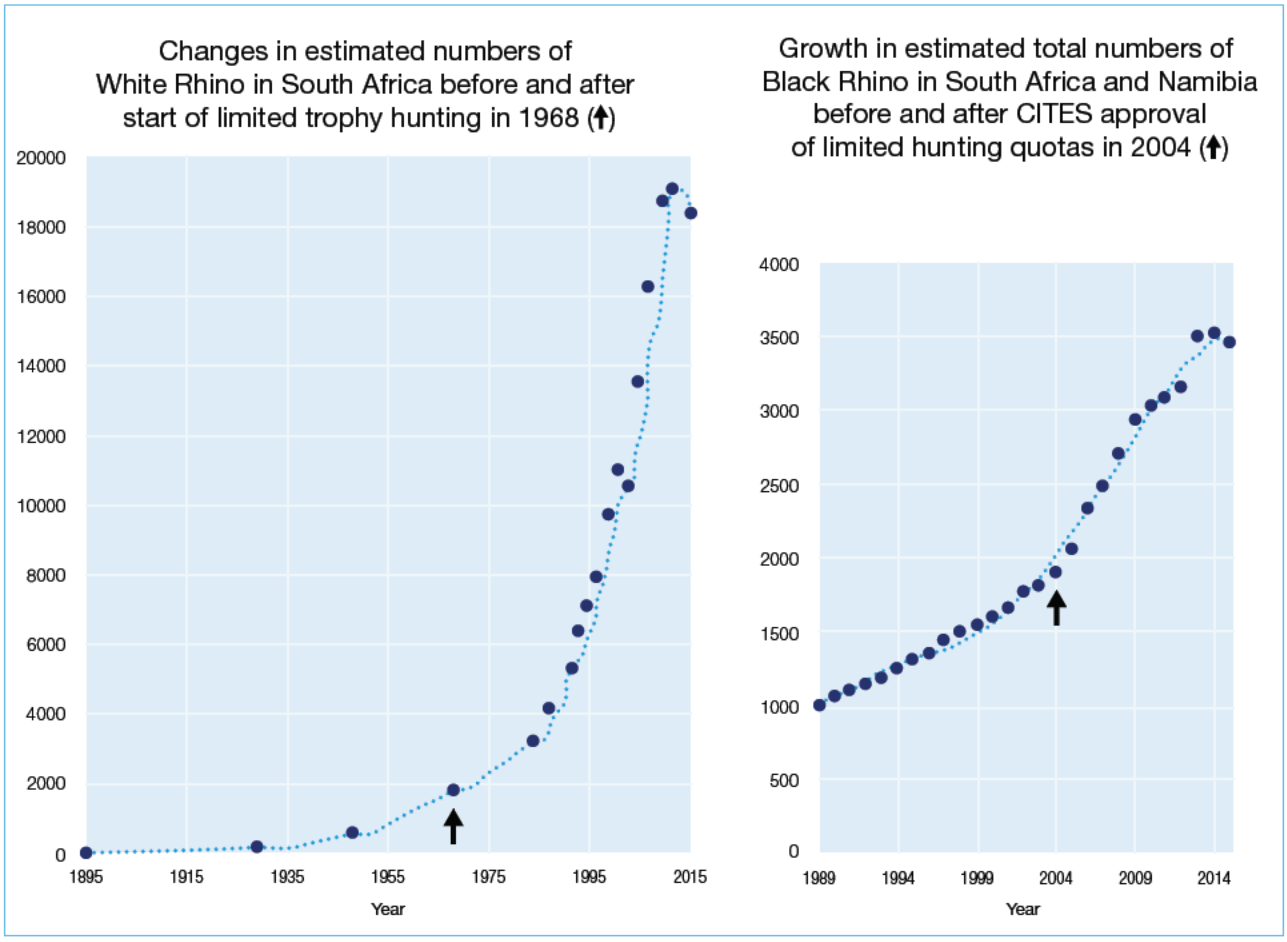


Figure 1 Trophy hunting programmes have contributed to the recovery of African White and Black Rhinos (see Annex 1: Case Study 1).

What is trophy hunting?

Trophy hunting generally involves the payment of a fee by a foreign or local hunter for a hunting experience, usually guided, for one or more individuals of a particular species with specific desired characteristics (such as large size or antlers). The trophy is usually retained by the hunter and taken home. Meat of hunted animals is usually used for food by local communities or the hunter. It may be a distinct activity or overlap with recreational or meat hunting. Many deer hunters, for example, may desire a trophy but also hunt for food or for the experience.

It takes place in most countries of Europe, the USA, Canada, Mexico, several countries in East, Central and South Asia, around half of the 54 countries in Africa (Booth and Chardonnet, 2015), several countries in Central and South America, and in Australia and New Zealand.

A wide variety of species are hunted, from abundant to threatened. Most are native, some are introduced. Hunting of introduced species is not further discussed here, as it constitutes a small proportion of hunting and raises quite different conservation issues.

Is trophy hunting "canned hunting"?

There is a tendency for the media and decision-makers to conflate canned hunting (hunting of animals in confined enclosures where they are unable to escape) with trophy hunting. Canned hunting represents a very small proportion of hunting, raises very different issues from trophy hunting of free-ranging animals, and is condemned by existing IUCN policy (IUCN Recommendation 3.093, "Application of the IUCN Sustainable Use Policy to sustainable consumptive use of wildlife and recreational hunting in southern Africa", 2004). It is not discussed further in this document.

Is it legal? And who decides?

Trophy hunting is often incorrectly conflated with the poaching for the organised international illegal wildlife trade (IWT) that is currently devastating many species including African elephant and African rhinos.

However, trophy hunting typically takes place as a legal, regulated activity under programmes implemented by government wildlife agencies, protected area managers, indigenous and local community bodies, private landowners, or conservation/development organisations. In a number of cases revenues from hunting are in fact funding law enforcement or providing community benefits that counter incentives to engage in IWT (see Case Studies 1,4,8,9; Figure 2).

In some contexts, all decisions on hunting quotas, species, and areas are made by government wildlife agencies. However, under many trophy hunting governance systems local landowners or community organizations participate alongside governments in deciding these questions and sometimes are the key decisionmakers (see Case Studies 2,4-7,10; Figure 2).

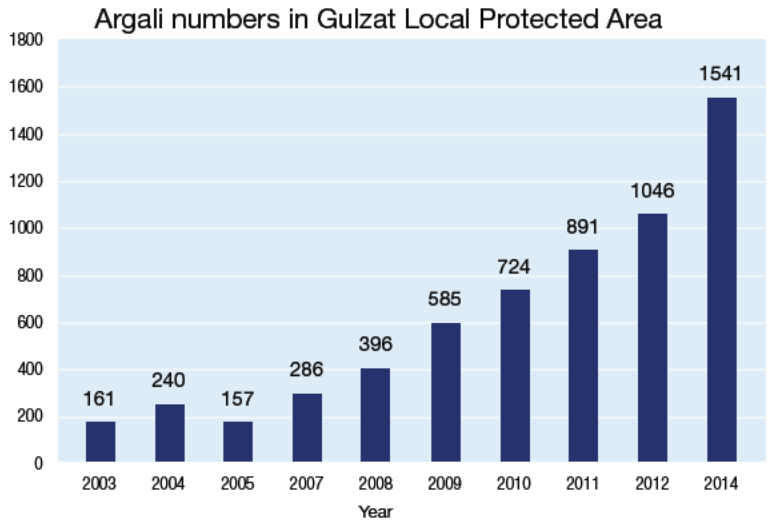


Figure 2 Local communities have developed a conservation approach for Argali in Mongolia using legal, regulated trophy hunting to pay guards and incentivise protection from poaching. Graph shows growth in population of Argali in Gulzat Local Protected Area. Trophy hunting was introduced in 2010 (see Annex 1; Case Study 2). Source: WWF Mongolia, unpublished data.

This is not to say that there is not a level of illegal practice taking place (both within and beyond the EU), as in most industries. There are regulatory weaknesses and illegal activities taking place in some countries, sometimes very serious. These include hunting in excess of quotas, in the wrong areas, taking of non-permitted species, and for African rhinos, problems with "pseudohunting" and sale of hunting trophies into black markets in consumer states.

Where does the money go?

Prices paid for hunts vary enormously, from hundreds to hundreds of thousands of (US) dollars, and globally involve a substantial revenue flow from developed to developing countries.

In developing countries, landowners/managers will often negotiate with "hunting operators" to decide who will get the hunting right or "concession" on their land, and on what terms. The operator, in turn, secures contracts with clients overseas and runs the hunting trips. The price paid by the hunter will generally include three things:

- the operator's costs (where applicable);
- payment to the local entity (community, private or state land owner/manager) with which the operator has the contract; and
- "official" government payments of various types which typically help finance wildlife management and conservation activities.

In developing countries generally 50-90% of the net revenues (excluding operator costs) are allocated to the local entity, with the remainder to the government authority. The local community benefit can be as high as 100% (Case Study 5). Meat from the hunts is also often contributed or sold to local community members and can be highly locally valued (Naidoo et al., 2016). In most of Europe and North America, a share of hunters' fees usually goes to governmental wildlife authorities to finance wildlife management and conservation activities.

How can trophy hunting be good for conservation?

Trophy hunting takes place in a great variety of governance, management, and ecological contexts, so its impacts on conservation vary enormously, from negative to neutral to positive. In many contexts good evidence is lacking or scanty, so it is currently impossible to evaluate precisely how widespread each outcome is.

Negative conservation impacts of poorly managed hunting can include overharvesting, artificial selection for rare or exaggerated features, genetic or phenotypic impacts due to hunting (such as reduced horn size), introduction of species or subspecies beyond their natural range (including into other countries), and predator removal.

With effective governance and management trophy hunting can and does have positive impacts

However, it is clear that with effective governance and management trophy hunting can and does have positive impacts (see Annex 1 for examples). Habitat loss and degradation, driven primarily by expansion of human economic activities, is the most important threat to terrestrial wildlife populations (Mace et al., 2005), along with other threats such as poaching for bushmeat and illegal wildlife trade and competition with livestock. Demographic change (population expansion) and demands for food, income and land for development are increasing in many biodiversity-rich parts of the globe, exacerbating these pressures on wildlife and making the need for viable conservation incentives more urgent.

In contrast, hunting can be a positive driver for conservation because it increases the value of wildlife and the habitats it depends on, providing critical benefit flows that can motivate and enable sustainable management approaches. Trophy hunting programmes can:

1. **generate incentives for landowners (government, private individuals or communities) to conserve or restore wildlife** on their land. Benefits to landowners from hunting can make wildlife an attractive land use option, encouraging them to maintain or restore wildlife habitat and populations, remove livestock, invest in monitoring and management, and carry out anti-poaching activities (see Case Studies 1,3-7 for examples). For example, policies enabling landowners to benefit from sustainable use of wildlife have led to the total or partial conversion of large areas of land from livestock and cropping *back* to wildlife in South Africa, Zimbabwe, Namibia, Pakistan, the United States and Mexico (see Case Studies 1, 3-6). Without such benefits, the future of these lands and the wildlife that inhabit them is highly uncertain.
2. **generate revenue for wildlife management and conservation, including anti-poaching activities**, for government, private and communal landholders (see Case Studies 1-7, 9 for examples). Government agencies in most regions depend at least in part on revenues from hunting to manage wildlife and protected areas. For example, state wildlife agencies in the USA are funded primarily by hunters (both trophy and broader recreational hunting) through various direct and indirect mechanisms including the sale/auction of trophy hunt permits (Heffelfinger, Geist and Wishart, 2013; Mahoney, 2013). The extent of the world's gazetted protected areas, many of which fall in IUCN categories IV and VI and include hunting areas, could significantly decline as these areas become inoperable. Private land-owners in South Africa and Zimbabwe and communal landowners in Namibia also use trophy-hunting revenues to pay guards and rangers, buy equipment, and otherwise manage and protect wildlife (Case Studies 1,4,5). Revenues from trophy hunting operations in Mongolia, Tajikistan and Pakistan are used to pay local guards to stop poaching and to improve habitat for game animals (Case Studies 2,6,7). Trophy hunting operators and the patrols they directly organize, finance and deploy can reduce poaching (Case Studies 4,6,9; Lindsey et al., 2007).
3. **increase tolerance for living with wildlife, reducing the effects of human-wildlife conflicts and reducing illegal killing**. Where wildlife imposes serious costs on local people, such as loss of crops and livestock or human injury and death, and there are no legal means for people to benefit from it, retaliatory killing and local poaching are common. This is particularly important in Africa where elephants and other species destroy crops and large cats kill humans and livestock (see Case Studies 4,5).

Is trophy hunting driving declines of large African mammals?

Concern is frequently expressed that trophy hunting is driving declines of iconic African large mammals such as elephants, rhinos and lions. While there is evidence for a small number of populations that unsustainable trophy hunting has contributed to local declines (e.g. Loveridge et al., 2007, Packer et al., 2009, 2011), it is not a significant threat to any of these species and is typically a negligible or minor threat to African wildlife populations (Lindsey, 2015).

The primary causes of population declines of the large mammals subject to trophy hunting, such as the African Elephant, African Buffalo, White Rhino, Black Rhino, African Wild Dog and Hartmann's Mountain Zebra are habitat loss and degradation, competition with livestock, illegal or uncontrolled poaching for meat and trade in animal products (ivory, horn, etc.), and retribution killing for human-wildlife conflict (Schipper et al., 2008). For Lions specifically, the most important causes of population declines are indiscriminate killing in defense of human life and livestock, habitat loss, and prey base depletion (usually from poaching) (Bauer et al., 2015).

For all of these species, as the case studies note, well-managed trophy hunting can indeed promote population recovery, protection, and maintenance of habitat (see Figure 3).

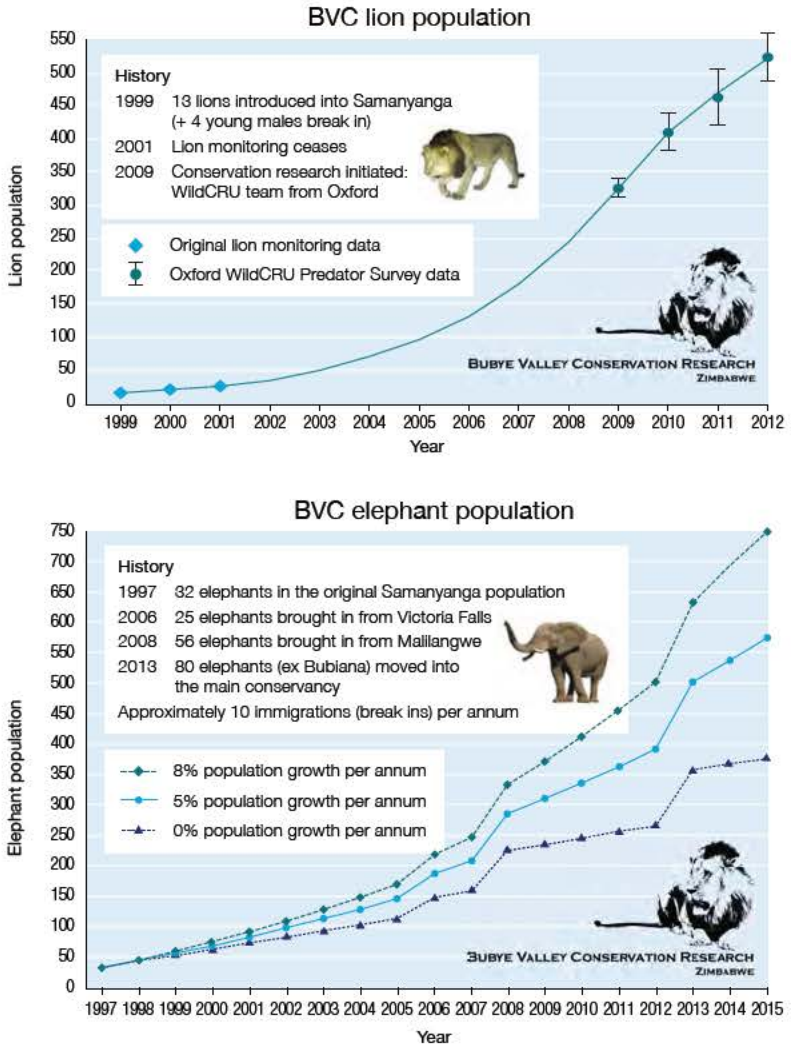


Figure 3 Bubye Valley Conservancy, a private conservancy in Zimbabwe on land previously used for farming, is dependent on limited trophy hunting to fund wildlife protection and conservation (see Annex 1; Case Study 4). Lion and African Elephant populations have grown steadily.

How does trophy hunting affect indigenous and local community rights and livelihoods?

This varies enormously across different contexts and different regions, and there are cases in which trophy hunting takes place without meaningful community participation in decision-making around wildlife management, without adequate respect for community rights and consent, and with insufficient or poorly functioning benefit-sharing mechanisms.

However, it is likewise clear that there are a significant number of trophy hunting programmes where indigenous or local communities have freely chosen to use trophy hunting as a tool to provide the incentives and revenue to help them conserve and manage their wildlife and/or improve their livelihoods (Case Studies 2,3,5–7,10). In many further cases communities have less decisionmaking power over trophy hunting, but nonetheless gain a share of hunting revenue (see Lindsey et al., 2013). Communities benefit from trophy hunting through hunting concession payments or other hunter investments, which typically support improved community services like water infrastructure, schools and health clinics; gaining jobs as guides, game guards, wildlife managers and other hunting-related employment; and gaining access to meat. These are typically poor rural communities with very few alternative sources of income and sometimes no other legal source of meat.

How would broad import restrictions, such as those raised by the Written Declaration on Trophy Hunting, affect conservation and livelihoods?

Trophy import restrictions by key importing entities such as the EU can make trophy hunting programmes economically unviable at local level, particularly where the restrictions affect "high value" iconic species (Case Study 5; Figure 4). Removing the incentives and revenue provided by hunting would be likely to cause serious declines of populations of a number of threatened or iconic species. For example, the recovery of some populations of African Elephant, Black Rhino, White Rhino, Hartmann's Mountain Zebra, Cheetah and Lion in Africa, of Markhor, Argali and Urial in Asia, and of Bighorn Sheep in North America could be stopped and reversed (Case Studies 1-8). Importantly, populations of threatened species that are not hunted could also be negatively impacted, including e.g. Snow Leopard and African Wild Dog (Case Study 8).

To avoid serious conservation impacts, any restrictions which would have this effect should be preceded by establishment of fully funded, feasible, long-term alternatives that generate conservation incentives and finance conservation actions.

Making the option of trophy hunting unviable through import restrictions would lead to some indigenous and local communities losing cash income from hunting concessions on their land, reduced access to meat, and loss of employment. For example, the indigenous Khwe San and the Mbukushu (around 5000 people) in Bwatwata National Park are some of Namibia's poorest people, but have earned around N$2.4 million (ca US$155,000) per year in hunting payments in recent years (R. Diggle, In litt.). Stopping trophy hunting would be an enormous setback, in terms not only of income but also meat – living in a National Park they cannot graze livestock or grow commercial crops. Likewise, if trophy hunting became unviable the thousands of rural Zimbabwean households that directly benefit from CAMPFIRE would lose approx. US$1.7 per annum (already reduced from US$2.2 million by US elephant trophy import bans) (C. Jonga (CAMPFIRE Association), In litt.). These are very substantial amounts in countries where the average income for rural residents is a few dollars a day or less.

Even more fundamentally, perhaps, unilateral trophy restrictions by importing states in these cases will take decision-making power away from already-marginalized rural communities as to how they can manage their land and wildlife in ways that respect their right to self-determination and that best meet their livelihood aspirations.

If and where import restrictions are pursued and where such owner/user rights and benefits exist, respect for equity, community rights and sustainable livelihoods require that they are based on consultation with such communities and establishment of feasible, sustainable, freely chosen alternative livelihood opportunities.

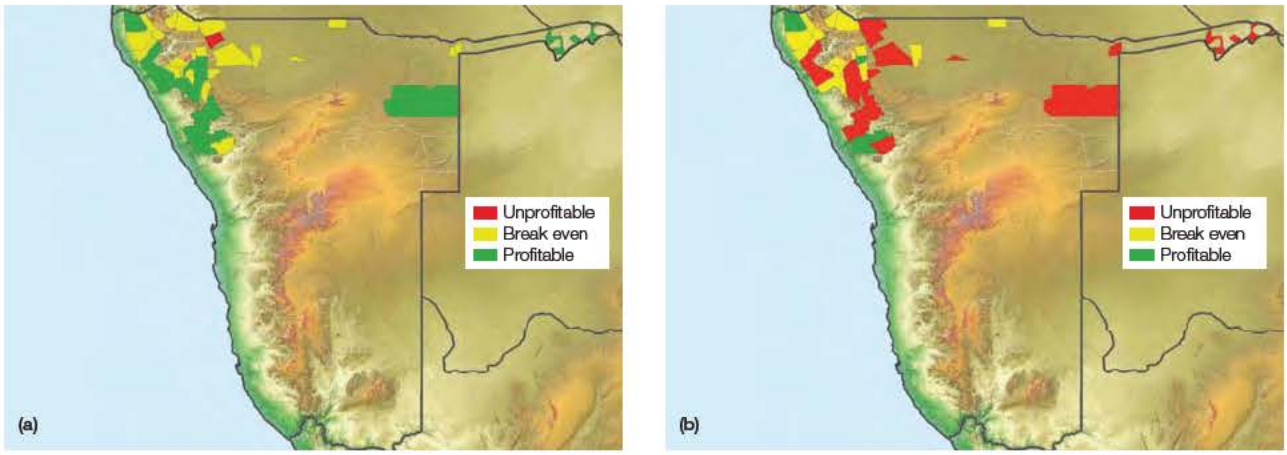


Figure 4 Trophy hunting provides critical revenue underpinning the success of the Namibian communal conservancy programme. Maps illustrate the economic viability of community conservancies in Namibia under (a) the status quo; and (b) a simulated trophy hunting ban (from Naidoo et al., 2016); see Annex 1; Case Study 5.





Images courtesy of Wildscreen Exchange, www.wildscreenexchange.org

Can't trophy hunting be replaced by photographic tourism?

Trophy hunting is not the only means to make wildlife valuable to people and to return local benefits. Photographic tourism can be a very valuable option in many places and has generated enormous benefits for conservation. However, it is viable over only a very limited percentage of the wildlife area currently managed for trophy hunting: it requires political stability, proximity to good transport links, minimal disease risks, high density wildlife populations to guarantee viewing, scenic landscapes, high capital investment, infrastructure (hotels, food and water supply, waste management), and local skills and capacity. Tourism and hunting are frequently highly complementary land uses when separated by time or space. Where tourism is feasible in areas currently used for hunting, it is typically already being employed alongside hunting (Case Studies 1,4,5). Like trophy hunting, if not carefully implemented it can have serious environmental impacts and can return a very low level of benefit to local communities, with most value captured offshore or by in-country elites (Sandbrook and Adams, 2012).

Are there other alternatives?

Effective alternative approaches to trophy hunting need to provide tangible and effective conservation incentives: they need to make wildlife valuable to people over the long term and should preferably empower local communities to exercise rights and responsibilities over wildlife conservation and management. For example, various forms of Payment for Ecological Services (PES schemes) offer considerable potential where they can effectively mobilise investments or voluntary contributions from governments, philanthropists and the private sector, and effectively motivate species and habitat conservation. The land leasing scheme carried out by Cottar's Safari Service with Maasai communities in Olderkesi, Kenya offers an example (IUCN SULi et al., 2015, p15), albeit limited by the difficulty of mobilising stable funding. The REDD+ approach (a form of PES scheme established through an intergovernmental process) can provide incentives and revenue flows to local communities in some areas, although with many caveats. All these options are challenging, with a critical challenge ensuring that revenue flows will be sustainable over the long term and not contingent on highly changeable donor priorities.

How could trophy hunting practices be improved?

Broad-scale restrictions and bans are not the only solution for addressing poor trophy hunting practice, outside or within the EU. Import restrictions are often attractive interventions as they are easy to implement and can be carried out at low cost to decision-making bodies. However, conservation success is rarely achieved by single decisions in distant capitals, but typically requires long term, sustained multi-stakeholder engagement in-country and on the ground. Trophy hunting is no exception.

As an alternative to blanket bans or other broad unilateral restrictions that would curtail trophy hunting programmes, EU decisionmakers may want to give more consideration to whether specific trophy hunting programmes both within the EU and beyond are meeting requirements for best practice, as elaborated in the IUCN SSC *Guiding Principles for Trophy Hunting as a Tool for Conservation Incentives* (IUCN SSC, 2012) and other publications including the *European Charter on Hunting and Biodiversity* adopted under the Bern Convention on the Conservation of European Wildlife and Natural Habitats (Brainerd, 2007). Where there are problems in governance and management of trophy hunting, as there are in many places, it will be most effective to actively engage with relevant countries to improve quality of governance and management, including increasing transparency in funding flows, community benefits, allocation of concessions and quota setting; strengthening of rights and responsibilities of indigenous peoples and local communities; and improving monitoring of populations and of hunts. There are important roles for many hunting stakeholders in improving standards, including importing countries, donors, national regulators and managers, community organisations, researchers, conservation organisations, and the hunting industry and hunter associations in reaching these standards.

Are there cases where trophy import bans might provide benefits?

Conditional, time-limited, targeted import moratoria aimed at addressing identified problems could help improve trophy hunting practice in certain instances. However, bans are unlikely to improve conservation outcomes unless there is a clear expectation that improved standards will lead to the ban being lifted, and the country has the capacity as well as the political will to address the problem. It is therefore critical to the impact of targeted moratoria that – at least in developing countries – they are accompanied by funding and technical support for on-the-ground management improvements, and the status of the initial problem is reviewed after a specified period.



Simon Stuart PhD
Chair
IUCN Species Survival Commission



Luc Bas
Director
IUCN European Regional Office

Annex

Case studies of trophy hunting having positive conservation and livelihood benefits

Case Study 1

Rhinos in South Africa and Namibia

Since trophy hunting programmes were introduced for these species, White Rhino increased in South Africa from 1,800 (in 1968) to around 18,400; and Black Rhino increased in South Africa and Namibia from around 2,520 (in 2004) to around 3,500 (see Figure 1). By end 2015, these two countries conserved 90% of Africa's rhinos, yet only 0.34% and 0.05% of their white and black rhino populations were hunted. Not only has rhino hunting clearly been sustainable, it has played an integral part in the recovery of these species through providing incentives for private and communal landholders to maintain the species on their land, generat ing income for conservation and protection, and/or helping manage populations to increase population recovery.

Limited sport hunting of rhinos along with live sales and tourism has provided the economic incentives to encourage over 300 South African private land owners to collectively build their herd to ~6140 white rhinos and 630 black rhinos on 49 private/communal land holdings – very important populations of these iconic species. This has added over 2,000 km^2 of conservation land – equivalent of another Kruger National Park! However, increasing security costs and risks due to escalating poaching and declining economic incentives have resulted in a worrying trend of private rhino owners and managers divesting their rhino, threatening future expansion of range and numbers. Import restrictions that threaten the viability of hunting would likely further reduce incentives and exacerbate this trend.

Many private reserves rely heavily on trophy hunting and that of white rhinos to cover operational expenses. For example, a South African reserve, known to the IUCN African Rhino Specialist Group, with identity concealed here for rhino security reasons, manages an increasing population of 195 white rhinos and many other species. Their conservation efforts are self-funded. Analysis of eight years' data revealed that only ~18% of the total reserve's operational expenditure was generated from tourism, while trophy hunting generated the bulk of income needed to fund operational expenditure (63%). Over the last eight years, only seven (or <1% of the population annually) white rhino have been hunted on the reserve, generating (inflation adjusted) US$617,000; with live sales of another 47 white rhino over the period bringing in an additional US$973,000. The reserve allocates all of the proceeds from rhino hunting towards rhino protection and conservation management costs. Average white rhino hunting revenue in the reserve over the last eight years translated to US$400 for each living white rhino in the reserve today/year; equivalent to 29%–33% of estimated current rhino protection and law enforcement costs/rhino/year in Kruger National Park and on Private Land of US$1,210–US$1,360/rhino/year, respectively. The Reserve Manager indicates that "the income from hunting in general and from the live sales of rhino, has sustained the management of the Reserve for decades" noting the recent ban on the import of lion trophies into the US has already had a negative impact on income to fund conservation with the cancellation of some hunts.

Rhino hunting has not been without its problems, with some 'pseudo-hunters' using the legal sport hunting route to access rhino horn for illegal sale in South East Asia. Increased regulation has seen the record high 231 rhino hunting applications in South Africa in 2011 plummet to normal levels of 62 white rhino and one black rhino hunted in 2015. In Namibia a further 3 white rhino and 1 black rhino were hunted in 2015. These numbers represent only 0.35% of the white and black rhinos conserved by these two countries, respectively, yet will have generated turnover close to US$4 million.

Case Study 2

Argali in Mongolia

As part of a plan to create community-based wildlife hunting management based on Altai Argali in the Gulzat Local Protected Area of northwest Mongolia, the Uvs Aimag Citizen's Meeting imposed a 4-year ban on Argali hunting to enable restoration of the population. Largely unmanaged, open-access hunting and increased competition for forage from goats were likely chief causes of the population decline.

With local herders now protecting the population, it grew from roughly 200 in the years immediately preceding the ban to an estimated 724 in 2010. After the ban was lifted in 2010, 12 Argali were harvested over the next 4 years generating around $123,000 at the local level. Meanwhile, the Argali population doubled again to more than 1,500 (WWF Mongolia, unpublished data) (Figure 2).

Case Study 3

Bighorn Sheep in North America

EuroAmerican settlement with the corresponding surge in livestock numbers and uncontrolled hunting led to a rapid decline in Bighorn Sheep in North America, from roughly 1 million in 1800 to fewer than 25,000 by 1950. Since then, based primarily on more than US$100 million contributed by trophy hunting groups through fees and donations, hundreds of thousands of hectares have been set aside for Bighorn Sheep and other wildlife and the bighorn population has more than tripled from its historic low to roughly 80,000 today (Damm and Franco, 2014; Hurley et al., 2015).

Restoration in Canada and the U.S. was largely based on hunters working with state/provincial wildlife agencies to support research, habitat acquisition and management. For example, in the state of Wyoming, auctions of Bighorn Sheep hunting tags yield approximately $350,000 annually, of which 70% goes to conserving Bighorn Sheep and 10% to other wildlife. These revenues and funds from Bighorn Sheep organizations were used to cover approximately one-third of the total cost of more than US$2 million paid to domestic sheep producers to voluntarily remove their sheep from 187,590 ha of public grazing lands. Other hunting, fishing, and wildlife groups covered the other two-thirds of the total cost because removing domestic sheep grazing from these areas benefitted a diversity of wildlife (K. Hurley (Wild Sheep Foundation), pers. comm.).

Indigenous-managed trophy hunting has driven recoveries in Mexico. In 1975, 20 Bighorn Sheep were reintroduced to Tiburon Island in the Sea of Cortez, an island owned and managed by Seri Indians. The original cause of the species' extinction on the island is unknown. The bighorn population quickly grew to around 500, probably the carrying capacity for the island. In 1995, a coalition of institutions initiated a programme to fund Bighorn Sheep research and conservation while providing needed income for the Seri through international auctioning of exclusive hunting permits on the island. Initially, permits often garnered 6-figure (US dollars) auction bids. From 1998 – 2007, the Seri Indians earned US$3.2 million from Bighorn Sheep hunting permits and sale of young for translocation, funds that were reinvested in Seri community projects, management of the Bighorn Sheep population, and maintenance of the island in an undisturbed state. Funding from trophy hunting for the island's conservation continues, with the Seri selling recent permits for US$80,000-90,000 each. The island has also been an important source population for reestablishing other Bighorn Sheep populations in the Sonoran Desert and elsewhere on the mainland. Because of the substantial revenues from trophy hunting of Bighorn Sheep and Mule Deer, many ranchers in the Sonoran Desert have greatly reduced or eliminated livestock to focus on wildlife (Valdez et al., 2006; Lee, 2008; Wilder et al., 2014; Hurley et al. 2015).

Case Study 4

Private wildlife lands in Zimbabwe

In Zimbabwe, the devolution of wildlife use rights to landholders in 1975 resulted in a transition from game ranching being a hobby practiced by a few dozen ranchers to some 1,000 landowners and 27,000 km^2 conserving wildlife by 2,000, with trophy hunting a primary driver of this change (Child, 2009; Lindsey et al., 2009). Although these numbers have declined significantly under the land reform programme, and despite the current challenging economic conditions in the country, some private conservancies continue to play a crucial role in conservation. The following all rely on trophy hunting as the primary source of revenue and they would all be unviable without it; photographic tourism has been tried and has not been a viable alternative.

The Savé Valley Conservancy (SVC), covering 344,000 ha, was created in the 1990s by livestock ranchers who agreed that wildlife management could be a better use of the land than livestock. Cattle ranching operations had eliminated all elephants, rhinos, buffalo and lions, among other species, in the area. Today, SVC has around 1,500 African Elephants, 117 Black Rhinos and 43 White Rhinos, 280 Lions and several packs of the Endangered African Wild Dog. Hunting on the Sango Ranch, SVC's largest property, yields around US$600,000 annually and employs 120 permanent workers who represent more than 1,000 family members (Lindsey et al., 2008; W. Pabst and D. Goosen, pers. comm.; SVC, n.d.; Sango Wildlife; n.d.).

The 323,000-ha Bubye Valley Conservancy (BVC) was converted from a cattle ranch 20 years ago and now has roughly 500 Lions, 700 African Elephants, 5,000 African Buffalo, 79 White Rhinos and, at 202, the third largest Black Rhino population in Africa (see Figure 3). Trophy fees in 2015 generated US$1,380,605. BVC employs approximately 400 people and invests US$200,000 annually in community development projects (BVC, n.d.; B. Leathem, pers. comm.).

The Cawston Game Ranch in Zimbabwe, at 12,600 ha, is much smaller than SVC and Bubye, and thus is more limited in terms of game species it can harbor. When the ranch was purchased a few native game species existed but Common Wildebeest, Plains Zebra, Giraffe, Tsessebe, Common Impala, Bushbuck, Red Hartebeest, Gemsbuck and Waterbuck had to be reintroduced. Approximately 4,500 game animals now inhabit the ranch. Large predators are limited to Leopards, Brown Hyaenas and an occasional Cheetah. Hunting contributes 68% of gross revenues, derived almost wholly from plains game, particularly Sable and Tsessebe. The ranch employs 41 people and its value to local communities is estimated at US$60,000/yr (V. Booth, unpublished data).



Image courtesy of Wildscreen Exchange, www.wildscreenexchange.org

Case Study 5

Communal conservancies in Namibia

In the early 1990s, many residents of Namibian communal lands viewed wildlife as a detriment to their livelihoods because animals destroyed crops and water installations and killed or injured livestock and people. Today, 82 communal conservancies covering 162,033 sq km and home to more than 184,000 people are engaged in community-based conservation, including indigenous and tribal communities.

Trophy hunting has underpinned Namibia's successes in community-based natural resource management. Recent analysis indicates that if revenues from trophy hunting were lost, **most** conservancies would be unable to cover their operating costs – they would become unviable, and both wildlife populations and local benefits would decline dramatically (Naidoo et al., 2016; see Figure 4). Overall, conservancies generate around half their benefits (including cash income to individuals or the community, meat, and social benefits like schools and health clinics) from photographic tourism and half from hunting. Note much of this is reinvested into managing and protecting wildlife. Around half the conservancies gain their benefits **solely** from hunting, with most of the rest deriving part of their income from hunting alongside tourism. Only 12% specialise in tourism (Naidoo et al., 2016). Revenues from trophy hunting of 29 wildlife species on conservancies totaled US$1,671,379 in 2013. Five CITES-listed species—Elephant, Common Hippopotamus, Hartmann's Mountain Zebra, Lion and Leopard—accounted for 63% of this total. For example, every time an elephant is harvested a community directly receives approximately US$20,000 in payment, plus approximately 3,000 kg of meat.

Wildlife populations have shown dramatic increases since the beginning of the communal conservancy programme in Namibia. On communal lands in northeast Namibia, from 1994-2011, the Sable population increased from 724 to 1,474 and the common impala from 439 to 9,374. In the conservancy region of northwest Namibia, from the early 1980s to 2011, the threatened Hartmann's Mountain Zebra population increased from less than 1,000 to an estimated 27,000, and the number of Black Rhino more than tripled, making it the largest free-roaming population in Africa (conservancies are unfenced). The growth of communal conservancies and protection offered by national parks has enabled elephants to increase their population from around 7,500 in 1995 to more than 20,000 today. The Kunene Conservancy's Lion population grew from roughly 25 lions in 1995 to 150 today, and Namibia now has a large free-roaming Lion population outside of national parks (NACSO, 2015; C. Weaver (WWF Namibia), pers. comm.).





Images courtesy of Wildscreen Exchange, www.wildscreenexchange.org

Case Study 6

Markhor and Urial in Pakistan

The Torghar Conservation Project in Pakistan was initiated by local Pathan tribal leaders in the mid-1980s concerned that uncontrolled illegal hunting for food had greatly reduced populations of both the Suleiman (straight-horned) Markhor (< 100 animals) and the Afghan Urial (around 200). After unsuccessfully petitioning the government to protect the populations, the local leaders developed the Torghar Conservation Project based on a simple concept: local Pathan tribesmen would give up hunting in exchange for being hired as game guards to prevent poaching, and the project would be financed by revenues derived from a limited trophy hunt of Markhor and Urial by foreign hunters. The area covers about 1,000 sq km inhabited by about 4,000 tribal people. Between 1986 and 2012, hunting of these two species generated US$486,400 for the provincial government and US$2,712,800 for the local community, the latter covering salaries of more than 80 game guards, funding various community projects including schools and healthcare facilities, and supporting actions to reduce grazing competition with livestock. Illegal hunting declined dramatically: as of 2012 the Markhor population had grown to an estimated 3,500, while a 2005 survey of Urial estimated 2,541 (Johnson, 1997; Woodford et al., 2004; Frisina and Tareen, 2009; Mallon, 2013).

Similar examples exist elsewhere in Pakistan. Community-based conservancies using trophy hunting in the regions Khyber-Pakhtunkhwa and Gilgit-Baltistan have led to the recovery and substantial increase of Markhor populations. These developments have contributed to the recent improvement of the conservation status of Markhor in the IUCN Red List, and it is no longer listed as threatened. Stable and increasing populations are limited to areas with sustainable hunting and protected areas (Michel and Rosen Michel, 2015).

Case Study 7

Markhor in Tajikistan

In the mid-90s fewer than 350 Tajik Markhor inhabited southern Tajikistan. Around 2004, several traditional local hunters, concerned that the Markhor population would go extinct due to widespread poaching, established small enterprises dedicated to Markhor conservation and future sustainable use. Trophy hunts yield ca. US$100,000 per Markhor. Today, based on revenues from trophy hunting, four community-based conservancies (run by three family enterprises and one community-based NGO) successfully lead the recovery of the Markhor, with local people employed as guards and various community development projects funded. A range-wide survey conducted in 2014 recorded 1,300 Markhor (Alidodov et al., 2014). This success is spawning the creation of more conservancies based on trophy hunting in the region (Michel and Rosen, in press; S. Michel, pers. comm.).

Case Study 8

Benefits to non-target threatened species

Revenues from trophy hunting are also important for conserving threatened species that are not hunted. Populations of Black Rhino and White Rhino and of the African Wild Dog on the Savé and Bubye Conservancies in Zimbabwe are not hunted, but proceeds from trophy hunting support their conservation. In the Pamirs in Tajikistan, trophy hunting concessions for Argali and ibex are showing higher densities of the threatened Snow Leopard than nearby areas without trophy hunting, likely due to higher prey densities and reduced poaching (Kachel, 2014). Likewise, high densities of Snow Leopard have been recorded in one Markhor conservancy (Rosen 2014). The threatened Grizzly Bear population of the Yellowstone National Park region in the United States has benefitted from the retirement of areas of land from livestock grazing—and thus reduced bear-livestock conflicts—partially paid for by Bighorn Sheep hunting revenues (K. Hurley (Wild Sheep Foundation), pers. comm.).

Case Study 9

Revenues for government wildlife agencies, including for anti-poaching

Even where there are clear and serious failures in hunting management, hunting may generate an important actual or potential revenue stream for conservation in the face of increasing threats of poaching and habitat loss. In Tanzania, for example, many commentators have highlighted serious weaknesses in hunting governance requiring deep reforms, including corruption in the distribution of revenues and other practices, unsustainable quotas, and poor law enforcementenforcement (Nelson, Lindsey and Balme, 2013). While this is not a "good practice" example, it clearly illustrates some of the complexity of the conservation costs and benefits of hunting in specific circumstances.

Financial Year (July/June)	Tourist Hunting	Photographic Tourism
2009/2010*	18,444,881.00	2,706,603.00
2010/2011*	23,536,347.00	2,863,287.24
2011/2012*	15,062,217.75	2,080,978.00
2012/2013*	15,917,430.93	3,904,808.35
2013/2014**	16,723,425.00	5,016,703.03
2014/2015**	16,277,373.00	4,736,187.00
2015/2016 (until January 2016)**	11,215,723.47	3,041,225.00

Table 1 Revenue from trophy hunting and photographic tourism accrued to the Wildlife Division in Tanzania from lands under its jurisdiction (in US$).
Source: *MNRT 2013; **figures provided by Tanzania Wildlife Division.

Tanzania has approximately 305,000 km^2 set aside as wildlife land managed as hunting blocks (including Game Reserves, Wildlife Management Areas, and other reserve types). Due to the fact that some hunting blocks are vacant, the area currently leased for hunting is estimated at 210,000 km^2 (V. Booth and M. Pani, *In litt*., based on analysis of official records provided by Tanzania Wildlife Division).

Hunting generates the bulk of the income raised in direct revenues by Tanzania's Wildlife Division from these lands, via a variety of fees (set out in the *Wildlife Conservation (Tourist Hunting) Regulations 2015)* (see Table 1). Revenue from hunting constituted approximately 16,277,373.00 USD in 2014/2015 (US$80/km^2 in the leased area). While most of these revenues are returned to central Treasury, 25% is directed into the Tanzania Wildlife Protection Fund (TWPF, 2016), established by statute to carry out wildlife protection and conservation activities including anti-poaching. According to the official TWPF website, these hunting revenues generate around three-quarters of its funding for these activities (TWPF, 2016).

If these revenues were not replaced by alternative means, expenditures on anti-poaching and other critical management activities would presumably sharply decrease.

Selous Game Reserve illustrates a special case. It has, over the last decade, suffered devastating levels of organised commercial elephant poaching for the illegal ivory trade, associated with serious allegations of official corruption and complicity and suggestions from some quarters of involvement of elements of the hunting industry. However, the Selous retention scheme (recently re-established) provides for the re-investment of 50% of revenues raised from hunting in the Reserve into conservation and anti-poaching activities to protect the Reserve's wildlife. Benson Kibonde, chief warden in Tanzania's Selous Game Reserve during 1994-2008 and 2012–2015, and responsible for leading two major anti-poaching initiatives, recently expressed serious concerns about the impacts of import bans on hunted ivory trophies on field level anti-poaching activities. He saw these as problematic not only because of heavy practical involvement of hunting companies in anti-poaching activities, but because "85% of the Selous retention scheme funds come from hunting. If any amount of the hunting revenue is compromised, the registered success in anti-poaching efforts could be seriously jeopardized" (Kibonde, 2015; p. 45).

Note that the revenues raised for conservation from hunting can be likewise important in developed countries (see Case Study 3). For instance, they form the bulk of wildlife management agencies' budgets in the USA and Canada (Heffelfinger et al., 2013; Mahoney, 2013).

Case Study 10

Polar Bears in Canada

Several hundred Polar Bears are harvested annually in northern Canada, the large majority for subsistence and the remainder for trophy hunts (with meat used for subsistence). The largest harvest of Polar Bears occurs in the territory of Nunavut, which harbors 50–60% of the world's population. At least nine Nunavut indigenous communities offer Polar Bear trophy hunts. Inuit have constitutionally protected rights under land claim agreements to co-manage wildlife. Most communities number a few hundred inhabitants. Income levels are generally low and unemployment rates very high. The Polar Bear harvest is based on quotas that are updated annually through a co-management system that integrates the best available scientific and traditional ecological knowledge. Community members decide how to allocate the quota between subsistence hunts and trophy hunts, with all meat from either used locally (Freeman and Wenzel, 2006; Shadbolt et al., 2012).

Communities work with hunting outfitters to attract hunters, usually from Canada or the United States. All trophy hunters are accompanied at all times by Inuit guides, with all transport and hunting conducted in the traditional method with a dogsled. Depending on the length of the hunt and other factors, hunting clients pay around US$20,000 – $50,000 to the outfitters, of which roughly half, US$10,000–$25,000, enters the northern communities. Almost all of the fees paid by the trophy hunter go to the Inuit outfitter, guide and assistants for their services and to maintain equipment used for both trophy and subsistence hunting. In accordance with the clan-sharing culture of Inuit society, community members recognize that these same people are the best providers of fresh food. In the community of Clyde River on Baffin Island, for example, each trophy-hunting guide harvested an average of ten times more food that was shared with community members than was harvested by hunters who were not guides (Foote and Wenzel, 2009; Shadbolt et al., 2012).

Inuit communities in Nunavut are already feeling the livelihood impacts of import bans, which nonetheless have had no effect on harvest levels. Approximately 400–500 Polar Bears were harvested annually in Nunavut during 2000–2012. In 2008, the United States listed the Polar Bear as endangered and banned the import of Polar Bear trophies. Before 2008, the U.S. accounted for the large majority of trophy hunters; after 2008 they accounted for none to a few annually. The U.S. ban had no obvious effect on the total harvested, but the proportion of the total taken by trophy hunters dropped from an average of 91 from 2003/4–2007/8 to 35 from 2008/9–2010/11, and the subsistence harvest increased accordingly (Shadbolt et al., 2012; Weber et al., 2015). Using a conservative value of $15,000 per trophy-hunted bear, this represents a reduction of at least $840,000 annually from trophy hunting for these Nunavut communities (excluding gratuities).



Image courtesy of Wildscreen Exchange, www.wildscreenexchange.org

References

Alidodov, M., Amirov, Z., Oshurmamadov, N., Saidov, K., Bahriev, J. and Kholmatov, I. 2014. Survey of markhor at the Hazratishoh and Darvaz Ranges, Tajikistan. State Forestry Agency under the Government of the Republic of Tajikistan, Dushanbe.

Bauer, H., Packer, C., Funston, P.F., Henschel, P. & Nowell, K. 2015. Panthera leo. The IUCN Red List of Threatened Species 2015: e.T15951A79929984.http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T15951A79929984.en. Downloaded on 25 March 2016.

Booth, V.R. and Chardonnet, P. (Editors) 2015. *Guidelines for improving the administration of sustainable hunting in sub-Saharan Africa*. FAO sub-Regional Office for Southern Africa, Harare, Zimbabwe.

Brainerd, S. 2007. *European Charter on Hunting and Biodiversity*. Adopted by the Standing Committee of the Bern Convention at its 27th meeting in Strasbourg, 26-29 November 2007. http://fp7hunt.net/Portals/HUNT/Hunting_Charter.pdf

BVC. n.d. *Bubye Valley Conservancy*. Bubye Valley Conservancy, Zimbabwe. http://bubyevalleyconservancy.com)

Child, B. 2009. Game ranching in Zimbabwe. In H. Suich, B. Child and A. Spenceley (eds.), *Evolution and Innovation in Wildlife Conservation*. Earthscan, London; pp 127-145.

Damm, G.R., and Franco, N.. 2014. *The CIC Caprinae Atlas of the World*. CIC International Council for Game and Wildlife Conservation, Budakeszi, Hungary with Rowland Ward Publications RSA Ltd., Johannesburg, South Africa.

European Parliament. 2016. Written Declaration, submitted under Rule 136 of the Rules of Procedure, on trophy hunting. DC\1083081EN.doc. http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-%2F%2FEP%2F%2FNONSGML%2BWDECL%2BP8-DCL-2016-0003%2B0%2BDOC%2BPDF%2BV0%2F%2FEN

Foote, L, and Wenzel, G.W. 2009. Polar Bear conservation hunting in Canada: economics, culture and unintended consequences. In M.M.R. Freeman and L. Foote (eds.), *Inuit, Polar Bears, and Sustainable Use: Local, National and International Perspectives.* CCI Press; pp 13-24.

Freeman, M.M.R., and Wenzel, G.W. 2006. The nature and significance of Polar Bear conservation hunting in the Canadian Arctic. *Arctic* **59**:21-30.

Frisina, M.R. and Tareen, N. 2009. Exploitation prevents extinction: case study of endangered Himalayan sheep and goats. In B. Dickson, J. Hutton and W.M. Adams (eds), *Recreational Hunting, Conservation, and Rural Livelihoods: Science and Practice*. Blackwell Publishing, UK; pp 141-154.

Heffelfinger, J.R., Geist, V., and Wishart, W., 2013, The role of hunting in North American wildlife conservation. *International Journal of Environmental Studies*, **70**, 399-413.

Hurley, K., Brewer, C. and Thornton, G.N. 2015. The role of hunters in conservation, restoration, and management of North American wild sheep. *International Journal of Environmental Studies* **72**:784-796.

IUCN SSC. 2012. *Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives* v1.0 (09 August 2012). IUCN, Gland. https://cmsdata.iucn.org/downloads/iucn_ssc_guiding_principles_on_trophy_hunting_ver1_09aug2012.pdf.

IUCN SULi, IIED, CEED, Austrian Ministry of Environment and TRAFFIC. 2015. Symposium Report, 'Beyond enforcement: communities, governance, incentives and sustainable use in combating wildlife crime', 26-28 February 2015, Glenburn Lodge, Muldersdrift, South Africa. http://pubs.iied.org/G03903.html.

Johnson, K.A. 1997. Trophy hunting as a conservation tool for Caprinae in Pakistan. In C.F. Freese (ed.), *Harvesting Wild Species: Implications for Biodiversity Conservation*. The Johns Hopkins University Press, Baltimore; pp 393-423.

Kachel, S.M. 2014. *Evaluating the Efficacy of Wild Ungulate Trophy Hunting as a Tool for Snow Leopard Conservation in the Pamir Mountains of Tajikistan*. A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Science in Wildlife Ecology; 87 pp.

Kibonde, B. 2015. Selous Game Reserve: Is there any hope for the future? *Hunter's Path* **4**, April 2015, pp. 42-45.

Lee, R. 2008. Hunting as a tool for wildlife conservation—the case of sheep hunting in Mexico. In R.D. Baldus, G.R. Damm and K. Wollscheid (eds), *Best Practices in Sustainable Hunting—A Guide to Best Practices from Around the World*. International Council for Game and Wildlife Conservation, Budapest, Hungary; pp 53-58.

Lindsey, P.A., Roulet, P.A, and Romañach, S.S. 2007 Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. *Biological Conservation* **134**: 455-469.

Lindsey, P.A., et. al. 2008. Savé Valley Conservancy: a large scale African experiment in cooperative wildlife management. Pages 163-184 in B. Child, H. Suich and A. Spencely (eds.), *Evolution and Innovation in Wildlife Conservation in Southern Africa*, Earthscan, London, UK.

Lindsey, P.A., Romañach, S. and Davies-Mostert, H. 2009. The importance of conservancies for enhancing the conservation value of game ranch land in Southern African. *Journal of Zoology* **277**: 99–105.

Lindsey, P.A., Balme, G.A., Funston, P., Henschel, P., Hunter, L., Madzikanda, H., Midlane, N., Nyirenda, V. 2013. The Trophy Hunting of African Lions: Scale, Current Management Practices and Factors Undermining Sustainability. *PLoS ONE* **8**(9): e73808. doi:10.1371/journal.pone.0073808

Lindsey, P.A. 2015. Bushmeat, wildlife-based economies, food security and conservation: Insights into the ecological and social impacts of the bushmeat trade in African savannahs. FAO/Panthera/ Zoological Society of London/IUCN SULi Report, FAO, Harare.

Loveridge, A.J., Searle, A.W., Murindagomo, F. and Macdonald, D.W. 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. *Biological Conservation* **134**: 548-558.

Mace, G., Masundire, H., Baillie, J., et al. (2005) Biodiversity. In Hassan R., Scholes R., Ash N., (eds). *Ecosystems and Human Well-being: Current State and Trends: Findings of the Condition and Trends Working Group*. Washington (D. C.): Island Press; pp 77–122.

Mahoney, S.P. 2013 Monograph: Conservation and Hunting in North America. *International Journal of Environmental Studies* **70**(3): 347-460.

Mallon, D. 2013. *Trophy Hunting of CITES-listed Species in Central Asia*. TRAFFIC report for the CITES Secretariat.

Michel, S., and Rosen, T. In press. Chapter 16.3 Hunting of Prey Species: A Review of Lessons, Successes, and Pitfalls – Experiences from Kyrgyzstan and Tajikistan. In P. Nyhus, T. McCarthy and D. Mallon (eds.), *Snow Leopards*. Elsevier.

Michel, S. & Rosen Michel, T. 2015. *Capra falconeri*. The IUCN Red List of Threatened Species 2015: e.T3787A82028427. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T3787A82028427.en.

MNRT. 2013. *The Wildlife Sub-sector Statistical Bulletin.* Wildlife Division, Dar Es Salaam, Tanzania.

NACSO. 2015. *The State of Community Conservation in Namibia – a Review of Communal Conservancies, Community Forests and other CBNRM Initiatives (2014/15 Annual Report)*. National Association of CBNRM Support Organisations, Windhoek.

Naidoo, R., Weaver, L.C., Diggle, R.W., Matongo, G., Stuart-Hill, G., and Thouless, C. 2016. Complementary benefits of tourism and hunting to communal conservancies in Namibia. *Conservation Biology* DOI: 10.1111/cobi.12643

Nelson, F., Lindsey, P. and Balme, G. 2013. Trophy hunting and lion conservation: A question ofgovernance? *Oryx* **47**(4): 501-509 doi:10.1017/S003060531200035X

Packer, C., Kosmala, M., Cooley, H.S., Brink, H., Pintea, L., Garshelis, D., & Nowel, K. 2009. Sport hunting, predator control and conservation of large carnivores. *PLoS ONE* **4**(6): e5941. doi:10.1371/ journal.pone.0005941

Packer, C., Brink, C., Kissui, B.M., Maliti H, Kushnir, H., Caro, T., 2011. Effects of trophy hunting on lion and leopard populations in Tanzania. *Conservation Biology* **25**:142–153.

Rosen, T. 2014. Tajikistan Brings Endangered Wild Goat From the Edge of Extinction to the Peak of Hope. *National Geographic Voices*: Cat Watch June 11, 2014. http://voices.nationalgeographic.com/2014/06/11/tajikistan-brings-endangered-wild-goat-from-the-edge-of-extinction-to-the-peak-of-hope/

Rosen Michel, T. and S. Michel. n.d. The return of the Markhor: Why CITES matters. Unpublished manuscript.

Sandbrook, C. and Adams, W.M., 2012. Accessing the Impenetrable: The Nature and Distribution of Tourism Benefits at a Ugandan National Park. *Society and Natural Resources*, **25**, 915-932. doi:10.1080/08941920.2011.644394

Sango Wildlife n.d. *Research*. Sango, Savé Valley Conservancy, Zimbabwe. http://www.sango-wildlife.com

Schipper, J., Chanson J. S., Chiozza, F. et al. 2008. Status of the World's Land and Marine Mammals: Diversity, Threat, and Knowledge. *Science* **322**: 225-230. doi: 10.1126/science.1165115

Shadbolt, T., York, G. and Cooper, E.W.T. 2012. Icon on Ice: *International Trade and Management of Polar Bears*. TRAFFIC North America and WWF-Canada. Vancouver, B.C.

SVC. n.d. *Savé Valley Conservancy*. Savé Valley Conservancy, Zimbabwe. http://savevalleyconservancy.org.

TWPF. 2016. *About Tanzania Wildlife Protection Fund (TWPF).* Tanzania Wildlife Protection Fund, Dar Es Salaam, Tanzania. http://www.twpf.go.tz/about/category/overview

Valdez, R., Guzman-Aranda, J.C., Abarca, F. J., Tarango-Aràmbula, L.A., and Clemente Sanchez, F. 2006. Wildlife conservation and management in Mexico. *Wildlife Society Bulletin* **34**(2): 270–282.

Weber, D.S., Mandler, T., Markus, D., Van Coeverden De Groot, P. J., Lee, D.S., Clark, D.A. 2015. Unexpected and undesired conservation outcomes of wild trade bans—an emerging problem for stakeholders? *Global Ecology and Conservation* **3**:389-400.

Wilder, B.T., et al. 2014. Local extinction and unintentional rewilding of Bighorn Sheep (*Ovis canadensis*) on a desert island. PLoS ONE **9**(3): e91358. doi:10.1371/journal.pone.0091358

Woodford, M.H., Frisina, M.R. and Awun, G.A. 2004. The Torghar conservation project: management of the livestock, Sulieman Markhor (Capra falconeri) and Afghan Urial (Ovis orientalis) in the Torghar Hills, Pakistan. *Game and Wildlife Science* **21**: 177-187.

Barry, Anna <anna_barry@fws.gov>

Conservation Status of African Lion in Zimbabwe

1 message

Barry, Anna <anna_barry@fws.gov> Thu, Jun 30, 2016 at 10:24 AM
To: snyasha@zimparks.co.zw
Cc: Tim Vannorman <tim_vannorman@fws.gov>

Dear Mr. Simukai Nyasha,

Again we wish to thank you for the information your office provided us regarding the status of lions in Zimbabwe. Tim asked me to contact you regarding a report mentioned in the "Study of the Contribution of Sustainable Trophy Hunting to the Management and Conservation of Lion in Zimbabwe" (see attached). In that document, it is mentioned that a report will be finalized during May 2016. If this report was prepared and finalized, we ask that you please send us a copy.

Thank you for all assistance in this matter.

Sincerely,

Anna Barry
Senior Biologist
USFWS/Division of Management Authority
Branch of Permits, MS: IA
5275 Leesburg Pike
Falls Church, VA 22041-3803
1-800-358-2104, ext. 1976 or 703-358-1976
Fax: 703-358-2281
E-mail: Anna_Barry@fws.gov

Please be aware that we process application on a first come first serve basis and due to the number of applications we receive some delays are unavoidable.

Application Forms 3-200 (http://www.fws.gov/forms/display.cfm?number1=200) were revised and available May 2014. Please ensure the application that you complete expires 05/31/2017 (found on upper right hand corner of page 1) to avoid the application being returned. We do not accept applications via fax or e-mail.

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

Lion..pdf
238K

Sport-Hunting and Lion *Panthera leo* Conservation in Zimbabwe

Dr Byron du Preez[†1], Dr Rosemary Groom[‡2], Olivia Mufute[§3] and Roseline Mandisodza-Chikerema[¶3]

[1]Bubye Valley Conservation Research Initiative
[2]African Wildlife Conservation Fund
[3]Zimbabwe Parks and Wildlife Management Authority

January 31, 2016



*
† byron.d.dupreez@gmail.com
‡ rosemary@africanwildlifeconservationfund.org
§ omufute@zimparks.co.zw
¶ mandisodzar@gmail.com

Contents

Summary of Steps Taken by Zimbabwe to Improve the Management of Lion Sport-Hunting **3**

Summary of Lion Sport-Hunting's Contribution to Conservation **3**

Introduction **3**

Lions – *Panthera leo* **5**

Conservation and Sport-Hunting **8**

Zimbabwe's Adaptive Lion Quota Management System **8**
Results of the Adaptive Lion Quota Management System 9
Human-Lion Conflict 11

The Bubye Valley Conservancy **12**
History of the Bubye Valley Conservancy 12
Bubye Valley Conservancy Community Support 12
Bubye Valley Conservancy Lion Monitoring and Management 13
Bubye Valley Conservancy Lion Hunting 13

The Savé Valley Conservancy **16**
History of the Savé Valley Conservancy 16
Savé Valley Conservancy Community Support and Anti-Poaching 17
Savé Valley Conservancy Lion Monitoring and Management 17
Savé Valley Conservancy Lion Hunting 18

The Pros and Cons of Conserving Lions **20**

**Where the Money Goes:
The Finances of Lion Sport-Hunting
and Reinvestment in their Conservation** **22**

Discussion **23**

Conclusion **25**

References **26**

Summary of Steps Taken by Zimbabwe to Improve the Management of Lion Sport-Hunting

i – Banning of all lioness hunting in Zimbabwe
ii – Hunting moratoria around the Gonarezhou and Hwange National Parks
iii – Removal of fixed hunting quotas
iv – Age restrictions on sport-hunted lions
v – Scientifically-based adaptive quota management system

Summary of Lion Sport-Hunting's Contribution to Conservation

i – Lion sport-hunting contributes 33.9% to 42.4% of total revenue on private land
ii – Lion sport-hunting generates up to US$ 557 km^{-2}
iii – Anti-poaching (in particular that of rhinoceroses) costs ∼US$ 216 km^{-2}

Introduction

The United States Fish and Wildlife Service (USFWS) have recently evaluated the conservation status of the lion *Panthera leo* with particular regard to sport-hunting (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). The results of this evaluation have led to the formal protection of two subspecies under the Endangered Species Act, classifying *P. l. leo* as endangered and *P. l. melanochaita* as threatened. Together these subspecies apparently represent all of the lions in Africa (Barnett et al. 2014).

Sport-hunting is a legal activity in which the international import/export of trophies is both sanctioned and carefully controlled by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The USFWS found that the sport-hunting of *P. l. melanochaita* "*if well managed, may provide a benefit to the subspecies*" (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). Here we explore this statement further, and present data from three long-term *in situ* lion research projects; the Bubye Valley Conservation Research Initiative, Savé Val-

ley Conservancy Research, and the Hwange Lion Research Project.

The data presented in this report clearly illustrates the positive conservation benefit that well-managed trophy hunting of lions can have for the species, as well as the importance of hunting in maintaining the wildlife in an area; addressing Point 5 on page 3 of the Federal Fish and Wildlife Permit Application Form (Form 3-200-20) [i.e. "*Please be aware that the U.S. Fish and Wildlife Service must make a finding that your activities will enhance or benefit wild populations of the species involved. If you have any information that could support this finding (e.g., population status or trend data; how the funds from license/trophy fees will be spent; what portion of the hunting fee will support conservation), please submit such information on a separate page with your application*"].



Figure 1: The lions pictured here, known as Winston (*standing*) and Geronimo (*lying*), were both collared in March 2012 when they were the dominant males in the Matombosa area and have been continuously monitored ever since as part of the on-going long-term WildCRU Bubye Valley Conservation Research Initiative. In November 2015 Geronimo, who was approximately 9 years old, died after succumbing to injuries sustained from fighting with another male. Winston, also 9 years old, has since lost his dominant status, lost his territory to two 4.5 year old males, become nomadic and avoids contact with other males. As of this report being written, the recent litter of cubs that both Winston and Geronimo sired are still alive.

Most importantly, since July 2013 there has been a continuous self-imposed internal reform of the lion hunting industry in Zimbabwe that is actively participated in and supported by all of the relevant stakeholders, including; the Zimbabwe Parks and Wildlife Management Authority (ZPWMA), non-governmental organisations, professional hunters, safari operators, scientists and researchers.

Here we discuss the results of this process in terms of robust evidence regarding the sustainability and self-regulation of lion hunting in Zimbabwe.



Figure 2: Winston and Geronimo's cubs.

Lions – *Panthera leo*

The IUCN Red List have recently reclassified lions as Vulnerable (remaining as such since 1996; IUCN 2015), estimating that there are between 20,000 and 30,000 free-ranging lions left (Bauer et al. 2015a) in less than 25% of their historic range (IUCN 2006). However, this generalised classification does not take into account an apparent conservation dichotomy: sample subpopulations of lions in Botswana, Namibia, South Africa and Zimbabwe have in fact increased overall (Bauer et al. 2015a). Lions were historically present throughout Africa, some of Europe, the Middle East and Asia (Bauer and Van Der Merwe 2004), but current conservation strongholds remain only in parts of eastern

and southern Africa (Brassine and Parker 2012; Nowell and Jackson 1996). The current lion population estimate for Zimbabwe's major lion areas is approximately 2,600 individuals [Hwange-Matetsi Complex: 750, South Eastern Lowveld: 350, Gonarezhou National Park: 60, Malilangwe: 37, Savé Valley Conservancy: 284, Bubye Valley Conservancy: 500, Mid-Zambezi Valley Complex: 600], though the actual number would be larger if there were data available for the countries minor lion areas that are yet to be surveyed] (ZPWMA 2015).

The lion is a uniquely social felid, forming coalitions of up to nine males associated with one or more female prides that may consist of more than 20 individuals (Macdonald et al. 2010; Schaller 1972). Lions are infamously infanticidal (Schaller 1972), where males will kill unrelated cubs so as to bring the female into oestrus and present an opportunity to sire their own litter, which is often used as an argument against sport-hunting of the species (e.g. Packer et al. 2010), where it is feared that the removal of dominant males causes cub mortality that eventually results in lowered population recruitment and survival (Packer et al. 2009). Infanticide, however, does not result from sport-hunting when age-appropriate males, past their prime and no longer territorial or with dependent cubs, are harvested (Whitman et al. 2004). Moreover, the fission-fusion nature of lion society (Mosser and Packer 2009; Pusey and Packer 1987) means that infanticide may still occur when the dominant males are simply not present there and then to defend their cubs (B. du Preez, pers. obs.).

In the 1990's, lions were successfully reintroduced into private areas in parts of their former range, where they achieved high reproductive and survival rates (Miller and Funston 2014). However, the resultant population growth inevitably led to the potential problem of overabundance (Funston 2008) and low genetic diversity (Trinkel et al. 2010), with both of these issues requiring active and intensive management (Hunter et al. 2007) and ultimately reducing the conservation value of these lion populations (Miller and Funston 2014). The ability to translocate lions originally facilitated the relief of overpopulation, but as the available areas for relocations were used up, sport-hunting and euthanasia have subsequently become the main methods of lion population control (Miller and Funston 2014).

The lion is the apex predator wherever it occurs (Macdonald et al. 2010), and is an ideal conservation umbrella; being large, charismatic and easily observable (e.g. Williams et al. 2000). Lions are important to commercial wildlife ventures, which risk losing significant market share where they cannot offer them to clients (Lindsey et al. 2007), and are thus prioritised in conservation; exploiting their charisma to attract tourists and raise the funds required in ensuring that wildlife areas remain viable. The lion is also a particularly valuable species in the sport-hunting industry, rivalled only in demand by buffalo *Syncerus caffer* and leopard *Panthera pardus* (Creel and Creel 1997), and are therefore prevalent in private wildlife areas (Packer et al. 2013) where their populations can achieve exponential growth rates given the protection and resources afforded by well-managed operations (Smuts et al. 1978; Loveridge et al. 2007b; Kettles and Slotow 2009; Miller and Funston 2014).

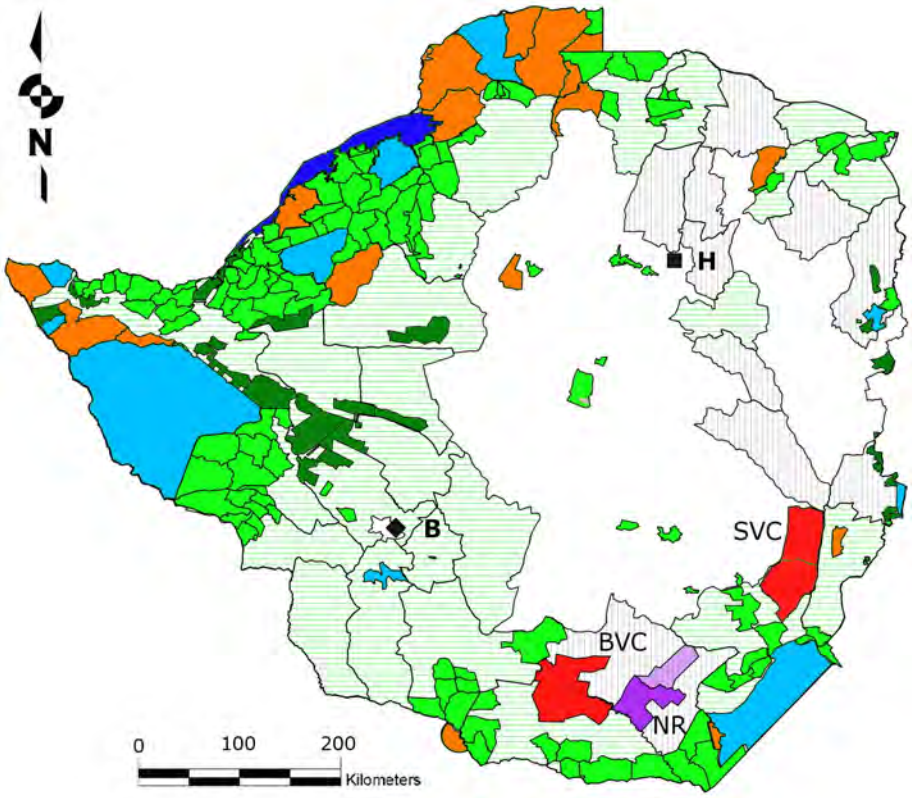


Figure 3: Map of Zimbabwe's main wildlife areas: [*i*] National Parks are represented in light blue; [*ii*] Safari areas are represented in orange; [*iii*] Forestry areas are represented in dark green; [*iv*] Community and Private wildlife areas are represented in light green; [*v*] Communal Land (CAMPFIRE Areas) in which sport-hunting may occur is represented by light green horizontal stripes; [*vi*] Communal Land in which sport-hunting does not occur is represented by grey vertical stripes. [*vii*] The Bubye Valley [BVC] and Savé Valley [SVC] Conservancies are represented in red. [*viii*]The Nuanetsi Ranch [NR] on which sport-hunting takes place is represented in dark purple (light purple represents the Nuanetsi Ranch cattle area); [*ix*] Lake Kariba is represented in dark blue. Harare (the capital city) is represented by a black square and letter '**H**'. Bulawayo is represented by a black diamond and letter '**B**'. Sport-hunting may occur in areas: *ii*, *iii*, *iv*, *v*, *vii* & *viii*

The ability of lions to rapidly increase in abundance is an aspect of their ecology that is often overlooked. Lion populations can achieve exponential growth rates (Miller and Funston 2015; Groom and Watermeyer 2015; du Preez et al. in prep.), and the problems associated with high lion densities fast present themselves and require significant investment in their solution (Hunter et al. 2007; Kettles and Slotow 2009; Loveridge et al. 2007; Packer et al. 2013; Smuts 1978). Whilst unregulated sport-hunting of lions (in particular that of dominant males and pride females) may result in population declines (e.g. Packer et al. 2010; Packer et al. 2009), restricting offtake to only males over

a certain age (i.e. have already bred and/or are no longer dominant) has no impact on lion population persistence, irrespective of quota size (Whitman et al. 2004). Such is the situation currently facing both the Bubye Valley and Savé Valley Conservancies, where the lion populations continue to grow despite sport-hunting and increasing quotas. Whilst sport-hunting may not alleviate over-population in these areas, it does somewhat offset the cost of keeping lions. Culling of lions may be the only realistic option for controlling numbers in larger areas, as the use of contraceptives is likely to be inefficient and expensive. Because of fears about public sentiment associated with sport-hunting, it has now become common practice for managers to cull excess lions in more than 45 wildlife areas in South Africa to which lions have been introduced, and which resulted in the wasteful destruction of about 200 lions in 2012 (Miller and Funston 2014).

Conservation and Sport-Hunting

There is more land area in Africa conserved for hunting than there is in all of Africa's formally protected areas combined: approximately 1.4 million km^2, which exceeds the total area covered by national parks by 22% (Lindsey et al. 2007). For wildlife conservation to be successful outside of national parks, these areas must be self-sufficient and able to generate sufficient revenue to cover the considerable costs of protecting the habitat and wildlife therein (Lindsey et al. 2006). Indeed, conservation would benefit from an incentive to utilise land for wildlife rather than the alternatives of livestock grazing, agriculture, and deforestation.

The international trade of lions, including trophies, is controlled by a strict CITES licensing system on the basis that this trade does not endanger the ultimate survival of the population (https://www.cites.org/eng/disc/how.php [accessed 2015-01-19]). The positive aspects of sport-hunting as a conservation tool include a focus on males and a low percentage off-take; neither of which generally jeopardise populations, and also suggest that hunting could play a role in population recovery (Leader-Williams et al. 2005).

The recommendation of setting uniform harvest limits, e.g. 1 lion 2,000 km^{-2} (Lindsey et al. 2012; Packer et al. 2010), may be overly simplistic, affect the economics of wildlife based landscape use, and disincentivise investment in conservation (Lindsey et al. 2007). A more practical approach to sustainably setting realistic lion sport-hunting quotas could involve using a positive/negative feedback method that calculates a fluid quota per area based on the previous season's performance. Such an adaptive quota management system has already been implemented in Zimbabwe.

Zimbabwe's Adaptive Lion Quota Management System

An adaptive quota management system for lion hunting based on the ages of lions hunted was agreed on in July 2013 in Harare, Zimbabwe, during a meeting hosted by the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) and an independent non-governmental conservation organisation. The points system is summarised in Table 1.

Table 1: *Points allocated to hunting blocks arising from the harvest of lions of different ages*

	≥ 6 years	No trophy	5 years old	4 years old	< 4 years	Failure to submit return, or incomplete return
For quotas of ≥3	4	3	3	2	-3	0
For quotas of 2	4	3	3	2	0	0
For quotas of 1	6	3	3	2	0	0
Resultant quota	*These points are added up and divided by 3 to yield the quota for next year*					

During 2013, operators were requested to submit hunt returns and photos as a trial run to get the system up and running. In 2014 operators were requested to do the same but were informed that the age of the lions hunted in 2014 would determine their lion quotas in 2015. The 2015 lion hunt results would thus also determine the 2016 quota.

Results of the Adaptive Lion Quota Management System

In 2015 there was a marked increase in the age of lions hunted in Zimbabwe as a whole. Notably, only one lion of <4 years of age was hunted and the large majority of lions were 5 years or older (Figure 4). In 2013, only 28% of the lions hunted were 5 years or older, in 2014 that figure had risen to 49% and in 2015 to 77.3% (Figure 5). The proportion of lions hunted that were less that 5 years of age dropped overall between 2013 and 2015 (Figure 6). For this achievement, credit is due to the hunting community for showing greater selectivity of harvest. A word of caution however, is that the majority of lions hunted were on the cusp of 5 - 6 years of age and were not older than six years. Restricting hunting to individuals that are at least six (and preferably older) is desirable from a biological perspective due to the reduced risk of the loss of pride males and infanticide of cubs associated with the harvest of such individuals (Whitman et al. 2004).

In 2015 the Zimbabwe national lion hunting quota was set at 85 lions. Of this 85, only 39 were hunted in 2015, and based on the resultant score from aging the trophies, and the fact that operators chose not to hunt lions of inadequate age (see Figures 4, 5 & 6), the recommended quota for 2016 was set at 75 [Harare 2015-11-11]. (The Rural District Council areas in which lions occur are currently exempted from the age restrictions, as was agreed upon at the 2013 lion management meeting in Harare, as a means of ensuring that impoverished communities obtain the opportunity to benefit from the presence of lions, recognising the potential negative impacts the species has on the livelihoods of livestock farmers).

Using these figures and estimating the average value of a lion safari at approximately US$ 80,000 then a 50% offtake (35 lions) would generate US$ 2,800,000 annually. If management costs are approximately \$150 km^{-2} (V. Booth, pers. comm.), then the lion safaris alone can support 18,600 km^{-2} of wildlife habitat in Zimbabwe.

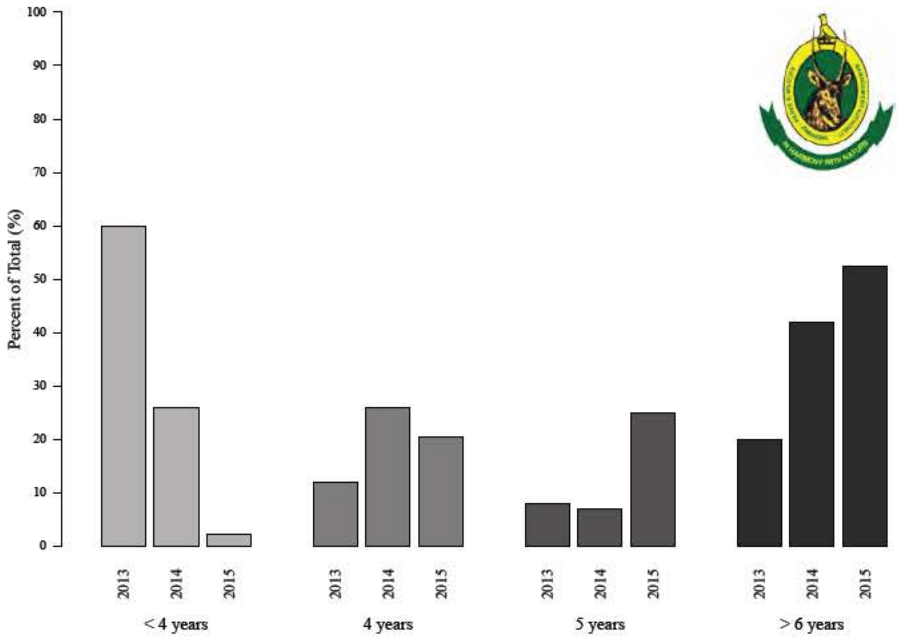


Figure 4: The percentage of lions hunted in each age class in 2013, 2014 and 2015 in Zimbabwe.

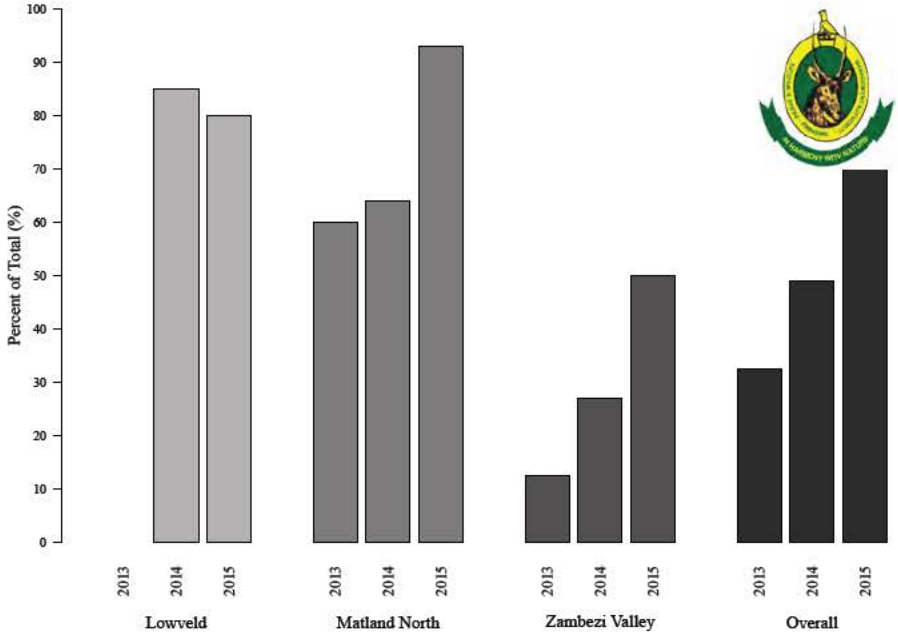


Figure 5: The proportion of lions hunted that were 5 years or older in the three main lion-hunting areas of Zimbabwe.

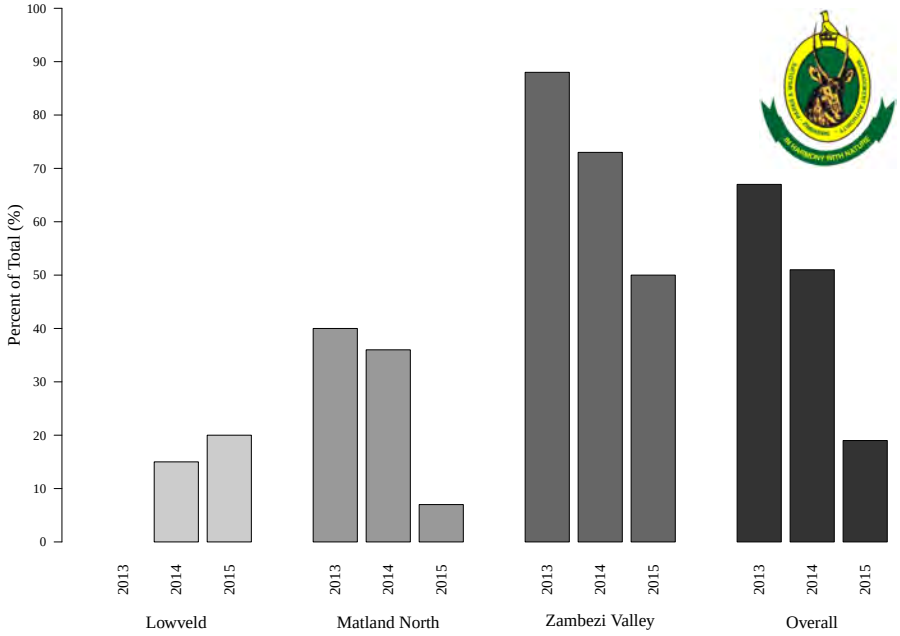


Figure 6: The proportion of lions hunted that were less than 5 years of age in the three main lion-hunting areas of Zimbabwe.

Table 2: *Human and Lion Conflict (2009 - 2011) in Zimbabwe, including human mortality caused by lion (CAMPFIRE Association, 2012)*

District	Total incidents	Livestock killed	*People Injured*	*People Killed*
Hurungwe	5	1	*2*	*2*
Chiredzi	25	136	*0*	*0*
Mbire	5	7	*0*	*5*
Binga	9	39	*0*	*0*
Total	**44**	**183**	***2***	***7***

Human-Lion Conflict

The lion is a flagship species and powerful symbol of Africa; yet living with lions poses hardships for many communities (e.g. Table 2). In some areas, the lion is a major predator on domestic livestock, inevitably leading to conflicts with local herders. Both sides suffer in this situation.

Outside of protected areas, the lion's prey base is much reduced, which results in relatively greater chance of encountering livestock. Co-existence of lions with people may be enhanced by giving value to lions through tourism and hunting promoted in communal lands under the Communal Area Management Programme for Indigenous Resources (CAMPFIRE). This hunting contributes to the conservation of lions via the financial revenue generated, which is ploughed back into conservation of the resource and empowers local communities to invest in their own rural development programs.

The Bubye Valley Conservancy

History of the Bubye Valley Conservancy

Towards the end of the nineteenth century, the Liebig's Extract of Meat Company (LEMCO) founded an extensive cattle ranch in the Zimbabwean lowveld, to the detriment of the indigenous wildlife that was initially eliminated because of competition for grazing with the livestock, as well as a risk of disease transmission from buffalo and wildebeest *Connochaetes taurinus*. As their natural prey base became depleted, the predators were subsequently persecuted when they began to prey on the livestock. Some wildlife persisted in small pockets of remote habitat, however lion, elephant *Loxodonta africana*, buffalo and rhinoceros *Diceros bicornis* [black] & *Ceratotherium simum* [white] were all completely eradicated. A monoculture of cattle dominated the landscape and impacted on the environment for the better part of a century.

Then, in 1992, Zimbabwe suffered one of the worst droughts on record, a relatively short time after the devastating one of 1983 that LEMCO was still trying to recover from. The frequency and severity of the droughts effectively reduced confidence in the economic viability of cattle ranching in the area, and the Bubye Valley Conservancy was subsequently founded in 1994 with the realisation that endemic wildlife, which are better adapted than livestock to cope with the local climate, could be successfully commercialised (Child 1988; Bond 1993).

The conversion from cattle ranching back to a wildlife area was neither straightforward nor cheap, requiring a significant initial investment and annual running costs. In just 20 years of operation the Bubye Valley Conservancy now protects the world's third largest black rhinoceros population, one of Zimbabwe's largest lion populations, a large and increasing elephant population, and abundant game.

Sport-hunting is an essential step in converting areas that were previously dedicated to livestock farming into non-consumptive tourism areas (Child 1993), and was fundamental to the formation of Bubye Valley Conservancy and allowing the wildlife populations to recover. The Samanyanga area of the Bubye Valley Conservancy, probably the most scenic section, was originally set aside for non-consumptive photographic tourism, but made an annual loss for several years, before, largely due to Zimbabwe's land reform program and resultant instability in the country, it was reverted back to sport-hunting as the only practical and economically viable option (K. Leathem, pers. comm.). Sustainable sport-hunting provides the sole economic incentive to continue operating the Bubye Valley Conservancy as a wildlife conservation area.

Bubye Valley Conservancy Community Support

The Bubye Valley Conservancy donates over 45 tonnes of meat from sport-hunting to the local communities each year. This meat donation is worth over US$ 100,000 per year, and the communities are free to decide how they use it. In addition to this, the Conservancy also supports several schools, clinics, and community projects in the three surrounding districts of Mwenezi, Maranda and Jopempe. The local community thus

sees a direct benefit from the wildlife on the Bubye Valley Conservancy, but is also empowered by job opportunities created both with these special projects, as well as on the Conservancy. A summary of the Bubye Valley Conservancy community support effort between 2011 and 2015 is provided in Table 4.

Bubye Valley Conservancy Lion Monitoring and Management

After originally being eradicated by cattle ranchers in the area, 13 lions were reintroduced to the Bubye Valley Conservancy in 1999, and four young males broke into the Conservancy that same year. From the original 17 animals present in 1999, the Bubye Valley Conservancy lion population was estimated at approximately 280 individuals in 2009 when robust population surveys were initiated by a research team from the University of Oxford Wildlife Conservation Research Unit (WildCRU), and this population has continued to grow. Today it is estimated that there are over 500 lions on the Bubye Valley Conservancy (du Preez et al. 2015). The exponentially increasing Bubye Valley Conservancy lion population currently exists at one of the highest densities in Africa (∼0.187 lions km^{-2}: du Preez et al. 2015; Figure 7), greater than that of the Serengeti, Tanzania (0.100 lions km^{-2}: Pusey and Packer 1987; Spong 2002), Selous, Tanzania (0.080 - 0.130 lions km^{-2}: Creel and Creel 1996, 1997), Kruger National Park, South Africa (0.096 - 0.112 lions km^{-2}: Mills 1995), and Hwange National Park, Zimbabwe (0.027 lions km^{-2}: Loveridge et al. 2007). This equates to one of the largest contiguous lion populations in Zimbabwe.

Bubye Valley Conservancy Lion Hunting

The Bubye Valley Conservancy offsets the cost of lion predation on its wildlife via sport-hunting of the species, and which began in 2002. In 2014, the lion hunting quota allocated to the Bubye Valley Conservancy by ZPWMA was 10 individuals. Based on the fact that the entire quota was harvested and that maximum points were scored for each individual trophy (more than six years in age), the allocated quota was raised to 13 lions for 2015. Only 12 out of 13 lions were hunted in 2015 due to a late cancellation; nevertheless eight lions over six years old and four lions of five years old were harvested and the resultant points justifying a quota of 15 lions for 2016.

Table 3: *The Bubye Valley Conservancy annual lion hunting quota and offtake from 2002 to 2015.*

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Approved quota	1	2	3	2	2	2	3	3	5	8	12	10	10	13
Quota taken	1	2	3	2	2	2	2	3	5	8	12	10	10	12
Percentage success	100	100	100	100	100	100	67	100	100	100	100	100	100	92

Note that while the lion hunting quota for Zimbabwe has been voluntarily reduced by the national steering committee, the Bubye Valley Conservancy lion hunting quota has been successively raised twice based on both hunt success and age of lions hunted and the resultant points scored under the national adaptive quota management system (Table 3).

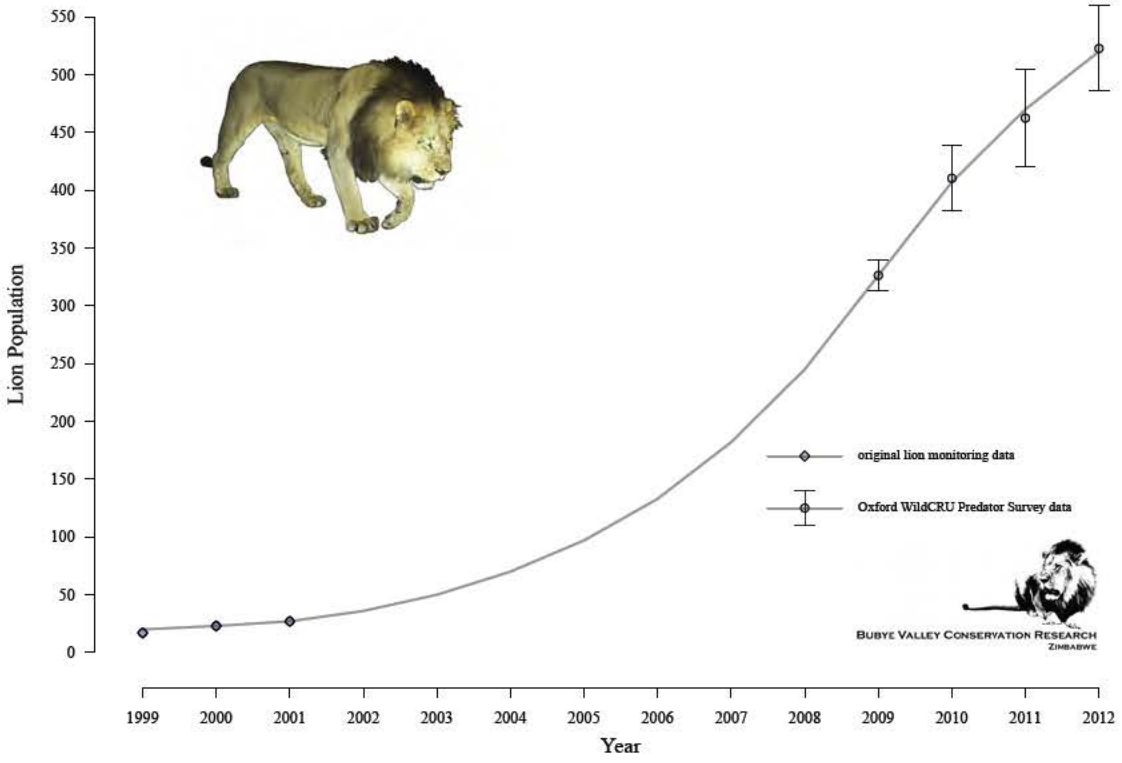


Figure 7: The Bubye Valley Conservancy lion population has grown exponentially since the reintroduction of lions in 1999. Diamonds represent the known lion abundance from monitoring of the original individuals introduced; Points indicate lion abundance calculated from spoor transect analyses; error bars represent the standard error of the mean.

Table 4: *Summary of the Bubye Valley Conservancy support to the surrounding local communities (2011 - 2015)*

Boreholes:	- 1 x Jompembi Village 2 - 1 x Penemene - 1 x Jompembi Village 4 - 1 x Nyimani village (Mwenezi) - 1 x Driehoek School - 1 x Mgaladhivha School - 2 x Mtetengwe to supply water to the clinic site - 2 new bush pumps (complete) purchased and installed at Village 2 & Village 3 and troughs built at both sites *Drinking trough for cattle built at Village 2 borehole* *All boreholes equiped with new bushpumps, piping and cylinders* *Boreholes at Village 3, Mtetengwe, Mdzwiti, Vumani and Penemene and Makado Police post repaired and maintained* *All new piping and pumps etc. are supplied by BVC*
Buildings:	- Mtetengwe Clinic's main building built - 3 x F13 staff houses built *Clinic and House fenced - everything funded and built by BVC* *The clinic is a standard large Government clinic - male & female wards + maternity ward and outpatients* *Storerooms, offices etc. also built* *All houses and buildings are electrified, painted and supplied with running water* - Mtetengwe School school office block and staff room built and painted *All classroom windows repaired and the schools second borehole repaired.* - Secure engine house was built at the second borehole site - Borehole equipped with BH15S mono pump unit driven by a rebuilt Lister LT 1 engine - 5000 litre header tank and stand errected - new 5000 litre header tank purchased and fitted - pipeline laid to connect the borehole to the clinic - another pipeline connected to the same borehole to supply the Mtetengwe school with fresh water - New coldroom and refrigeration unit purchased and fitted at the Lutumba butchery *Part of aid program to get the Beit Bridge RDC self funding projects up and running* - New coldroom and refrigeration unit was purchased and fitted at the Rutenga butchery *Part of aid program to get the Mwenezi RDC self funding projects up and running*
Meat Donations:	- BVC donates meat on a regularly basis to the Mwenezi Orphange - Numerous donations of meat were made to support school sports days & speech nights/prize giving events *Both Beit Bridge & Mwenezi districts* - 1600 kgs of meat has been donated each month since July 2011 to a Maranda trust *Administered by Chiefs andlocal headmen* *Excess meat sold and funds used for community projects* *Classroom roof replaced at Vhongwe school* *4 new classroom blocks constructed at other schools using funds from these monthly allocations* - 1000 kgs of meat per month is been donated to Beit Bridge communities since April 2014 - 1000 kgs of meat per month is been donated to Mwenezi communities since August 2013
Miscellaneous:	- Sports uniforms for the Penemene school team purchased ($2600) *Sports uniforms required for inter-schools sports* - Transport the soccor teams representing Mgaladivha, Jompembi and Tongwe *To Lutumba for the inter-school competitions* - 2 sets of soccer goal posts & 2 sets of Netball poles were made for Mgaladivha School *New soccer field graded by BVC* - 2m security fencing supplied to Penemene School - Second hand door and window frames donated to Mapiri school (ex Mazunga School) - 1 new 3 1/2 " rod pump cylinder was purchased and fitted to the Vumhani borehole *All repairs to b/holes in the Vumhani area are done by BVC* - 26 bags of cement were donated to Mgaladivha School - Fencing donated to the Mgaladivha School - Supplied 10 x 5/8" mono shafts for the Botalele Clinic (Maranda) borehole - Water supply to Mlelezi Clinic - 400 m pipeline laid to supply the Nyimani Villarge's cattle with water *3.5 m drinking trough build for this same project* - 60 bags cement donated to the Welkom for repairs to a dam wall - 6 loads of riversand and 20 cement donated to Vumani Preschool - Various school renovations in both the Beit Bridge and Maranda areas
Current Projects:	- Construction of a School admin block at Mgaladhivha School - Supply of 24 loads of riversand to Mdzwiti School (value $1200) - All roofing materials supplied to Mdzwiti School - Supply roofing materials, cement, all window and door frames for Vumani Preschool

The Savé Valley Conservancy

History of the Savé Valley Conservancy

The Savé Valley was a wildlife-rich wilderness until the early 1900's, when the first cattle ranching initiatives started in the area. The establishment of Devuli Ranch and Angus Ranch in 1920 paved the way for seven decades of commercial cattle ranching in the area we know today as the Savé Valley Conservancy. Roads were cut, fences erected and an everlasting 'battle' ensued against the wildlife, especially against all predators.

The large predators, especially lions, were virtually eradicated (Pole 1999). However, by the late 1980's, declining range productivity, depressions and droughts forced the landowners to consider alternative options. Around that time, empirical evidence of the competitive advantage of wildlife over livestock began to emerge (Child 1988; Bond 1993), especially in arid areas (Jansen et al 1992; Cumming 1993), and wildlife was finally given serious consideration as a viable land use option.

In 1989, a proposal was drawn up (du Toit 1989) to turn what was then the Sabi Valley Intensive Conservation Area into a wildlife conservancy. The plan was to create a single large wildlife area, especially for the re-establishment of endangered species and overexploited species, with cattle remaining the primary income generator. The Savé Valley Conservancy was constitutionally inaugurated in June 1991, and following the severe 1991/1992 drought, wildlife ranching became the primary land-use. At the time this was the largest private wildlife conservancy in the world (3,410 km^2).

The conservancy members then restocked the wildlife, removed all internal fencing, erected a common perimeter fence and developed effective security systems. A double, electrified, veterinary-approved fence was completed in 1995, and the following decade saw a massive investment in wildlife re-stocking and security systems.

Sport-hunting was essential for the successful transition of the conservancy from cattle to wildlife. During the early years, wildlife densities were low, resulting in poor potential for ecotourism, and hunting generated the income needed to erect the fence, re-stock game, and improve security, especially because of the significant numbers of black rhinoceros now found there. Gradually, some of the ranchers shifted more into ecotourism. One property, Senuko Ranch, completed a 16 bed up-market lodge with a view of marketing non-consumptive safaris, offering game drives and bush walks and specializing in rhino walks and African wild dog *Lycaon pictus* den visits. Lodge occupancy rose from 0% in 1996 to 62% by the end of 1999.

However, the Zimbabwean land reform program, which was initiated in February 2000, soon made a strong negative impression in the international community, and resulted in travel bans and warning from most of Zimbabwe's source markets. This, together with the political instability meant that the wildlife industry and ecotourism industry collapsed over-night: sport-hunting became the only economically viable land use option, and has remained the only tangible source of income to the landowners of the Savé Valley Conservancy. In the case of the Senuko Lodge, for example, the land reform program resulted in a 98% cancellation of

the confirmed bookings. After four years of seeking alternative markets, the lodge could achieve no higher than 17% occupancy, and in 2005 moved back into a hunting-based operation.

A more direct impact of the land reform program for the Savé Valley Conservancy was the loss of 33% of the area of the conservancy to invading subsistence farmers (Lindsey et al 2008). The loss of land was catastrophic and the related pressure from wire snare poaching was extreme. In the following eight years (2001 to 2009), 10,520 illegal hunting incidences were recorded, 84,396 wire snares were removed and at least 6,454 wild animals killed (Lindsey et al. 2011).

Savé Valley Conservancy Community Support and Anti-Poaching

In 2012, conservancy members provided over US$ 100,000 worth of support to adjacent villages or farmers in the resettled areas. Assistance included drilling boreholes, maintaining boreholes, dredging of dams, assisting with building projects in clinics and schools, assisting with repairs, maintenance and materials at schools, education initiatives, school field trips, provision of computer equipment in schools, craft programs and regular donations of meat.

Moreover, the conservancy recently entered into a mutually dependent agreement with the Chiefs representing the communities surrounding the Savé Valley Conservancy. The agreement links the communities to the Natural Resource Utilisation that occurs through the business operation of the conservancy and opens up opportunities for the local indigenous populations to share in any wealth creation. This agreement strengthens relations between the conservancy and the surrounding local communities and creates an environment that helps to protect, conserve and sustain the natural assets of the area. The hunting tourism of the conservancy is currently the only form of income by which the surrounding communities can benefit. Revenues from trophy lion hunting constitute a significant portion of inflow and thus an important part of the community benefits. Any reduction would seriously jeopardise the growth of this infant positive relationship and community empowerment initiative.

The Savé Valley Conservancy is thus pioneering private-community partnerships in Zimbabwe, and trade restrictions on lion trophies will indirectly adversely affect these already seriously impoverished communities through a reduction in available income to share with communities. This is very likely to have a knock on impact on the lions themselves with a significantly reduced tolerance and an increase in retaliatory poisoning of lions for livestock predation. Without a demonstration of income from lions, the political pressure from the surrounding communities to remove them from the conservancy altogether will be a challenge to resist.

Savé Valley Conservancy Lion Monitoring and Management

After the Conservancy was formed, and persecution stopped, lions, mainly males, recolonized the area and their numbers started to increase in the late 1990's / early 2000's. Few lionesses were observed until 2003, when small family groups and male-female pairs were seen, and by 2004 - 2005 there were some reports of cubs. During this period 13

lions were also reintroduced into the Savé Valley Conservancy. After an initial lag phase the lion population on the Savé Valley Conservancy has increased dramatically and at present is growing exponentially (Figure 8; Groom and Watermeyer 2015).

Monitoring of the lion population began in 1999 (Pole 1999) with track index or call-up surveys being conducted sporadically until 2006. From 2007 to present, annual conservancy-wide track index surveys have been conducted using a standardized methodology (Groom and Watermeyer 2015). The resulting population estimates were verified in 2011 by a baited lion call-up survey and a collation of managers' estimates, all of which provided similar results.

Prey availability models (Hayward et al. 2007) suggest that the carrying capacity for the lion population in the Savé Valley Conservancy is approximately 271 lions. The population estimate for 2015 was 284 lions, suggesting lions have reached their ecological carrying capacity, even whilst being responsibly hunted.

A professional lion management plan was commissioned by the conservancy in 2011 (Funston 2011), to provide the Savé Valley Conservancy members with a science-based plan to help them ethically and sustainably manage their lion population. This plan specifically advocates the use of hunting as a conservation management tool. It also demonstrates willingness by the conservancy to guide their lion management based on science and advice from professionals.

Savé Valley Conservancy Lion Hunting

Lions have been hunted in the Savé Valley Conservancy since 2002, although that was largely for removal of problem animals. Hunting began properly in 2005 with quotas increasing annually to a maximum of seven per year from 2009 onwards (Table 5), with the quota being raised to ten for 2016 based on trophy ages.

Despite offtakes of lions through sport-hunting, the lion population has continued to increase in the Conservancy. The revenue generated from hunting lions has enabled landowners to invest in proper land management, anti-poaching, water provision and fence maintenance, all of which benefit the lion population (especially as lions seem to be vulnerable to being caught in wire snares; Becker et al 2013; R. Groom, pers. obs.).

Table 5: *The Savé Valley Conservancy annual lion hunting quota and offtake from 2002 to 2015.*

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Approved quota	5	5	1	3	3	4	6	7	7	7	4	2	3	5
Quota taken	1	0	1	3	3	3	3	6	5	3	4	1	3	5
Percentage success	20	0	100	100	100	75	50	86	71	43	100	50	100	100

Sport-hunting of lions brings considerable revenue to the Conservancy, revenue that is vital for the continued functioning of the area for wildlife conservation. Without the costs of lions being offset by the income from sport-hunting, landowners cannot reasonably be expected to tolerate such high lion densities, and their numbers would have to be reduced significantly.

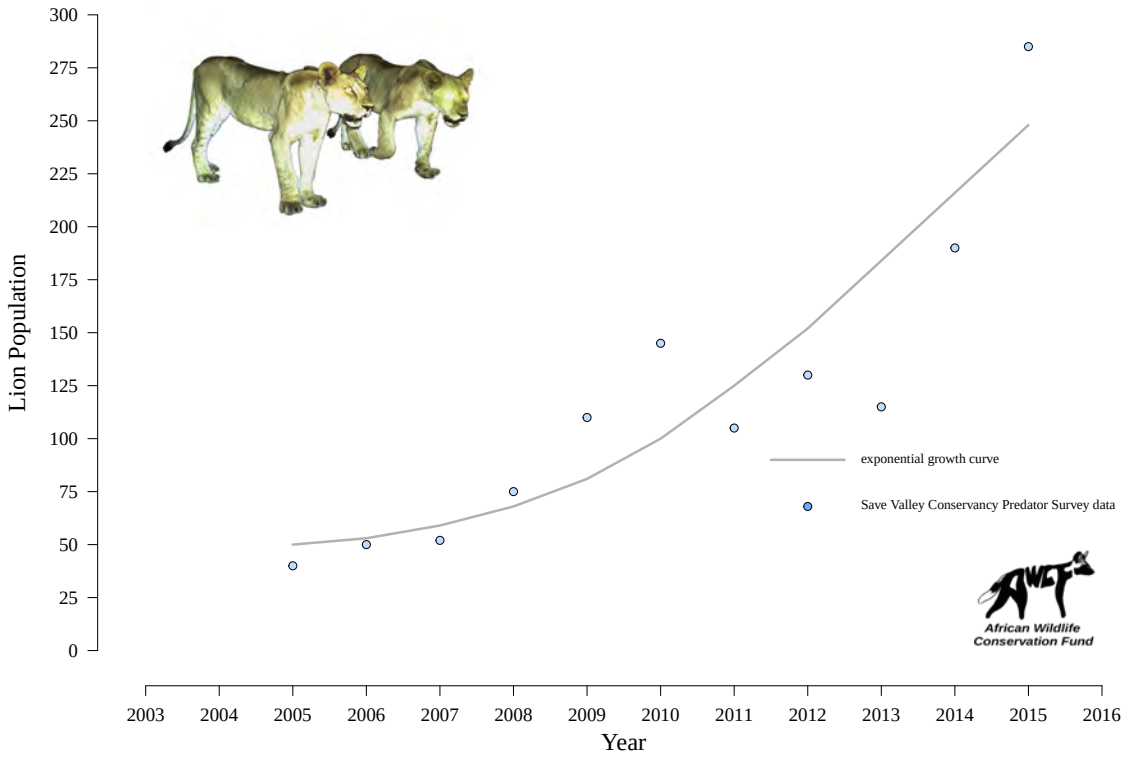


Figure 8: The Savé Valley Conservancy lion population, like that of the Bubye Valley Conservancy, has grown exponentially. Points indicate estimated lion abundance calculated from field surveys; the line represents the exponential growth curve.

The Pros and Cons of Conserving Lions

The saturation of lions in wildlife areas on both state and private land is positive for their future conservation security; but it is also critical to that of incidentally conserved endangered species, such as both species of rhinoceros on private wildlife conservancies in Zimbabwe (Lindsey et al. 2009; Suzuki 2001), which benefit from the same resources and protection that are incentivised and provided by the revenue generated from sport-hunting. The Bubye Valley Conservancy now boasts the world's third largest black rhinoceros population (N. Anderson [Lowveld Rhino Trust], pers. comm.), which is classified as Key 1 by the African Rhino Specialist Group and means that this population is considered key to the overall survival of the species. The Savé Valley Conservancy has the second largest black rhinoceros population in Zimbabwe after Bubye. These are not coincidences. These rhinoceros (and other endangered species, such as wild dog) strongholds are the result of the incidental conservation benefits derived entirely from sport-hunting activities - there are no photographic tourists visiting either the Bubye Valley or Savé Valley Conservancies, and the rhinoceros are not hunted. Having rhinoceros on the land therefore generates no revenue - and in fact there is a significant cost associated with protecting these animals; US$ 590,000 (not including incentive and reward bonuses donated for these purposes) was spent on anti-poaching by the Bubye Valley Conservancy during 2015 (K. Leathem, pers. comm.), and US$ 546,000 is spent annually on anti-poaching by the Savé Valley Conservancy (Lindsey et al. 2012). This expense is covered mainly by the revenue generated by sport-hunting with additional donations from the clients; and most importantly, the habitat for the rhinoceros is preserved by maintaining the land as a conservation area, as opposed to converting it into agricultural or grazing land for example.

However, the high densities of lion populations achieved within commercial wildlife areas have the potential for intense intraguild persecution. Lions are aggressively competitive, and research on the relationship between lions and leopards has shown that high densities of lions can negatively affect leopard population density, demographic structure, cub survival, and spatial ecology down to even the step-wise decisions that leopards make regarding habitat use and behaviour based on both the actual and potential risk of encountering lions (du Preez 2014; du Preez 2015). Leopards are a generalist species that are able to cope with persecution by adapting their behaviour and ecological niche, and even they suffer under a burgeoning lion population; ecological specialists and endangered species, such as cheetah *Acinonyx jubatus* and wild dog, do not fare nearly as well under such intense competitive pressure. In fact, competition with lions has been directly linked to reductions in cheetah (e.g. Durant 1998, 2000; Laurenson 1995) and wild dog (e.g. Creel 2001; Creel and Creel 1996; Vucetich and Creel 1999) densities, both of which face local extinction where lion abundance, and the respective level of persecution, is high. Excessive lion densities may also result in population declines of ungulate prey (e.g. Wegge et al. 2009). It is vital to holistic conservation that wildlife managers can understand and deal with the level of impact that lions exert on other species; particularly those that

are elusive difficult to observe, and which face decline if not carefully monitored. To this end, a conservation research initiative in partnership with WildCRU was established on the Bubye Valley Conservancy in 2009, and research conducted on the Savé Valley Conservancy since 2007.

Based on the number of kills made (du Preez et al. in prep.) and the current value of the meat (K. Leathem, pers. comm.), the Bubye Valley Conservancy lion population consumes hundreds of thousands of dollars worth of prey each year. These lions are mainly tolerated because of their ability to generate the revenue that helps to offset this expense - although it is estimated that economically it is still not worth keeping the lions whose cost outweighs their value (Funston et al. 2013).

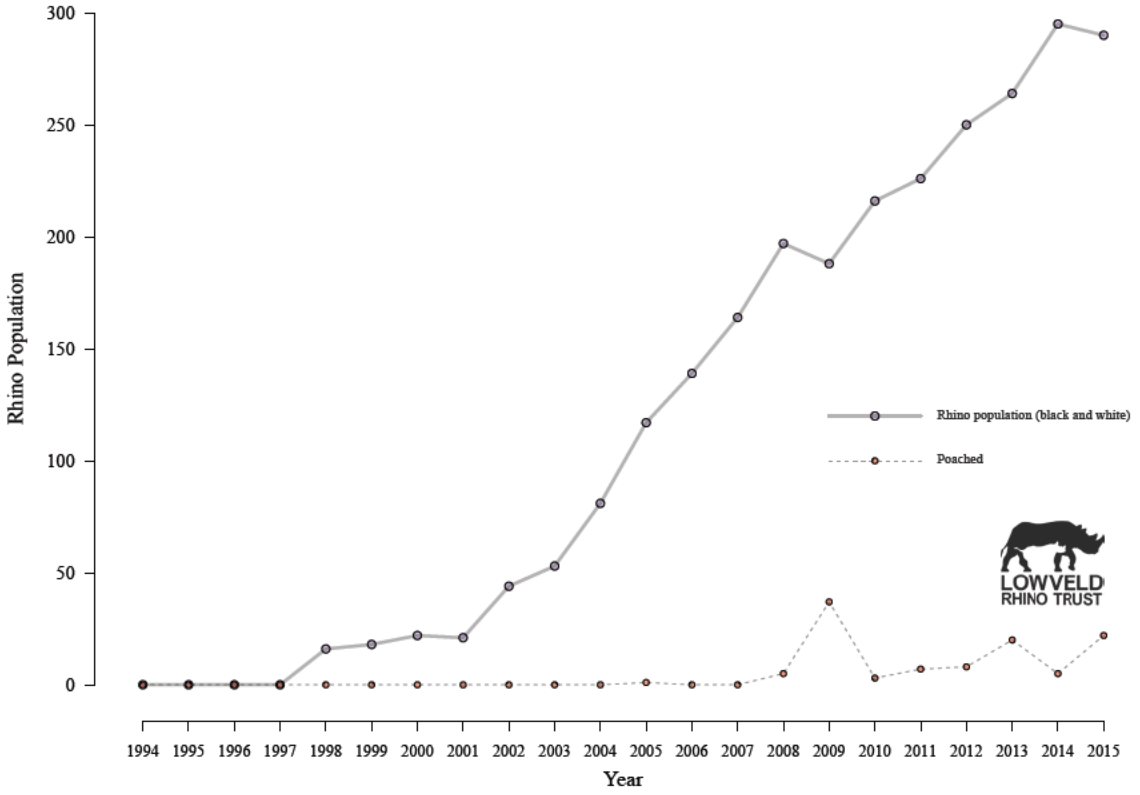


Figure 9: The Bubye Valley Conservancy black rhino population is rated as Key 1 by the African Rhino Specialist Group which means that the population is considered key to the overall survival of the species.

Where the Money Goes: The Finances of Lion Sport-Hunting and Reinvestment in their Conservation

Break-down of the finances involved in a typical lion hunt on the Bubye Valley Conservancy:

Lion Trophy fee: US$ 42,000
Lion Hunt Daily rate: US$ 2,950 day^{-1}
(Minimum lion hunt duration: 18 days [*total daily rate of US$ 53,100 lion hunt^{-1}*])

Additional costs include:
ZPWMA scout
Observers
Bait used
Other trophy species taken during the lion hunt, etc.
[*These additional costs average approximately US$ 6,500 lion hunt^{-1}*]

Bubye Valley Conservancy - Lion Sport-Hunting Revenue Generated (2015):

((18 days × 2,950 day^{-1}) + 42,000 trophy fee + 6,500 additional costs) × 12 lions
= **US$ 1,219,200**

Lion sport-hunting therefore represents approximately 33.9% of the Bubye Valley Conservancy's total annual revenue generation (which includes post-hunt meat and hide sales).

All of the revenue generated from lion sport-hunting on the Bubye Valley Conservancy has gone back into the running costs of the Conservancy, which is all part of conservation, and which includes: anti-poaching and fence monitoring and maintenance (approximately US$ 506,000 year^{-1}), research (approximately US$ 34,700 year^{-1} not including client and sponsor donations), and community support assistance (approximately US$ 210,000 year^{-1}).

[*No profit after costs has been declared, nor dividends taken by shareholders, since the Bubye Valley Conservancy was formed in 1994. All revenue generated to date has been spent on running costs, improvements and restocking.*]

Discussion

Here we have shown that since their reintroduction after historical eradication, both the Bubye Valley and Savé Valley Conservancies' lion populations have increased exponentially - not despite sport-hunting, but because of sport-hunting and the incentive it provides for protection.

The success of the Bubye Valley and Savé Valley Conservancies, in terms of both of their hunted lion and non-hunted rhinoceros populations, may also provide the motivation for other areas in the country to sustainably manage their wildlife resource. A case in point is the Nuanetsi Ranch, a wildlife area that is also a legacy of failed cattle ranching, located almost directly between the Bubye Valley and Savé Valley Conservancies in Zimbabwe (Figure 3). At present there is a single lion on the Nuanetsi Ranch but management is not able to justify introducing more due to the current uncertainty over the future of lion hunting (B. Lees-May [Nuanetsi Ranch Conservator], pers. comm.). The Nuanetsi Ranch is a wildlife area of 1,489 km^2, and could conceivably sustainably hold between 201 and 278 lions (based on the most recently estimated lion densities of the Savé Valley [0.135 lions km^{-2}; Groom and Watermeyer 2015]; and Bubye Valley [0.187 lions km^{-2}; du Preez et al. 2015] Conservancies respectively). However, the Nuanetsi Ranch has invested in building up an abundant wildlife population, which is sport-hunted, and the management will not risk losing a significant amount of valuable game, that could otherwise be sold as trophies or meat, to a species from which it can not recuperate lost revenue, and instead that requires further investment in control measures (B. Lees-May [Nuanetsi Ranch Conservator], pers. comm.).

Between 2005 and 2015 the United States market has represented 70.4% of the total Zimbabwean lion sport-hunting industry (http://trade.cites.org/en/cites_trade/ [accessed 2015-01-19]), though in reality it constituted over 90% for both the Bubye Valley and Savé Valley Conservancies. If this market was effectively lost due an inability of prospective clients to import their trophies, based on the economics involved it would become unviable to continue managing the Bubye Valley Conservancy as a wildlife area in its current form, and lions would either have to be re-exterminated, or at least severely reduced via culling; or else what is the largest privately owned wildlife area in the world would be converted back into a cattle ranching area (K. Leathem, pers. comm.). This is the reality of any business, in that it needs to cover costs and pay staff and cannot run at a loss for luxury of conservation. Child (1993) states "*A refusal to treat wildlife in the same way as other resources and maintenance of centralised protectionist management prejudices its survival. Only by raising its commercial value will wildlife be able to compete for space on the scarce African landscape. Trade bans which detract from wildlife's commercial value prejudice its chances of survival in the long term*".

Although the USFWS understandably categorises lion conservation by country for simplicity, rather than individual properties, the Bubye Valley and Savé Valley Conservancies currently and deservedly hunt more than a third of the total Zimbabwean lion quota between them. Here we have shown that this sport-hunting does not negatively affect the lion population, which remains in positive growth despite off-take. In addition

to this, other areas, such as the Nuanetsi Ranch, could be incentivised to invest in lion conservation if the ability to sustainably utilise the lions as a resource was guaranteed.

The USFWS identified five primary factors that threaten lion survival in the wild, namely: habitat loss; loss of prey; retaliatory killing due to increased human-lion conflicts; inadequate regulatory mechanisms; and weak management of protected areas (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). Each and every point on this list, which notably does not include sport-hunting, supports the fact that incentivising tolerance for lions through sustainable use would enhance the species' overall survival.

As responsible conservationists, we are not arguing against tight regulation of sport-hunting, especially with regard to sensitive species such as lions, and we support the need for transparency and accountability within the industry. However, this reform is a process being driven from within, as any indiscretion is an affront on all stakeholders. For example, long-term lion monitoring by WildCRU in Hwange National Park (HNP), Matabeleland North, Zimbabwe, documented a 'vacuum effect' and reduction in male lion density in the Park as a result of sport-hunting in the surrounding areas (Loveridge et al. 2007). A result of this research was the recommendation that ZPWMA implement a hunting moratorium in western Zimbabwe, which was accepted and enforced from 2005 to 2008 (Davidson 2009). Subsequent monitoring of the HNP lion population showed that the perturbation effects caused by sport-hunting were reversed during the moratorium, and sport-hunting was reinstated at a reduced, more sustainable quota (Davidson 2009). This example demonstrates both the relationship between independent researchers and ZP-WMA, and that the research assists ZP-WMA in robust decision making. This study has also shown that the lion population was able to recover quickly, and that a blanket-ban would have been as unnecessary as it would have been detrimental to overall lion conservation in the country.

In addition to the self-imposed hunting moratorium in the Matabeleland North district, Zimbabwe has voluntarily stopped sport-hunting of any lioness. The fixed-quota concept, in which hunting quotas had to be paid for upfront before the hunting season even began, and which was resultantly attributed to poor quality trophies and young animals being hunted, has also been abandoned. The adaptive quota management system for lion hunting based on the ages of lions hunted has been accepted and embraced by all stakeholders. This adaptive quota management system has not only led to a reduced national lion hunting quota, but has also resulted in a significant increase in the age of harvested lions to a level that is considered to have minimal ecological impact, being old individuals that are no longer contributing to the gene pool nor protecting cubs.

The IUCN Red List lion conservation status has remained unchanged for 20 years even in the face of Africa's ever-changing landscape. Despite fears that lion abundance is decreasing overall, in southern Africa it is in fact increasing (Bauer et al. 2015b).

Conclusion

Given the evidence presented, the arguments against sport-hunting would appear to be based more in emotion than logic and reality (e.g. Lindsey et al. 2015). Conservation, however, is not about individuals within populations, but the overall populations themselves. Sustainable sport-hunting of lions is just that: *sustainable* - and ironically, without it, the lions themselves become unsustainable. Conservation objectives need to be balanced with both social and economic factors if they are to be achieved.

The USFWS states "Well-managed conservation programs use trophy hunting revenues to sustain lion conservation, research and anti-poaching activitie" (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). The Bubye Valley and Savé Valley Conservancies both fully meet each one of these conditions: clearly contributing to lion conservation in Zimbabwe; having long-term conservation research programs; and self-funded anti-poaching units.

The histories regarding the formation of both the Bubye Valley and Savé Valley Conservancies were both presented in this report, despite being remarkably similar; the point being that lion conservation in both areas, and many others, has the same fate either way. The Bubye Valley and Savé Valley Conservancies are both excellent examples of focussed and determined efforts to make wildlife based land use viable in an otherwise cattle dominated landscape. However, the fact remains that the cost of having lions, both ecologically and financially, is high. Simply increasing the abundance of one species at the expense of another cannot be considered a conservation success.

References

Barnett, R., Yamaguchi, N., Shapiro, B., Ho, S.Y., Barnes, I., Sabin, R., Werdelin, L., Cuisin, J., Larson, G., 2014. Revealing the maternal demographic history of Panthera leo using ancient DNA and a spatially explicit genealogical analysis. Bmc Evolutionary Biology 14.

Bauer, H., Chapron, G., Nowell, K., Henschel, P., Funston, P., Hunter, L., Macdonald, D., Packer, C., 2015a. Lion (Panthera leo) populations are declining rapidly across Africa, except in intensively managed areas. Proceedings of the National Academy of Sciences of the United States of America-Biological Sciences 10.

Bauer, H., Packer, C., Funston, P.F., Henschel, P., Nowell, K., 2015b. Panthera leo. The IUCN Red List of Threatened Species 2015.

Bauer, H., Van Der Merwe, S., 2004. Inventory of free-ranging lions Panthera leo in Africa. Oryx 38, 26-31.

Becker, M., McRobb, R., Watson, F., Droge, E., Kanyembo, B., Murdoch, J., Kakumbi, C., 2013. Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. Biological Conservation 158, 26-36.

Bond, I., 1993. The economics of wildlife and landuse in Zimbabwe: An examination of current knowledge and issues. WWF Multispecies Project Paper No 36, Worldwide Fund for Nature, Harare, Zimbabwe.

Brassine, M.C., Parker, D.M., 2012. Does the presence of large predators affect the diet of a mesopredator? African Journal of Ecology 50, 243-246.

Child, B., 1988. The role of wildlife utilization in the sustainable economic development of semi-arid rangelands in Zimbabwe. D.Phil. Thesis, University of Oxford, Oxford, UK.

Child, B., 1993. Using wildlife as a development tool in Zimbabwe.

Creel, S., 2001. Four factors modifying the effect of competition on carnivore population dynamics as illustrated by African wild dogs. Conservation Biology 15, 271-274.

Creel, S., Creel, N.M., 1996. Limitation of African wild dogs by competition with larger carnivores. Conservation Biology 10, 526-538.

Creel, S., Creel, N.M., 1997. Lion density and population structure in the Selous Game Reserve: Evaluation of hunting quotas and offtake. African Journal of Ecology 35, 83-93.

Cumming, D.H.M., 1993. Multi-species systems: Progress, prospects and challenges in sustaining range animal production and biodiversity in East and southern Africa. In Proceedings VII World Conference on Animal Production, Edmonton, Alberta, Canada

Davidson, Z., 2009. Lion ecology and socio-spatial impacts of trophy hunting in Zimbabwe. D.Phil. Thesis, University of Oxford, Oxford, UK.

du Preez, B., Hart, T., Loveridge, A.J., Macdonald, D.W., 2015. Impact of risk on animal behaviour and habitat transition probabilities. Animal Behaviour 100, 22-37.

du Preez, B.D., 2014. The impact of intraguild competition with lion Panthera leo on leopard Panthera pardus behavioural ecology. D.Phil. Thesis, University of Oxford, Oxford, UK.

du Toit, R., 1989. Proposal for Savé Valley Conservancy. Unpublished report for the Intensive Conservation Areas Committee, October 1989, Harare, Zimbabwe

Durant, S.M., 1998. Competition refuges and coexistence: an example from Serengeti carnivores. Journal of Animal Ecology 67, 370-386.

Durant, S.M., 2000. Living with the enemy: avoidance of hyenas and lions by cheetahs in the Serengeti. Behavioral Ecology 11, 624-632.

Funston, P.J., 2008. Conservation and management of lions in Southern Africa: status, threats, utilization and the restoration option, In Management and conservation of large carnivores

in West and Central Africa. eds B. Croes, H.H. Delongh, H. Bauer, pp. 109-131. Leiden, Institute of Environmental Sciences.

Funston, P.J., 2011. The Savé Valley Conservancy Lion Management Plan, 2011. Report for the Savé Valley Conservancy.

Funston, P.J., Groom, R.J., Lindsey, P.A., 2013. Insights into the Management of Large Carnivores for Profitable Wildlife-Based Land Uses in African Savannas. Plos One 8.

Groom, R.J., P., W.J., 2015. Carnivore densities in the Savé Valley Conservancy: 2015. Report for the Savé Valley Conservancy.

Hayward, M.W., O'Brein, J., Kerley, G.I.H., 2007. Carrying capacity of large African predators: predictions and tests. Biological Conservation 139, 219-229.

Hunter, L.T.B., Pretorius, K., Carlisle, L.C., Rickelton, M., Walker, C., Slotow, R., Skinner, J.D., 2007. Restoring lions Panthera leo to northern KwaZulu-Natal, South Africa: short-term biological and technical success but equivocal long-term conservation. Oryx 41, 196-204.

IUCN, 2006. Conservation strategy for the lion in eastern and southern Africa. IUCN SSC Cat Specialist Group, Gland, Switzerland and Cambridge, UK.

IUCN, 2015. The IUCN Red List of Threatened Species. Version 2015-4.

Jansen, D.J., Child, B., Bond, I., 1992. Cattle, wildlife, both or neither: Results of a financial and economic survey of commercial ranches in southern Zimbabwe. WWF Multispecies Project Paper No 27, Worldwide Fund for Nature, Harare, Zimbabwe.

Kettles, R., Slotow, R., 2009. Management of free-ranging lions on an enclosed game reserve. South African Journal of Wildlife Research 39, 23-33.

Laurenson, M.K., Wielebnowski, N., Caro, T.M., 1995. Extrinsic Factors and Juvenile Mortality in Cheetahs. Conservation Biology 9, 1329-1331.

Leader-Williams, N., Milledge, S., Adcock, K., Brooks, M., Conway, A., Knight, M., Mainka, S., Martin, E.B., Teferi, T., 2005. Trophy hunting of black rhino Diceros bicornis: Proposals to ensure is future sustainability. Journal of International Wildlife Law & Policy and Politics 8, 1-11.

Lindsey, P., du Toit, R., Pole, A., Romanach, S., 2008. Savé Valley Conservancy: a large scale African experiment in cooperative wildlife management. Chapter 11, pages 163-184 in B. Child, H. Suich and A. Spenceley, "Evolution and innovation in wildlife conservation in southern Africa." Earthscan, London.

Lindsey, P.A., Alexander, R., Frank, L.G., Mathieson, A., Romanach, S.S., 2006. Potential of trophy hunting to create incentives for wildlife conservation in Africa where alternative wildlife-based land uses may not be viable. Animal Conservation 9, 283-291.

Lindsey, P.A., Balme, G.A., Booth, V.R., Midlane, N., 2012. The Significance of African Lions for the Financial Viability of Trophy Hunting and the Maintenance of Wild Land. Plos One 7.

Lindsey, P.A., Balme, G.A., Funston, P.J., Henschel, P.H., Hunter, L.T.B., 2015. Life after Cecil: channelling global outrage into funding for conservation in Africa. Conservation Letters 0, 1-6.

Lindsey, P.A., Balme, G.A., Booth, V.R., Midlane, N., 2012. The Significance of African Lions for the Financial Viability of Trophy Hunting and the Maintenance of Wild Land. Plos One 7.

Lindsey, P.A., Romanach, S.S., Davies-Mostert, H.T., 2009. The importance of conservancies for enhancing the value of game ranch land for large mammal conservation in southern Africa. Journal of Zoology 277, 99-105.

Lindsey, P.A., Romanach, S.S., Tambling, C.J., Chartier, K., Groom, R., 2011. Ecological and financial impacts of illegal bushmeat trade in Zimbabwe. Oryx 45, 96-111.

Lindsey, P.A., Roulet, P.A., Romanach, S.S., 2007. Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. Biological Conservation 134, 455-469.

Loveridge, A.J., Searle, A.W., Murindagomo, F., Macdonald, D.W., 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation 134, 548-558.

Macdonald, D.W., Loveridge, A.J., Nowell, K., 2010. Dramatis personae: an introduction to the wild felids, In Biology and Conservation of Wild Felids. eds D.W. Macdonald, A.J. Loveridge, pp. 3-58. Oxford University Press Inc., New York, United States.

Miller, S.M., Funston, P.J., 2014. Rapid growth rates of lion (Panthera leo) populations in small, fenced reserves in South Africa: a management dilemma. South African Journal of Wildlife Research 43, 1-13.

Mills, M.G.L., 1995. Notes on wild dog Lycaon pictus and lion Panthera leo population trends during a drought in the Kruger National Park. Koedoe 38, 95-99.

Mosser, A., Packer, C., 2009. Group territoriality and the benefits of sociality in the African lion, Panthera leo. Animal Behaviour 78, 359-370.

Nowell, K., Jackson, P., 1996. Leopard, Panthera pardus, In Wild Cats: Status Survey and Conservation Action Plan. p. 406. IUCN, Switzerland.

Packer, C., Brink, H., Kissui, B.M., Maliti, H., Kushnir, H., Caro, T., 2010. Effects of Trophy Hunting on Lion and Leopard Populations in Tanzania. Conservation Biology 25, 142-153.

Packer, C., Kosmala, M., Cooley, H.S., Brink, H., Pintea, L., Garshelis, D., Purchase, G., Strauss, M., Swanson, A., Balme, G., Hunter, L., Nowell, K., 2009. Sport Hunting, Predator Control and Conservation of Large Carnivores. Plos One 4.

Packer, C., Loveridge, A., Canney, S., Caro, T., Garnett, S.T., Pfeifer, M., Zander, K.K., Swanson, A., MacNulty, D., Balme, G., Bauer, H., Begg, C.M., Begg, K.S., Bhalla, S., Bissett, C., Bodasing, T., Brink, H., Burger, A., Burton, A.C., Clegg, B., Dell, S., Delsink, A., Dickerson, T., Dloniak, S.M., Druce, D., Frank, L., Funston, P., Gichohi, N., Groom, R., Hanekom, C., Heath, B., Hunter, L., DeIongh, H.H., Joubert, C.J., Kasiki, S.M., Kissui, B., Knocker, W., Leathem, B., Lindsey, P.A., Maclennan, S.D., McNutt, J.W., Miller, S.M., Naylor, S., Nel, P., Ng'weno, C., Nicholls, K., Ogutu, J.O., Okot-Omoya, E., Patterson, B.D., Plumptre, A., Salerno, J., Skinner, K., Slotow, R., Sogbohossou, E.A., Stratford, K.J., Winterbach, C., Winterbach, H., Polasky, S., 2013. Conserving large carnivores: dollars and fence. Ecol Lett 16, 635-641.

Pole, A., 1999. The behaviour and ecology of African wild dogs, Lycaon pictus, in an environment with reduced competitor density. PhD thesis, University of Aberdeen, Aberdeen, Scotland.

Pusey, A.E., Packer, C., 1987. The Evolution of Sex-Biased Dispersal in Lions. Behaviour 101, 275-310.

Schaller, G.B., 1972. The Serengeti Lion: A Study of Predator-Prey Relations. University of Chicago Press.

Smuts, G.L., 1978. Effects of Population Reduction on Travels and Reproduction of Lions in Kruger National Park. Carnivore 1, 61 - 72.

Spong, G., 2002. Space use in lions, Panthera leo, in the Selous Game Reserve: social and ecological factors. Behavioral Ecology and Sociobiology 52, 303-307.

Suzuki, Y., 2001. Drifting Rhinos and Fluid Properties: The Turn to Wildlife Production in Western Zimbabwe. Journal of Agrarian Change 1, 600-625.

Trinkel, M., Funston, P., Hofmeyr, M., Hofmeyr, D., Dell, S., Packer, C., Slotow, R., 2010. Inbreeding and density-dependent population growth in a small, isolated lion population. Animal Conservation 13, 374-382.

Vucetich, J.A., Creel, S., 1999. Ecological interactions, social organization, and extinction risk in African wild dogs. Conservation Biology 13, 1172-1182.

Wegge, P., Odden, M., Pokharel, C.P., Storaas, T., 2009. Predator-prey relationships and responses of ungulates and their predators to the establishment of protected areas: A case study of tigers, leopards and their prey in Bardia National Park, Nepal. Biological Conservation 142, 189-202.

Whitman, K., Starfield, A.M., Quadling, H.S., Packer, C., 2004. Sustainable trophy hunting of African lions. Nature 428, 175-178.

Williams, P.H., Burgess, N.D., Rahbek, C., 2000. Flagship species, ecological complementary and conserving the diversity of mammals and birds in sub-Saharan Africa (vol 3, part 3, pg 258, 2000). Animal Conservation 3, 365-365.

ZPWMA, 2015. Conservation Status of the African Lion (Panthera leo) in Zimbabwe. Unpublished Report for the USFWS.

Republic of Zimbabwe

Enhancement and Non-Detrimental Findings for

Panthera leo in Zimbabwe

Zimbabwe Parks and Wildlife Management Authority



October 2016

Contents

1 Introduction 1

2 Status and Distribution of Lion in Zimbabwe 2

2.1 The extent of lion distribution in Zimbabwe 2

2.2 Minimum population of lion in Zimbabwe 5

2.2.1 Captive Breeding Facilities 7

3 Conservation and Management 7

3.1 Policy And Legislation 7

3.2 The Zimbabwe Parks and Wildlife Management Authority 8

3.3 Conservation Strategy and Action Plan for Lion 9

3.3.1 National Lion Captive Breeding Policy 14

4 Population Trend Data For Key Lion Populations In Zimbabwe 14

4.1 Lion survey techniques 15

4.2 Results of regional lion surveys 15

4.2.1 Gonarezhou National Park 15

4.2.2 Save Valley Conservancy 16

4.2.3 Bubiana Valley Conservancy 16

4.2.4 Mana Pools National Park 17

4.2.5 Hwange National Park 17

4.2.6 Zambezi National Park and Units 6 and 7 19

4.2.7 Chizarira National Park and Chirisa/Sengwa Safari Area 19

5 Conservation in Zimbabwe 19

5.1 Staff Establishment 20

5.2 Transport operations 20

5.3 Law enforcement 21

5.3.1 Illegal Harvesting of Wildlife 21

5.3.2 Illegal trophy hunting – the “Cecil” effect 22

5.4 Human Wildlife Conflict 23

5.4.1 Case Study of Human- Lion Conflict from Hwange National Park 24

5.5 Trend in Financial Performance of the Authority 26

6 Stakeholder involvement in lion management and conservation 27

6.1 Beneficiaries of Wildlife Based Land Use 27

6.2 Contribution of the Private Sector 28

6.3 CAMPFIRE Community programmes 30

7 Management and Administration of the Safari Hunting Industry in Zimbabwe 34

7.1 Performance of the industry 34

7.1.1 Global earnings of the industry 34

7.1.2 Quota allocation, Utilisation and Total Trophy Fees Earned 35
7.1.3 Total trophy fees generated by land category 36
7.5 Quota Setting Process 37
7.6 Points system for adaptively managing lion quotas in Zimbabwe 39
7.6.1 Results of the Adaptive Lion Quota Management System: 2013 to 2016 40
7.6.2 Case study: Safari Hunting surrounding Hwange National Park 43
8 Threats and Mitigation 43
8.1 Human-lion conflict 44
8.2 Habitat loss 44
8.3 Illegal Trade in Lion Products 44
8.4 Bushmeat Poaching 45
8.5 Prey Abundance 46
9 Assessment of the Enhancement and Non-Detriment Findings 53
10 References 60
11 Appendices 63
11.1 Annex I: Summary of National Parks Estate, Forestry, Communal and Private Land where lion are known to occur 63
11.2 Annex II: Summary of primary legislation and regulations 68
11.2.1 The Policy for Wild Life of 1992 68
11.2.2 Wildlife Based Land Reform Policy 69
11.2.3 Parks and Wild Life Act Chapter 20:14 of 1996 as amended in 2001: 71
11.2.4 The Rural District Councils Act Chapter [29:13] 2002 76
11.2.5 The Forest Act of 1948 77
11.3 Annex III: Analysis of Total Revenue by Country of Destination 77
11.4 Annex IV: Analysis of Total Revenue by Species 79

1 INTRODUCTION

The United States Fish and Wildlife Service (USFWLS) made a ruling in terms of its Endangered Species Act of 1973 (ESA) that the status of the southern and eastern African lion subspecies (*Panthera leo melanochaita*) is threatened (see http://www.regulations.gov). This ruling, which came into effect on January 22, 2016, now requires that the importation of all trophy lion from Zimbabwe will require an import permit. The decision whether to issue an import permit will in future be based on a Non-Detrimental Finding (NDF) that takes into consideration four main factors outlined under 50 CFR 17.22 and 17.32. These are:

- What direct and indirect impacts would occur on the wild population?
- Would issuing a permit conflict with any known programs intended to conserve the species?
- Would the purposes of the permit reduce the threat of extinction facing the species?
- What are the opinions of experts?

In addition to these factors USFWLS will also take into consideration the IUCN Species Survival Commission (SSC) *Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0* (IUCN/SSC 2012). This document identifies five guiding principles of a hunting program that creates "*incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources*" and recognizes that trophy hunting can contribute to biodiversity conservation and the conservation of the hunted species.

These are:

- **Biological sustainability** i.e. the hunting program:
  - Cannot contribute to the long-term decline of the hunted species
  - It should not alter natural selection and ecological function of the hunted species or any other species that share the habitat
  - It should not inadvertently facilitate poaching or illegal trade in wildlife by acting as a cover for such illegal activities
  - It should also not manipulate the ecosystem or its component elements in a way that alters the native biodiversity.

- **Net Conservation Benefit** i.e. the biologically sustainable hunting program should be:
  - Based on laws, regulations, and scientifically based quotas, established with local input, that are transparent and periodically reviewed
  - It should produce income, employment, and other benefits to create incentives for reducing the pressure on the target species
  - It should create benefits for local residents to co-exist with the target species and other species

- **Socio-Economic-Cultural Benefit** i.e. a well-managed hunting program can serve as a conservation tool when:
  - It respects the local cultural values and practices
  - It involves and benefits residents in an equitable manner
  - It adopts business practices that promote long-term economic sustainability

- **Adaptive Management: Planning, Monitoring, and Reporting** i.e. can the hunting programme enhance the species when it is based on appropriate resource assessments and monitoring (e.g., population counts, trend data), upon which specific science-based quotas can be established. Resource assessments should be objective, well documented, and use

the best science available. Adaptive management of quotas, based on the results of resource assessments and monitoring, is essential

- **Accountable and Effective Governance** i.e. a biologically sustainable trophy-hunting program should be subject to a governance structure that clearly allocates management responsibilities. The program should account for revenues in a transparent manner and distribute net revenues to conservation and community beneficiaries, and take steps when needed to eliminate corruption and ensure compliance with national and international requirements and regulations.

To address the points raised above, a systematic review of the status of lion in Zimbabwe has been undertaken with the full cooperation of stakeholders from the Government, Private Hunting Sector, Community NGOs and research organisations to demonstrate that the lion populations in Zimbabwe are being managed sustainably for benefit of both the conservation of the species and that the management programme is also providing economic incentives for local communities to protect and expand lion habitats. In doing so this assessment addresses the following issues:

- That the Zimbabwe hunting industry is based on sound scientific information and identifies mechanisms that would arrest the loss of habitat or increase available habitat (where feasible) and ensuring adequate protection from human encroachment.
- Demonstrate that there are government incentives in place to encourage habitat protection by private landowners and communities and incentives to local communities to reduce human-wildlife conflicts.
- Demonstrate that hunting concessions are managed to ensure the long-term survival of the listed species and its habitat.
- That trophy hunting provides financial assistance to the Zimbabwe Parks and Wildlife Management Authority, including the communal CAMPFIRE programme and private sector, to carry out various wildlife management programmes. It will also highlight how local communities directly and indirectly benefit from the presence of lion in their areas.
- Finally, this document will demonstrate how the participation of U.S. hunters in the Zimbabwe hunting industry contribute to the overall management of lion within the country.

2 Status and Distribution of Lion in Zimbabwe

Bauer et al (2015) summarise time series data for 47 lion populations across West, Central, East and Southern Africa where regular survey data are available. Using a Bayesian state space model to estimate growth rate-λ for each population, this study concludes that lion populations are declining everywhere across Africa, except in four southern countries (Botswana, Namibia, South Africa, and Zimbabwe). The population models indicate a 67% chance that lions in West and Central Africa will decline by one half, while estimating a 37% chance that lions in East Africa will also decline by one-half over two decades. It is concluded that almost all lion populations that historically exceeded ~500 individuals are declining, *but lion conservation is successful in southern Africa, in part because of the proliferation of reintroduced lions in small, fenced, intensively managed, and funded reserves.* This statement reflects the situation in Zimbabwe where lion populations in the conservancies have flourished under sound management regimes. They have also recovered rapidly in instances where appropriate actions have been taken to arrest unsustainable practices (i.e. Hwange) and where protected areas are receiving adequate funding (i.e. Gonarezhou).

2.1 The extent of lion distribution in Zimbabwe

The Zimbabwe Parks and Wildlife Management Authority (ZPWMA) is responsible for managing one of the largest estates in the country which constitutes approximately 5 million hectares of land or 13%

of the Zimbabwe's total land area (see Table 1 below). The bulk of Zimbabwe's wildlife occurs within the Parks Estate which includes 11 national parks, 16 safari areas, 16 recreational parks, 6 sanctuaries, 12 botanical reserves and 3 botanical gardens, all spread across the country, among other wildlife tourism related activities (Parks and Wildlife Act 2001 Chapter 20:14).

Wildlife populations also occur on the state Forest Areas, Communal CAMPFIRE areas and private conservancies dedicated to wildlife-based land use (Figure 1). Table 1 below provides a summary of these different categories, and whether they support lion populations (see Annex 1 for the details of each area).

Table 1. Summary of the National Parks Estate, CAMPFIRE, Forestry and Conservancies where lion populations are resident

Land Category		**Presence of Lion**				**Total (ha)**	**Total (km^2)**
		Yes (ha)	**%**	**No (Ha)**	**Migratory (Ha)**		
Parks Estate	National Parks	2,608,710	96	61,850	47,150	2,717,710	27,177
	Safari Area	1,745,300	92	146,600	-	1,891,900	18,919
	Botanical gardens	-	-	2,069	-	2,069	21
	Sanctuary	-	-	18,980	-	18,980	190
	Recreational	-	-	357,161	-	357,161	3,572
Forestry		436,165	47	491,701	-	927,866	9,279
CAMPFIRE		8,953,700	36	5,435,100	10,319,000	24,707,800	247,078
Private Conservancies		758,200	66	243,500	150,897	1,152,597	11,526
Matetsi Farms		-	-	-	155,627	155,627	1,556
Total Ha		**14,502,075**		**6,756,961**	**10,672,674**	**31,931,710**	**319,317**
Total km^2		**145,021**		**67,570**	**106,727**	**319,317**	
Percentage		**45%**		**21%**	**33%**		

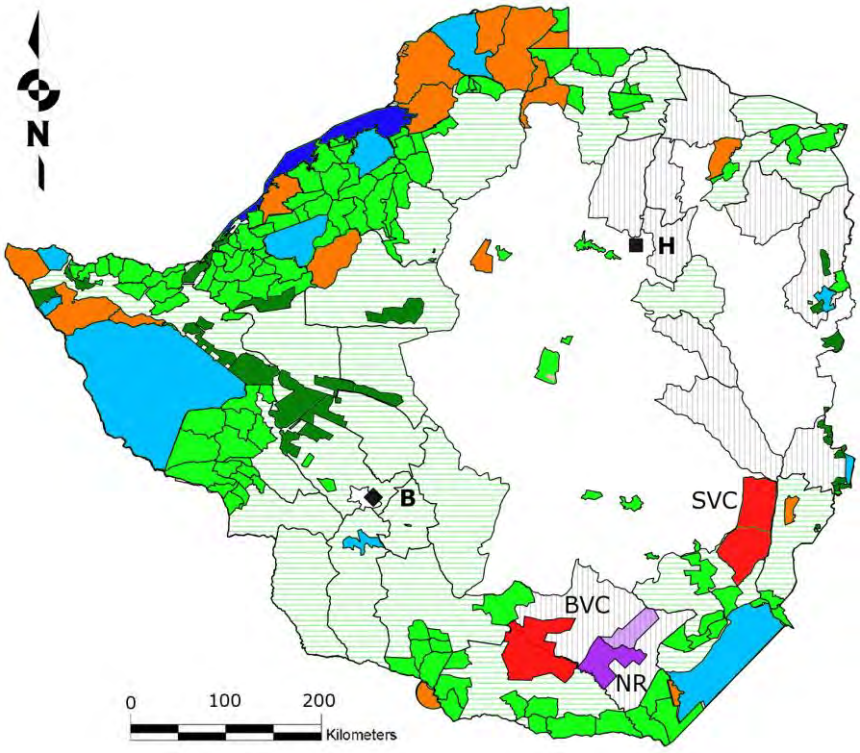


Figure 1: Map of Zimbabwe's main wildlife areas: [i] National Parks are represented in light blue; [ii] Safari areas are represented in orange; [iii] Forestry areas are represented in dark green; [iv] Community and Private wildlife areas are represented in light green; [v] Communal Land (CAMPFIRE Areas) in which sport-hunting may occur is represented by light green horizontal stripes; [vi] Communal Land in which sport-hunting does not occur is represented by grey vertical stripes. [vii] The Bubye Valley [BVC] and Savé Valley [SVC] Conservancies are represented in red. [viii] The Nuanetsi Ranch [NR] on which sport-hunting takes place is represented in dark purple (light purple represents the Nuanetsi Ranch cattle area); [ix] Lake Kariba is represented in dark blue. Harare (the capital city) is represented by a black square and letter '**H**'. Bulawayo is represented by a black diamond and letter '**B**'. Sport-hunting may occur in areas: ii, iii, iv, v, vii & viii (from du Preez, B. Groom, R., Mufute, O., Mandisodza-Chikerema, R. and Booth, V. (2016).

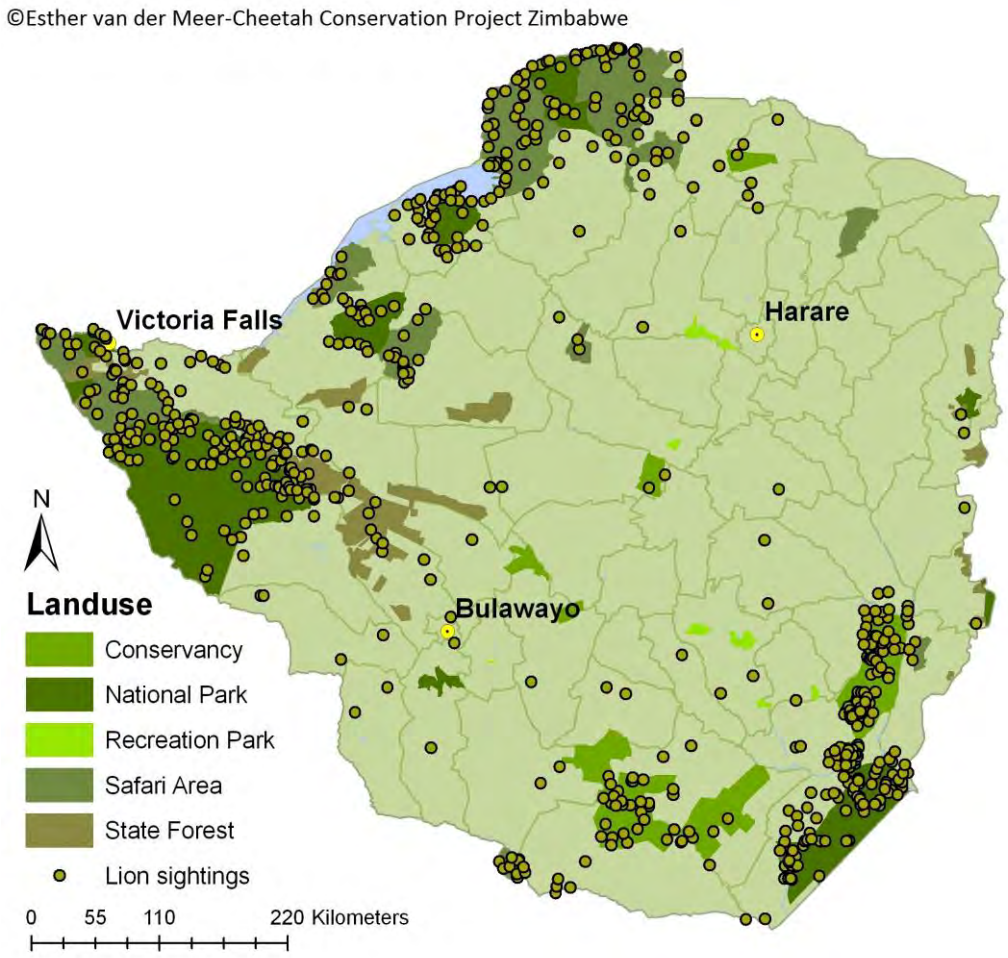


Figure 2: Range of African Lion Distribution in Zimbabwe

There are approximately 319,317 km^2 of land where some form of wildlife based land use is practiced in Zimbabwe. Lion occur permanently in 45% of this available range (c. 145,00km^2), with the majority occurring in State protected national parks (96%) and safari areas (92%). Lion also occur permanently in 47% of the State forest areas and 66% of privately owned Conservancies. The CAMPFIRE areas comprise approximately 247,000km^2 and lion occur in 36% of these areas. Lion are transient in CAMPFIRE, Conservancy and resettled areas adjacent to the major protected areas, and move across the border into Zambia, Mozambique, South Africa and Botswana (Figure 2).

There are two established Transfrontier Conservation Areas (TFCAs), the Great Limpopo Transfrontier Park (GLTP) which includes Gonarezhou National Park, and the Limpopo/Shashe TFCA. Other TFCAs that are at various stages of development are the Kavango-Zambezi (KAZA), Lower Zambezi-Mana Pools, Zimbabwe-Mozambique-Zambia (ZiMoZa) and Chimanimani.

2.2 Minimum population of lion in Zimbabwe

The minimum number lion that occur in approximately 51,642km^2 of land where reliable survey data are available is estimated to be c.1,917 (range 1,800 – 2,000) and is summarised in Table 2. The Western sector of the country dominated by Hwange National Park and the surrounding safari areas, forest areas, communal areas and private conservancies supports c.737 lion (or 38% of the overall population). The Southern sector dominated by the two major conservancies (Save and Bubye) and

Gonarezhou National Park supports c. 896 lions (48%) while the Central and Northern sectors of the country support c.284 lions (15%).

Table 2: Estimated minimum population of Wild Lion populations in Zimbabwe – September 2016 (Data compiled from a variety of reports)

REGION	AREA	AREA (km^2)	Estimated Number of Lions	Percentage
Western	Hwange NP	14,900	559	38%
	Matetsi Units 1-5	1,934	59	
	Matetsi Units 6-7 and Zambezi NP	1,585	67	
	Kazuma Pan NP	313	20	
	Kazuma Forest	240		
	Panda Masuie Forest	355		
	Matetsi ECA	1,556	15	
	Ngamo and Sikumi Forest	1,386	6	
	Gwaai Conservancy	927	22	
	Hwange Communal Land	392	2	
	Tsholotsho buffer adjacent HNP	1,275	7	
Subtotal		**24,863**	**737**	
Central	Chizarira NP	1,948	31	4%
	Chirisa SA	1,713		
	Omay	1,865	10	
	Matusadona NP	1,427	31	
Subtotal		**6,953**	**72**	
Northern	Chewore North and South	1,648	45	11%
	Dande	1,155	21	
	Hurungwe (Nyakasanga and Rifa)	1,709	32	
	Charara/Mukuti	1,692	20	
	Mana Pools	1,287	94	
Subtotal		**7,491**	**212**	
Southern	Gonarezhou National Park	5,053	125	48%
	Malilangwe	400	37	
	Bubye Valley Conservancy	3,440	450	
	Save	3,442	284	
Subtotal		**12,335**	**896**	
Overall Total		**51,642**	**1,917**	

2.2.1 Captive Breeding Facilities

Currently there are only two properties registered as captive lion breeders (Lion and Cheetah Park, and Antelope Park) and < 10 non-registered captive lion breeding operations (Table 3). Most of these centres keep lions for non-consumptive tourism and environmental education purposes with only a few keeping lions as pets. Altogether there are 345 lions held in captivity.

Table 3: Record of lions held in captivity – September 2016

Property	TOTAL
Doddieburn	13
Lion & Cheetah Park	40
Sentinel	2
Vhuka	5
Antelope Park	114
Safari Par, Masuwi Lodge (Lion Encounter)	4
Mhondoro Game Park	2
Chedgelow Farm	9
Chengeta	5
Turk Mine	6
Bally Vaughan	8
Mwanga Lodge	8
Masvingo	17
Karoi	2
Oscro	10
Simply Wild	19
Sondelani	9
Ruwazi	7
Imire	2
Makado Ranch	2
Chipangali	32
Crocodile Farm, Victoria Falls	1
Kuimba Shiri	2
Pamuzinda	6
Shearwater	10
Inyathi Ecogame Park	10
Total	**345**

3 Conservation and Management

3.1 Policy And Legislation

The Ministry of Environment, Water and Climate has a comprehensive suite of policies and legislation that provides the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) with a mandate to conserve and protect all fauna and flora in the country.

The legal framework is enshrined in the National Legislation and associated Regulations that are informed by the Wildlife Policy (1992) that seeks to maintain a protected area network for the conservation of the nation's wild resources and biological diversity. Amongst others it seeks to create

economic activity to enhance rural development and encourages the conservation of wild animals and their habitats outside the protected areas.

The ZPWMA is established by the Parks and Wildlife Act of 1996 (Chapter 20:14) as amended by Act Number 19 of 2001 which came into operation on the 1st of June 2002 through a Statutory Instrument 144C of 2002. The Act provides for the:

- Establishment of a Parks and Wildlife Board;
- Confers functions and imposes duties on the Board;
- Establishment of national parks, botanical reserves, botanical gardens, sanctuaries, safari areas and recreational parks;
- The preservation, conservation, propagation or control of wildlife, fish, and plants of Zimbabwe and the protection of her natural landscape and scenery;
- Conferment of privileges on owners and occupiers of alienated land as custodians of wildlife, fish and plants;
- Giving of certain powers to environment committees (formerly intensive conservation area committees); and matters incidental to or connected with the foregoing.

The Act that was originally passed by Parliament in 1975 was unique in that it provided a legal basis for the devolution of Authority to private landowners over all wildlife on their land which resulted in in the rapid development of the country's wild life industry. It also paved the way for the partial extension of this principle to the Communal Lands through the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in the 1980s that granted Appropriate Authority Status to the communal areas to manage the wildlife resources for their own benefit.

The Act was subsequently revised in 1996 and 2001 with the latest revision paving the way for the establishment of the current Parks and Wild Life Management Authority to replace the former Department of National Parks and Wild Life Management.

The legal and regulation framework applicable to the conservation and protection of lion and all other species includes:

- Parks and Wildlife Act; Chapter 20:14 (1996) as amended in 2001.
- Environmental Management Act; Chapter 20:27.
- Forest Act; Chapter 19:05.
- Statutory Instrument 362 of 1990: Parks and Wildlife (General) Regulations, 1990.
- Statutory Instrument 76 of 1998: Import and Export of Wildlife Products.
- Statutory Instrument 40 of 1994: Parks and Wildlife Act (General) Amendments.
- Statutory Instrument 26 of 1998: Parks & Wildlife Act (General) Amendment.
- Statutory Instrument 92 of 2009: Compensation Values for Wildlife.
- Statutory Instrument 93 of 2009: Compensation Values for Trapping of Animals.
- Trapping of Animals Control Act 20.16.

A summary overview of these instruments is provided in Annex II.

3.2 The Zimbabwe Parks and Wildlife Management Authority

The Parks and Wildlife Management Authority is mandated by the Parks and Wildlife Act [Chapter 20:14] with the responsibility of conserving Zimbabwe's wildlife heritage through effective, efficient and sustainable protection and utilisation of natural resources for the benefit of present and future generations. The Authority was established to allow it to retain the revenue that it generates for

funding its operations and thereby reducing its dependence on Treasury. This entailed introducing a commercial dispensation and putting in place effective revenue generation and financial management systems.

The ZPWMA has the mandate to manage the entire wildlife population of Zimbabwe, whether on state, private and communal land. Vision, mission and core values of ZPWMA are as follows:

Vision: *To be the world leader in sustainable conservation*.

Mission: *To conserve Zimbabwe's wildlife heritage through effective, efficient and sustainable utilisation of natural resources for the benefit of present and future generations and stakeholders*

Core Values: Teamwork, Commitment, Transparency, Professionalism, Integrity, Accountability, Fairness, in harmony with nature.

While private landowners may utilise the wildlife on their land, they are still accountable to the ZPWMA for the welfare of the wildlife in terms of Statutory Instrument 26 of 1998, which, among other things, states that "*No person shall permit any person who is not ordinarily resident in Zimbabwe to hunt on any land for which he is the appropriate authority any animals other than those entered on the authority to hunt…*'

3.3 Conservation Strategy and Action Plan for Lion

A *Conservation Strategy and Action Plan for the Lion (Panthera leo) in Zimbabwe* was prepared in 2006 by the ZPWMA, local and international NGOs. This was in response to the proposal submitted by Kenya at the 13th Conference of the Parties to the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) calling for the transfer of the lion population from Appendix II to Appendix I. The Parties recommended a detailed examination of the issues surrounding the conservation of the African lion, through a series of regional workshops.

IUCN responded to this and together with other key stakeholders, organised the first workshop in 2005 which involved the 14 West and Central African lion range states. The second workshop brought together 15 lion range states from Eastern and Southern African in January 2006 (Bauer, Chardonnet and Nowell, 2005). Each workshop included the Directors of Wildlife Conservation Departments and their technical advisors, safari operators, community leaders, non-governmental organisations involved in conservation, as well as researchers on the African lion.

The workshops came up with several recommendations which included:

- The need for African lion range States to follow up the workshops by developing and implementing national lion management plans.
- The need for a Pan African Conservation strategy to form the basis of a region wide collaboration in the conservation of the lion and which would also form the basis for the management of other wildlife species on regional scale.

Responding to the first recommendation, the ZPWMA, together with IUCN, convened a workshop in November 2006 to develop a national lion conservation strategy and action plan for Zimbabwe attended by conservation NGOs, the private sector, and Rural District Councils (RDCs), as well as ZPWMA and IUCN (Conservation Strategy and Action plan for the Lion (*Panthera leo*) In Zimbabwe, 2006).

The deliberations of this workshop identified the following issues related to lion conservation in Zimbabwe:

- Management and research including technical advice, policy formulation and management interventions
- Capacity needs as reflected by adequate human, financial and material resources
- Mitigation of human-wildlife conflict
- Socio-economic costs and benefits of long-term lion conservation
- Communication and information dissemination for key decision makers at different levels
- Framework for captive breeding of lions
- Trade and regulations to ensure non-detriment findings related to trade in all lion related products
- Regional collaboration to strengthen bilateral and regional lion conservation strategies

The analysis of these issues led to the formulation of the conservation strategy whose vision is that *Lions (*are*) conserved and managed sustainably for their aesthetic, cultural and ecological values, and the socio-economic development of Zimbabwe*. The immediate objective of this strategy is *to secure and where possible, restore as many viable lion populations as possible in Zimbabwe whilst mitigating their negative impacts and enhancing their value for the benefit of people through sustainable use*.

Three broad targets were identified to achieve this objective:

1. Ensure the persistence of key lion populations and other important populations including those of doubtful viability;
2. Human and livestock loss reduced, and
3. Optimize wildlife conservation-related net benefits to local communities

Table 4 summaries the progress with achieving the results identified in the strategy:

Table 4: Summary of implementation progress of the 2006 lion conservation strategy.

Output 1. Lion Management - Lion populations, their habitats and wild prey effectively conserved and managed in collaboration with local stakeholders	
Target 1.1 Establish a baseline survey and monitoring programme for identified lion populations and their range inside and outside the Parks & Wildlife Estate	Baseline surveys have been completed for the Parks Estate using monitoring protocols for key variables (populations, habitats, prey). Selected surveys undertaken of areas outside National Parks in conservancies and some communal land and forest areas.
Target 1.2 Maintain and strengthen capacity for lion conservation, management, monitoring and research within PWMA and amongst other key stakeholders	Carnivore research programmes undertaken by NGOs (Mana, Matusadona, Gonarezhou, Zambezi and Hwange NPs, Matetsi, Chirisa SA) and research institutions (Bubye and Save Conservancies) in various parts of the country. Personnel trained in data collection and capture, management, lion aging and analysis.
Target 1.3 Identify and implement best management standards and practice for all trophy hunted lion populations, ensuring their viability and sustainable, equitable and adaptively managed trophy quotas	Quota setting methodology reviewed and annual quotas and offtakes analysed considering population changes, trophy quality and levels of PAC over time. Trophy hunting database in place and in process of being refined to provide cost-effective system for collation, entry, analysis, reporting and feedback to key stakeholders in the wildlife industry (ZPWMA, RDCs, SOAZ, ZPHGA, conservation NGOs, Researchers etc.). System of fixed and optional quotas reviewed and age-based criteria for male trophy animals in place and functioning.
Target 1.4 Develop and implement a national lion captive breeding management policy	Policy in place (see discussion below).
Target 1.5 Develop and implement co-management frameworks for wildlife management	Collaborative national lion action plans to co-management lion populations in place for NW Matabeleland and SE Lowveld, including three conservancies (Bubye Valley, Save and Malilangwe).
Target 1.6 The geographic distribution range of the lion population expanded	Conservancies and neighbouring communities are working together to maintain existing geographic distribution of lion populations. Zimbabwe proactive in the KAZA and GLTFCA programmes.
Output 2. Lion Research - Information for effective and adaptive lion conservation management generated	
Target 2.1 Initiate targeted research on lion ecology, management and mitigation of conflict	Extensive research programmes focussing on lion ecology and biology undertaken in Hwange, Bubye, Save, Malilangwe, Matusadona, Chizarira and Chirisa. ZPWMA have cooperated with NGOs, such as Panthera, to develop cost-effective age determination methods for lions. Key threats to lion populations, with focus on human-lion conflict, snaring and poisoning, undertaken and continually monitored.
Output 3. Mitigation - Human-lion related conflicts minimized and, where possible, eliminated	

Target 3.1 Develop and establish databases on lion/human conflict	Data on Problem Animal Control (PAC) reports on lion related problems collated.
Target 3.2 Identify and implement methods to reduce and mitigate livestock losses and lion attacks on humans	Approaches to mitigate livestock losses and lion attacks on humans being tested and implemented in Hwange. Methods to mitigate lion attacks on livestock being implemented as appropriate at selected sites (e.g. Tsholotsho).
Target 3.3 Trained and properly staffed PAC Units established to conduct rapid response, restrained and precisely targeted problem animal control	PAC Units at ZPWMA field station and/or RDC levels partially established.
Target 3.4 Incidents of human-lion conflict reduced by at least 30% in 5 years while also reducing retaliatory killing	Specific awareness and education package on lion conservation and management developed and implemented in Matusadona, Hwange and Gonarezhou regions.
Output 4. Socio- Economic - The costs and benefits of long-term lion management equitably distributed	
Target 4.1 Complete an inventory of stakeholders directly affected by lion conservation	Stakeholder groups (e.g. local communities, CAMPFIRE RDC representatives, commercial safari hunting operators (SOAZ, ZPHGA), tourism operators (ZATSO) identified. Financial impacts of lion conservation and extent and magnitude of socio-economic impacts on each stakeholder group completed.
Target 4.2 Deliver appropriate training and capacity building to prioritised stakeholders	Representative stakeholder groups in some regions identified (Hwange, Matusadona, Gonarezhou). Limited training undertaken. Implement adaptive programme across four wildlife regions
Target 4.3 Agree and implement collaboratively developed area-specific lion management plans with identified stakeholder groups in each wildlife region within 5 years	In progress. Hwange NP Management Plan approved.
Target 4.4 Implement transparent mechanisms to equitably distribute lion-related/generated income to identified stakeholders (groups and/or communities)	Scale of income generated from lion conservation reviewed and use of funds to encourage protection of lion populations reach local stakeholders undertaken (see CAMPFIRE generated revenues)
Output 5. Regulations - Effective regulation of consumptive lion utilisation ensured	
Target 5.1 Implement approved policy and practice at national and local levels regarding problem animal control (PAC) of lions within 2 years	Current policy and practice regarding problem animal control of lion reviewed, at national and local levels. PAC offtakes reconciled with trophy hunting quota offtake to ensure that the overall offtake (i.e. total quota) is sustainable.
Output 6. Communication, Awareness and Information Dissemination	

Target 6.1 To carry out awareness programmes in 50% of the districts in Zimbabwe within the next three 3 years	Awareness programmes initiated at a national level, with professional hunters, communities and NGO community. Awareness campaigns being carried out by the Extension and Interpretation Unit in all the regions.
Target 6.2 Create lion conservation and management information units within one year	Databases established at some key research centres using dedicated external research programmes (e.g. WILDCRU).
Output 7. Regional and Trans-Boundary Collaboration	
Target 7.1 Undertake an inventory of national strategies for lion management	Done.
Target 7.2 Encourage the development of national lion conservation strategies where these are missing &/ or incomplete	National lion conservation strategies discussed at AWCF (meeting held under auspices of KAZA).
Target 7.3 Develop an integrated and harmonised lion management strategy for Transfrontier Conservation Areas (TFCAs)	Lion conservation strategies for SADC discussed at AWCF meeting held under auspices of KAZA.
Target 7.4 Implement lion conservation strategy and management plan	Strategy under review.

3.3.1 National Lion Captive Breeding Policy

A target of the Conservation Strategy and Action Plan for the Lion in Zimbabwe was to develop and implement a National Lion Captive Breeding Management Policy. This was achieved in 2011 when the ZPWMA met with lion breeders, keepers and animal welfare organizations to define the purpose of breeding and keeping lions; identify and discuss issues related to breeding and keeping of lions in captivity and to chart the way forward on the breeding and keeping of lions in captivity.

The objectives of the policy are to provide a national approach and minimum standards to all aspects relating to the management of captive bred lions including the role of captive bred lions upon reaching maturity and regulate the import and export of captive bred lions. The policy also defines the measures to protect the genetic integrity of indigenous lion populations. The use and welfare of captive bred lions is monitored by a captive lion inspection team.

In terms of this policy, lions that are kept in captivity for species conservation and commercial purposes are subject to the following conditions:

1. No permit for the keeping of lions in captivity will be issued before the facility has been inspected and approved by ZPWMA as a Captive Lion Holding Facility.
2. Lions may not be allowed to breed in captivity unless the holding facility is registered as a Captive Lion Breeding Centre. If a breeding permit is not issued, it is the responsibility of the owner to ensure that the animals do not breed. If breeding occurs without a permit the owner will be fined and the animals are subject to confiscation and possible destruction by ZPWMA.
3. Lions may not be captured from the wild population and kept in captivity unless the animal is orphaned or injured and is captured with the purpose of rehabilitating the animal and returning it to the wild within as short a time as possible.
4. Captive bred lions may not be released into the wild or transferred from the facility without prior permission from ZPWMA, and are subject to an approved release plan.

No lion can be transported without the necessary internal and national permits and without being micro-chipped, and all transportation of live animals must comply with CITES Resolution Conf. 10.21(Rev. CoP 14). To safeguard the integrity of the indigenous gene pool, no import permits will be issued for non-indigenous lions. Any lion that are to be transported must be issued a certificate of health by a competent veterinarian confirming that the premises of origin has been free from anthrax, panleukopenia and canine distemper for six months, and that each predator is free from diseases such as FIV, BTB or any other disease which may threaten local populations. The animal should also have been vaccinated for rabies and treated with a broad spectrum de-wormer and acaricide.

It is an offence to export lions from Zimbabwe without a ZPWMA export permit, and all export permit will only be considered if the exporting facility holds a current permit to keep captive lions. Moreover, an export permit will only be issued if the importing facility, in the country of import, conforms to regulations laid out in this policy document.

4 Population Trend Data For Key Lion Populations In Zimbabwe

Zimbabwe has in recent years taken proactive actions to enhance the conservation of lion populations both inside and outside the protected areas. These have included implementing moratoriums on hunting, reducing quotas, implementing an age-based hunting regulation and undertaking independent monitoring programmes conducted by international research institutions. Emerging from this is evidence that by implementing appropriate regulatory, management and monitoring actions, coupled with raising awareness, the lion populations respond rapidly and recover to near

former levels. The section below summarises the data from key range areas both inside and outside the National Parks Estate to substantiate this.

4.1 LION SURVEY TECHNIQUES

The population estimates of lions in Zimbabwe are determined through carnivore spoor surveys, systematic lion collaring and call-up surveys. With the strategy to maintain the wilderness values of most protected areas, there is low road penetration in the parks estates, however all suitable roads are used as transects, and in areas of suitable substrate, spoor surveys have shown to be an effective and efficient means to assess wildlife densities (Stander 1998, Fuston et al. 2001, Davidson and Romanach 2007). Patrol reports, field observations by ZPWMA rangers and other sightings by tour operators and tourists also contribute to the knowledge of the status of lions in Zimbabwe's protected areas. Similarly, the occurrence of lion in Safari Areas is recorded by resident safari operators, including those operating in CAMPFIRE areas.

4.2 RESULTS OF REGIONAL LION SURVEYS

Lion population surveys provide indices of abundance that can be used to determine spatial distribution, as well as temporal trends in population numbers. The results of the different survey methods are used to generate information for setting sustainable lion trophy hunting quotas and for population management.

4.2.1 Gonarezhou National Park

Spoor count surveys of the Gonarezhou National Park have been conducted since 2009 using the same methodology to obtain direct estimates of lion populations to compared actual lion densities with potential density estimates (Groom, 2009, Groom et. al. 2014). Table 5 below illustrates the growth of the lion population in the Park (Groom and Watermeyer, 2015).

Table 5: Population estimates of lion in the whole of Gonarezhou National Park (extrapolated from survey area) from 2009 – 2015 (Groom and Watermeyer, 2015).

2009	2010	2011	2012	2013	2014	2015
31	45	72	64	77	116	125

As with many lion populations anthropogenic factors can be key drivers of lion population dynamics, and in areas with high human impact lion numbers may be significantly lower than those predicted by prey biomass models. This was found to be the case in the Gonarezhou National Park. Groom et. al. (2014) concluded that high hunting quotas either within or around the protected area were the most likely cause of the low lion numbers, with quotas in some areas being as high as seven lions per 1,000km^2 in some years. Other factors included persecution, poisoning and problem animal control, as well as disease and competition with spotted hyaenas (*Crocuta crocuta*).

Following decisions to halt lion hunting, and reducing human-lion conflict, the lion population responded and steadily increased, reaching a density of 2.5 lions / 100km^2 in 2014 (as compared with 0.6 / 100km^2 in 2009). Relative to other populations (average over Kruger NP, Hwange NP, Selous GR and Serengeti NP = 9.6 lions / 100km^2) this is still low, suggesting the population could continue to increase further. Groom et. al. (2015) conclude that the lack of artificial water in Gonarezhou means that natural carrying capacity will be lower but based on prey biomass availability predictions of lion carrying capacity could support between 200 and 300 lions (Groom 2010). It is therefore still possible that the lion population in the park could at least double before reaching carrying capacity (especially because prey biomass is now greater than it was in 2010 – see Section 8.5 below).

4.2.2 Save Valley Conservancy

The African Wildlife Conservation Fund carries out an annual large carnivore spoor survey to assess population trends of the carnivores in the Savé Valley Conservancy (SVC) to aid management decisions. A standardised methodology is used to ensure consistency through time and comparability with other studies. Since 2008, the spoor surveys have been done using the same roads and the same observer. The results of these surveys are provided in Table 6 showing that the lion population has increased from 40 in 2005 to 284 in 2015 (Groom and Watermeyer, 2015, du Preez et al, 2016).

Table 6: Population estimates of lion in the whole of Savé Valley Conservancy from 2005 – 2015

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
40	50	52	76	114	143	105	130	115	182	284

The lion population has increased substantially in the last two years, and there are now an estimated 284 lions in the whole of the conservancy. This is a notable increase since the 2013 estimate of 115 lions and 2014 estimate of 182, and is perhaps a latent effect of no hunting for over several years. Of the 149 lion tracks encountered, 28% were big adult males with 53% identified as females/juveniles and 15% as young cubs (3% of tracks were unidentified). The number of lions in SVC equates to a density of 11.7 lions/100km². This is slightly higher than other population estimates of 9.6 lions/100km² (average over Kruger, Hwange, Selous and Serengeti).

4.2.3 Bubiana Valley Conservancy

After originally being eradicated by cattle ranchers in the area, 13 lions were reintroduced to the Bubye Valley Conservancy in 1999, and four young males broke into the Conservancy that same year. From the original 17 animals present in 1999, the Bubye Valley Conservancy lion population was estimated at approximately 280 individuals in 2009 when robust population surveys were initiated by a team from the University of Oxford Wildlife Conservation Research Unit (WildCRU), and this population has continued to grow. Today it is estimated that there are over 500 lions on the Bubye Valley Conservancy (Figure 3, du Preez et. al., 2016).

The exponentially increasing Bubye Valley Conservancy lion population currently exists at one of the highest densities in Africa (~0.190 lions/km^2: du Preez et al. 2015, du Preez et al. 2016), greater than that of the Serengeti, Tanzania (0.10 lions/km^2), Selous, Tanzania (0.080 – 0.130 lions/km^2: Creel and Creel 1997), Kruger National Park, South Africa (0.096 – 0.112 lions/km^2: Mills et. al. 1995), and Hwange National Park, Zimbabwe (0.027 lions/km^2: Loveridge et. al. 2007). This equates to the largest contiguous lion population in Zimbabwe.

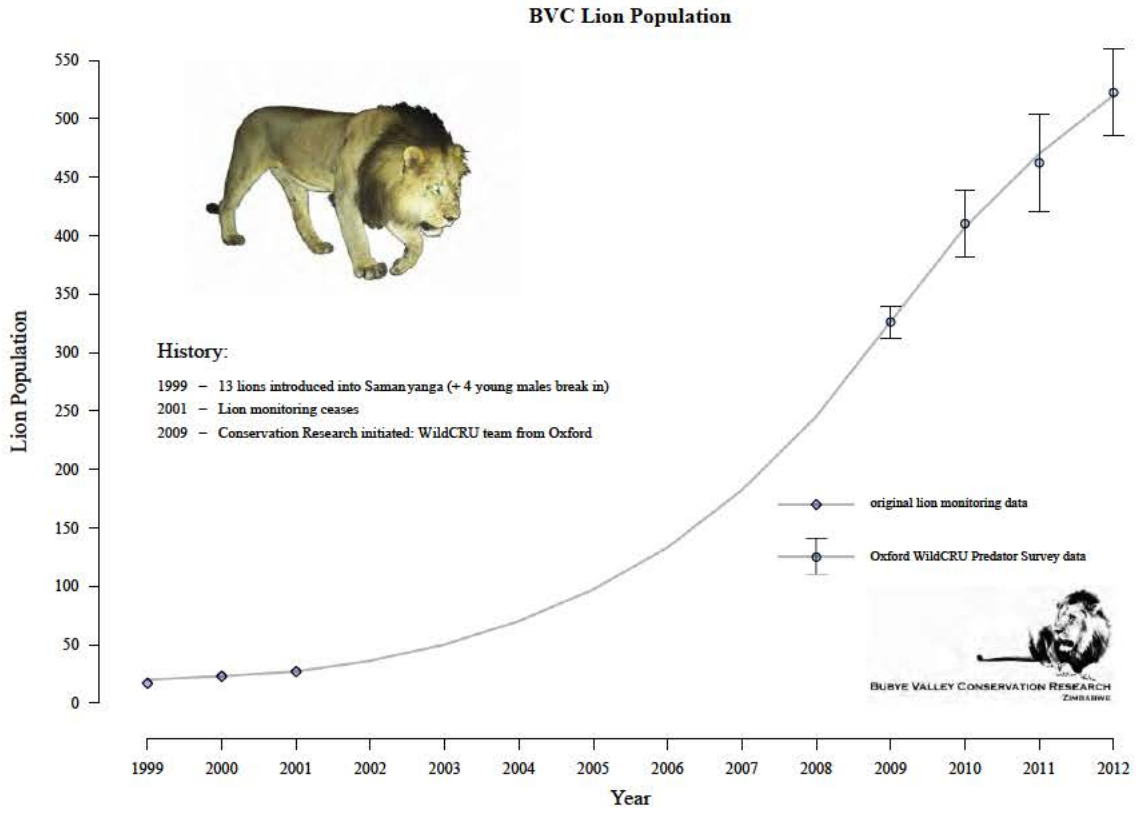


Figure 3: The Bubye Valley Conservancy lion population has increased exponentially since the original reintroduction of the species to the conservancy in 1999.

4.2.4 Mana Pools National Park

In conjunction with ZPWMA, Zambezi Society and the Cheetah Conservation Project, the Wildlife Conservation Research Unit (WILDCRU) based in Oxford (U.K.) conducted a camera trap and spoor count survey of Mana Pools National Park with the objective of:

- To undertake park wide surveys to estimate population density, distribution and habitat occupancy of common predator species in Mana Pools National Park.
- To contribute to Cheetah Conservation Project Zimbabwe's (CCPZ) cheetah monitoring protocol.
- To provide presence/absence data on all the larger mammal species.

A Facebook page was also created for the survey that was regularly updated on the progress of the survey (Facebook.com/Mana Pools Survey 2015).

The preliminary results of this survey identified 67 individual lions from the 267 images captured. When combined with the spoor count surveys, the population was estimated at 94 lions at a density of 4.5 lion/km^2 (Seymour-Smith and Loveridge, 2015),

4.2.5 Hwange National Park

The Hwange Lion Research Project undertaken by the Wildlife Conservation Research Unit (WILDCRU, Oxford University) works in association with the Zimbabwe Parks and Wildlife Management Authority. Since 1999 this project has identified over 600 lions and currently monitors approximately 15 prides and 12 male coalitions in a 5,000km^2 study area. This is one of the most intensive and long-term lion

projects in Africa. A key finding of this research programme has been to demonstrate that the way lion trophy hunting is managed can rapidly improve the status of lion populations by implementing a biologically sustainable system of allocating quotas. This project has also increase the understanding of human related impacts on lion populations (and vice-versa) along the park boundary. More recent research is focussed on understanding connectivity between Hwange NP and other areas such as parks in Botswana and in Zimbabwe.

This project was initiated because there was a perception that levels of sport hunting of male lions' in the hunting concessions surrounding the Hwange National Park were having a negative impact on the conservation of the population (Loveridge, et. al. 2007). Data collected between 1999 and 2004 suggest that this was indeed the case and this contributed to a suspension of sport hunting of lions in the area surrounding the Park between 2005 and 2009. This was a crucial shift in management policy for this species and an important step towards sustainable management and conservation of lions. Following the imposition of the hunting moratorium, lion densities increased (Figure 4).

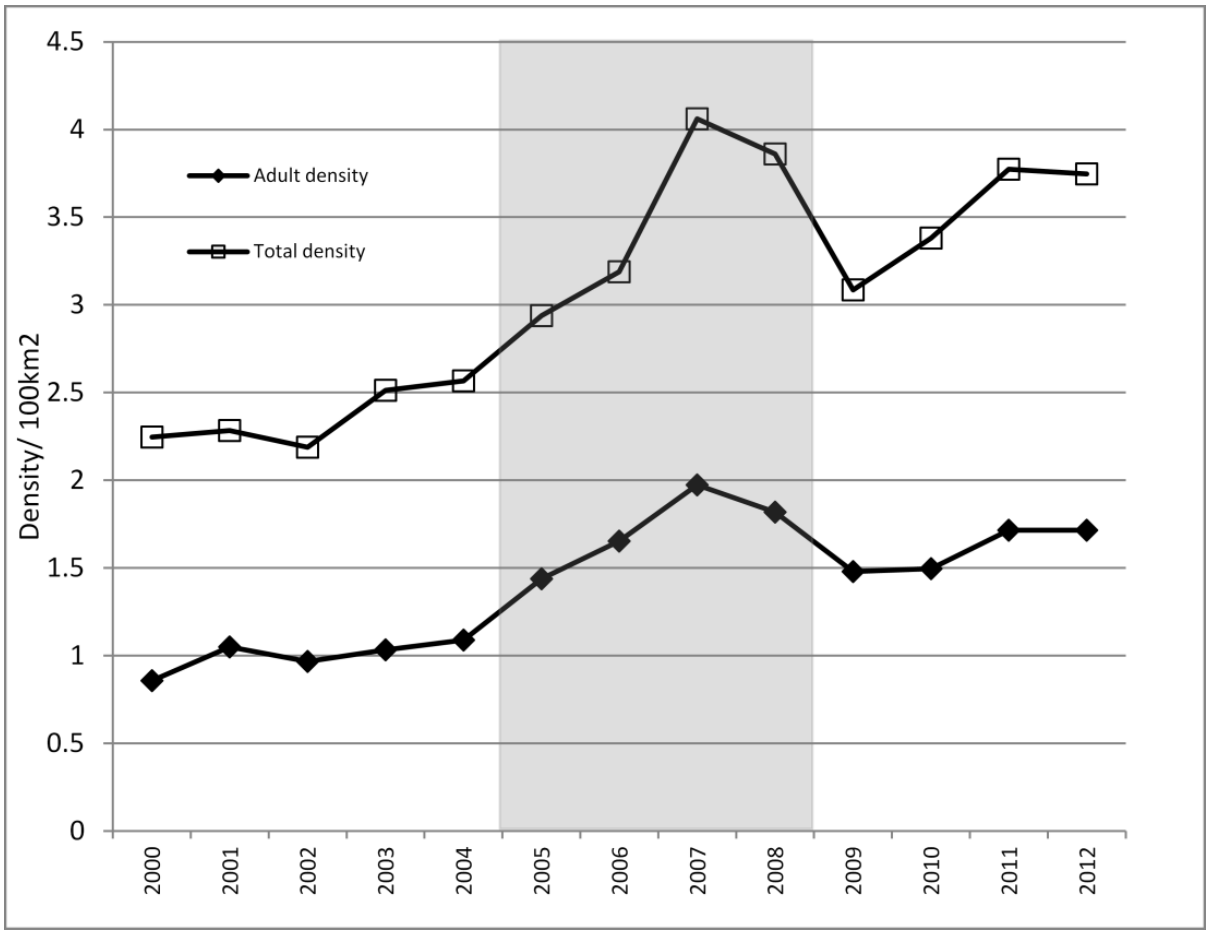


Figure 4: Lion densities in the Hwange area between 2000 and 2012

Following the lifting of the moratorium, and by implementing strict monitoring and hunting guidelines, the overall Hwange lion population has continued to show a positive trend, and is now estimated at over 550 animals.

4.2.6 Zambezi National Park and Units 6 and 7

Victoria Falls Wildlife Trust (VFWT) in collaboration with ZPWMA and the Hwange Lion Research Project has recently completed both spoor count transects and a camera trap surveys in Zambezi National Park, and Units 6 and 7 of the Matetsi Safari Area. The preliminary results of these surveys show that the lion population has increased since 2013 to approximately 67 (Rodger Parry, pers comm.).



Coalition males, Zambezi National Park, June 2016 (*Photo credit: Jessica Dawson, Victoria Falls Wildlife Trust)*

4.2.7 Chizarira National Park and Chirisa/Sengwa Safari Area

A survey was undertaken jointly by the Zimbabwe Parks and Wildlife Management Authority and the African Lion and Environmental Research Trust in September 2015 (Dr Norman Monks pers comm.). The survey area consisted of the 1,910 km^2 Chizarira National Park (a non-hunting area) and the adjoining 1,713 km^2 Chirisa/Sengwa Safari Area (a hunting area). No large carnivore counts using the call-up method had previously been conducted in these contiguous protected areas.

The survey method used the standardized protocol of audio broadcasts of a buffalo calf in distress. Spoor counts were not used for these surveys since previous research had shown that the call-up method was more precise, took less time, and was less costly to complete to achieve accurate results. Up to three stations were sampled nightly commencing just after sunset.

Twelve call-up sites were sampled. Response to the call-up stations by lions was low with only 2 of the 12 stations visited. The population abundance was estimated to be 31.6 (0.872 lion 100/km^2), suggesting a decline of 68.4% since 2004 when estimates of lion numbers were provided to Bauer and van der Merwe, (2004).

5 CONSERVATION IN ZIMBABWE

Zimbabwe Parks and Wildlife Management Authority (ZPWMA) falls under the Ministry of Environment, Water and Climate and it was established under the Parks and Wildlife Act of 1996 (Chapter 20:14) as amended by Act Number 19 of 2001. The rationale behind the establishment of the Authority was to allow it to retain all the revenue it generates to be ploughed back into conservation. The functions of the Authority are provided for in detail in section 4 of the Parks and Wildlife Amendment Act Number 19 of 2001. The Act gives the Authority power to control, manage and maintain Zimbabwe's wildlife resources.

Its **vision** is "*To be a World Leader in sustainable conservation*" and its **mission** is "*To conserve Zimbabwe's wildlife heritage through protection and sustainable utilisation of natural resources for the benefit of present and future generations*."

5.1 STAFF ESTABLISHMENT

The staff strength at the beginning of January 2015 was 2,043 and ended at 2,044 on 31, December 2015 (2015 Annual Report (unpublished). Fifty (50) rangers were recruited in 2015. The following is the staff status report as at 31st December, 2015 (Table 7).

Table 7: Summary Staff Establishment by Region

Position	Grade	HQ	VMU	Northern	Western	Southern	Central	Total
Executive	F & E	3	0	0	0	0	0	**3**
Department Managers/Sectional Heads	D3-D5	19	0	3	4	3	3	**32**
Ecologists/ Area Managers/Officers	D1-D2	11	1	19	19	13	4	**67**
Snr Rangers /Officers	C1-C5	29	6	64	89	49	34	**271**
Rangers/Clerical	B2-B5	33	12	507	461	310	197	**1,520**
Gen. Hands / Lodge Attendants	B1	2	2	30	66	33	17	**150**
TOTAL		**97**	**21**	**623**	**639**	**408**	**255**	**2,043**

The current remuneration levels have remained low with the lowest paid worker receiving a gross salary of $375 per month. The last salary increase of 23% was in January, 2014. A comparison with other Parastatals within the same parent ministry, shows that the Authority has the lowest salary scales.

5.2 TRANSPORT OPERATIONS

As indicated in Table 8, the total cost of operating the Parks transport fleet was is $1,547,172.82 (excluding insurance and licensing) in 2015. The existence of old and obsolete vehicles in the fleet increases costs as most of them require major component replacements thereby increasing vehicle downtime.

Table 8: Overall travel and fuel consumed by Region

Station	Km travelled	Fuel Consumed		Repairs & Maintenance Cost ($)	Total Cost ($)
		Litres	Cost ($)		
Head Office	1,489,294	190,644	272,620	136,419	409,039
Northern	1,429,260	149,577	213,895	147,113	361,007
Southern	1,075,077	110,111	157,458	59,548	217,006
Western	1,313,263	142,012	203,077	161,120	364,196
Central	392,885	47,995	68,632	127,288	195,920
TOTAL	**5,699,779**	**640,339**	**$915,684**	**$631,486**	**$1,547,172.**

Table 9 below summarises the status of the Authority's vehicle fleet as of 2015. Out of the fleet complement of 316 (including tractors and motor cycles), only 70% are in sound condition.

Table 9: Number of vehicles per region

Region	Runners	Non-Runner	Total	% of Non-Runner
Head Office	41	6	47	13
Northern	53	19	72	26
Southern	30	21	51	41
Western	80	39	119	33
Central	17	10	27	37
Total	**221**	**95**	**316**	**30**

The Authority also owns three aircraft: Bell Jet Ranger and Robinson R22 Beta 11 helicopters, and a Cessna 185. The Jet Ranger is based at Hwange National Park and is used for game capture and law enforcement. The remaining aircrafts are non-operational.

5.3 LAW ENFORCEMENT

A major component of the Authority's mandate is law enforcement. This has become increasingly more important with the escalation in illegal wildlife trade, particularly involving elephant and rhino. The Authority has an establishment of 2,146 rangers however by the end 2015, there were 1,448 rangers in post (67%). Of the 1,448 rangers in post, 1,004 are deployable for anti-poaching operations.

The level of effort of law enforcement over the last 3 year is summarised in Table 10. In 2015 there were 2,139 incursions detected, and arrest of 1,354 local and 129 foreign poachers. The number of armed contacts declined from 26 in 2014 to 23 in 2015, and number of poachers killed declined from 13 in 2014 to 11 in 2015. Recoveries made in the field included 25 rifles, 276 rounds of ammunition, 496 pieces of elephant ivory, 4 rhino horns and 5,133 wire snares.

Table 10: Detections, Arrests and Recoveries for 2013, 2014 and 2015

Year	No of Incursions	No of contacts		Number of poachers				Recoveries					Other recoveries and arrests		
				Killed		Arrested									
		Armed	Visual	Local	Foreign	Local	Foreign	Rifles	Ammunition	Ivory	Rhino horn	Snares	Gold	Poachers Camp	Dogs
2013	1842	27	344	9	0	1421	131	20	945	436	5	4415	93	264	180
2014	1571	26	362	10	3	4161	94	20	163	202	19	4864	221	186	272
2015	2139	23	356	6	5	1354	129	25	276	496	4	5133	134	339	167

5.3.1 Illegal Harvesting of Wildlife

Commercial wildlife poaching involving both local and foreign nationals continues to plague Zimbabwe, especially with respect to elephant and rhino located in the Zambezi Valley, Sebungwe, North-West Matabeleland, South-East Lowveld. The species targeted are shown in Table 11 and 12. Note that 21 lions were killed illegal between 2013 – 2015, with 6 animals killed through snaring in the area adjacent to Hwange National Park in 2015.

Table 11: Trends in wildlife poaching in the parks estate

Year	Illegally killed wildlife										
	Elephant	Buffalo	**Lion**	Kudu	Zebra	Impala	Warthog	Nyala	Eland	Crocodile	Waterbuc k
2013	293	65	**12**	65	21	67	22	5	6	2	15
2014	176	44	**2**	34	8	65	26	2	5	3	15
2015	317	78	**7**	76	21	92	46		9	17	6
2016*	101	23	**0**	23	22	54	12	1	4	1	5
Total	**807**	**210**	**21**	**200**	**72**	**278**	**106**	**8**	**24**	**23**	**41**

*To September 2016

Table 12: Illegally killed wildlife 2015 in the four regions

Region	Elephant	Buffalo	**Lion**	Kudu	Sable	Zebra	Croc	Impala	Eland	Warthog	B/Buck	waterbuck
Central	46	30	**0**	16	0	6	1	28	0	17	7	
Northern	75	6	**0**	6	0	0	0	0	0	0	0	0
Southern	65	38	**1**	42	0	9	4	31	4	25	1	6
Western	131	4	**6**	12	1	6	12	33	5	4	1	0
Total	**317**	**78**	**7**	**76**	**1**	**21**	**17**	**92**	**9**	**46**	**9**	**6**

5.3.2 Illegal trophy hunting – the "Cecil" effect

Professional hunter Theodor Bronkhorst was arrested for allegedly illegally hunting of a lion popularly known as 'Cecil' with a foreign client on Antoinette and Antoinette farm in Gwayi River Conservancy (which is adjacent to Hwange National Park). The same case involved Umguza Rural District Council in alleged illegal quota transfer[1]. At the time of writing, this case has not been brought before the court, and is still under judicial review[2].

The Authority immediately implemented the following measures in response to this incident:

- Hunting of lions, leopards and elephant in areas outside of Hwange National Parks required confirmation and authorization in writing by the Director-General of the Zimbabwe Parks and Wildlife Management Authority, and all hunts are to be accompanied by the Authority's staff whose costs will be met by the landowner.
- Bow hunting was suspended except with confirmation and authorization in writing by the Director-General of the Zimbabwe Parks and Wildlife Management Authority.
- Members of the hunting fraternity were reminded that it was illegal for quotas to be transferred from one hunting area to another. Any case of quota transfer would be regarded as poaching, and the Authority will not hesitate to arrest, prosecute, and ban for life any persons including professional hunters, clients and land owners who were caught on the wrong side of the law.

[1] This system facilitated the transfer of a quota from one property to another has since been suspended by the Authority.

[2] Note: This case has been dismissed by the court on 12th November 2016.

- 2015 hunting quotas and permits for Antoinette and Antoinette farm, Railway farm 33, Umguza Rural District Council and Kusile Rural District Council were suspended.
- Professional hunters' license for Theodor Bronkhorst was suspended.

5.4 Human Wildlife Conflict

The Authority is called upon to deal with human-wildlife conflict (HWC) issues across the country, and this continues to be a challenge. A total of 863 reports of problem wild animals causing threat to human life and property were received in 2015 compared to 1,637 reports in 2014 (Table 13). From these incidents, a total of 39 human fatalities by crocodiles, elephants, lions and buffaloes were recorded in 2015 compared to the 27 fatalities in 2014.

Table 13: Trends of Human and Wildlife Conflict Incidents

Year	Total Reports Received	People killed	People Injured	Cattle killed	Goats killed
2013	1 088	21	16	67	65
2014	1 637	27	24	217	129
2015	863	39	23	232	213
Total	**3 588**	**87**	**63**	**516**	**407**

The scale and species involved in HWC is summarised in Table 14. The authority received 200 problem lion reports and responded to 177. One person was killed by lion, and 206 livestock. The Authority elected to capture problem lion (6) rather than destroy the animals.

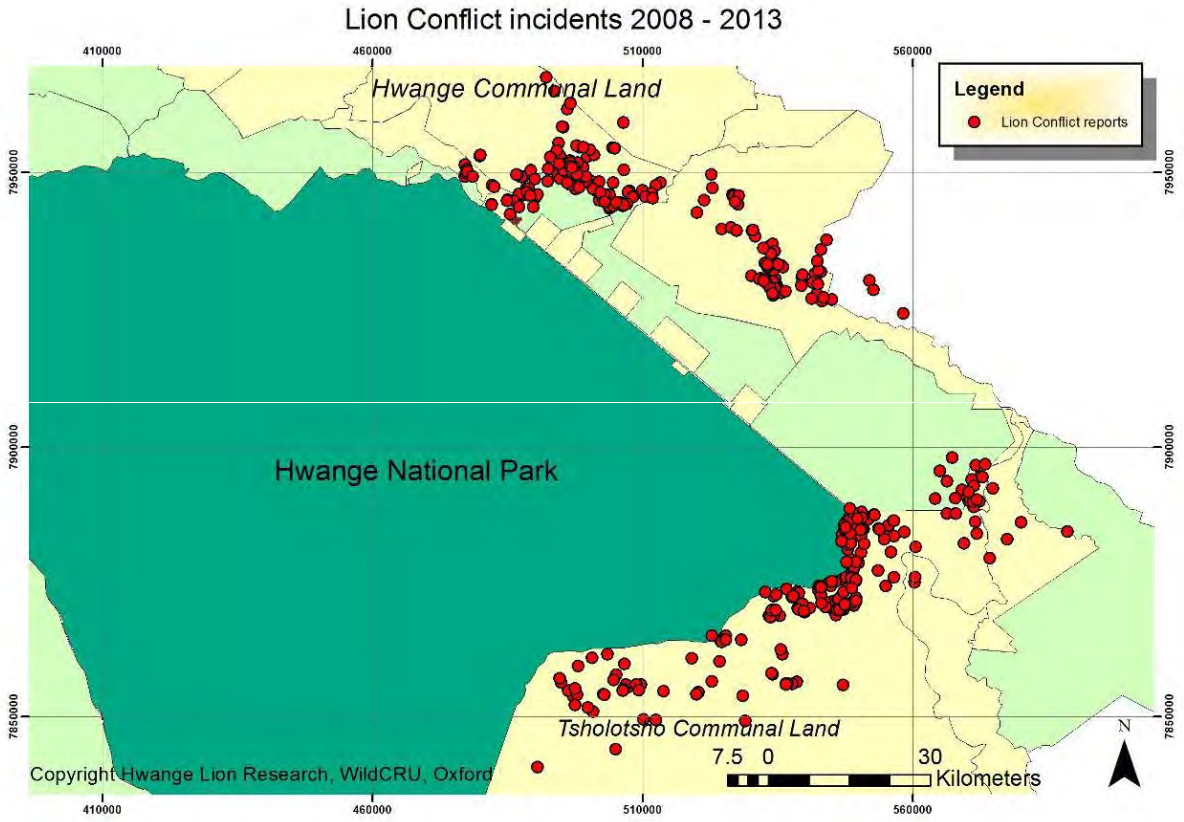
Table 14: Scale of countrywide human wildlife conflict in 2015.

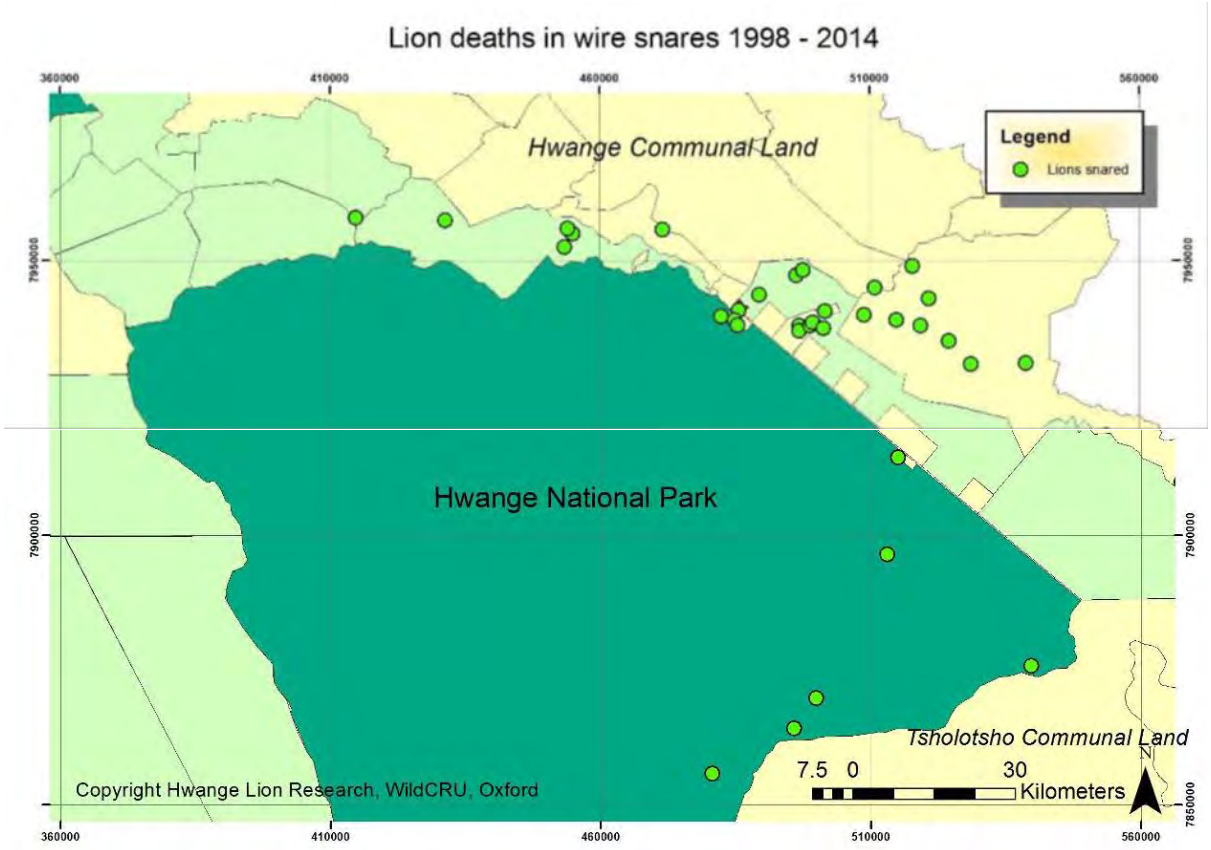
Species	Nature of problem	No of reports received	Reports attended	Number of animals eliminated		People		Livestock killed		
				Killed	Captured	Killed	injured	Cattle	Donkeys	Goats
Baboons	Damage to infrastructure, crop raiding, threat to humans	109	105	51	48	0	0		0	0
Buffalo	Threat to human life and crop raiding	46	40	0	15	2	1		0	0
Elephant	Threat to human life, crop raising, destroying property	216	177	0	38	4	5	0	0	0
Hippo	Threat to human life and crop raiding	131	87	0	34	0	0	0	0	0
Crocodile	Threat to human life and killing livestock	106	85	39	9	27	14	16	1	47
Hyenas	Killing livestock	36	18	0	7	0	0	68	2	54
Leopard	Killing livestock	19	11	0	1	0	0	32	0	33
Lion	**Threat to human life and livestock killing**	**200**	**177**	**0**	**6**	**1**	**0**	**115**	**12**	**79**
Total		**863**	**700**	**90**	**158**	**34**	**20**	**231**	**15**	**213**

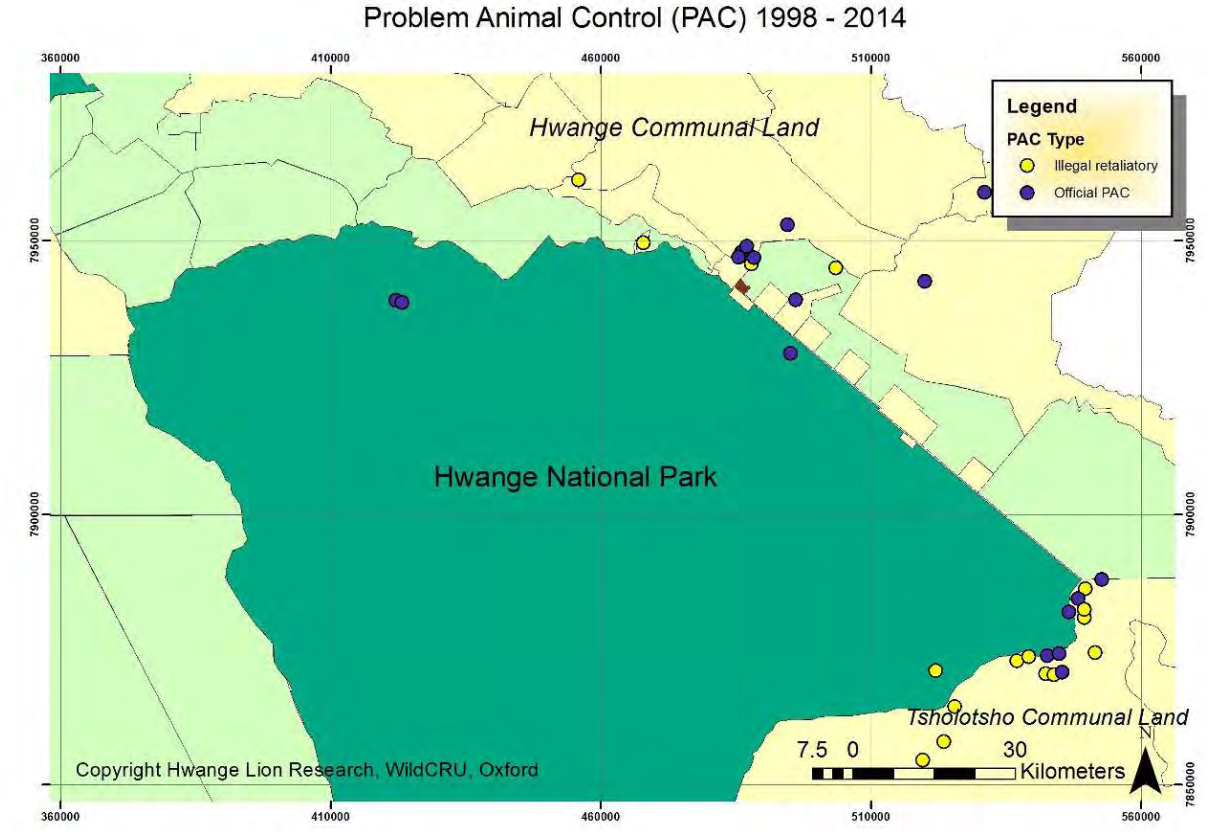
5.4.1 Case Study of Human- Lion Conflict from Hwange National Park

The following information has been extracted from the Hwange National Park Management Plan (ZPWMA, 2016) and is provided here to illustrate the challenges facing the management of lion populations residing adjacent to communal and commercial properties. Variations of the scenario described here apply to other areas of the country where hyaenas and lions are the most problematic carnivores in the communal areas adjacent to protected areas. Hyaenas are perceived to be more of a problem than lions as they account for large numbers of livestock (cattle, goats and sheep). The data presented here has been extracted from the WildCru Lion Research project in Hwange and considers only lions.

Since its inception in 2007 a significant component of the WildCru Lion Research project has focused on understanding the ecological and human socio-economic factors of conflict between the local agro-pastoralist people residing in Tsholotsho and Hwange Communal Land and lions. The project developed an intensive reporting system to record conflicts and has undertaken a detailed survey to record the baseline data on human wildlife conflict at the household level. Between 2007 and 2013 a total of 1,113 conflict incidents were recorded in the Hwange area in which 915 head of stock was lost to lions.







To mitigate this conflict, the project has initiated the "Long Shields Guardian Programme" whereby communities are notified of movements of collared into their areas via cell phone who then motivate the community to take appropriate action (i.e. moving the cattle, chase the lions etc.). In 2013 alone,

1,850 warnings were passed to the "Long Shields". In addition, the project is working on improving bomas and husbandry techniques as another way to lessen the conflict between lions and people, and although these actions may reduce the incidents of livestock marauding lions, cattle deaths still occur resulting in retaliatory killings or action on the part of National Parks to destroy the animals.

5.5 Trend in Financial Performance of the Authority

The average Income and Expenditure for the period 2010 – 2015 is shown in Table 15 that highlights the inability of the Authority to generate adequate revenue to cover both the capital and operating requirements. The average total income over this period is US$22.4 million (range US$16.5 – US$29.3 million). For the period ending December 2015, the Authority generated total revenue of $24,1million, which is 32% below the anticipated budget of $35.5 million. This includes a government grant of $716 000 and a donation of vehicles and equipment worth $2,1 million from the Government of China.

The average total expenditure for the period 2010 – 2015 is US$25.3 million (range US$18.1 – US$30.7 million). The Authority has thus incurred a loss of approximately US$2.8million/year. For the year ended December 2015, the Authority incurred a loss of US$5,4 million including depreciation.

The Authority is dependent on income from Conservation Fees (i.e. entry fees to Parks etc.) that accounted for 39% in 2015 (average 34%/year), hunting (13% in 2015) and leases (10% in 2015, Table 15).

Although individual salaries remained low, staff costs in 2015 were $20,7 million which is 71% of total revenue raised (average 64%). This is unsustainably high and leaves very limited resources for operation (16%), marketing (1%) and administrative expenses (7%, Table 15).

The major reasons for the budget deficits in the past six years can be attributed to:

- Declining income from hunting – this has been exacerbated by the recent bans imposed on elephant trophy imports into the United States by US Fish Wildlife Service (USFWS) and the much-publicised death of *Cecil the lion* that had a negative effect on revenue generated from hunting.
- Government Grant – The Authority has not received meaningful funding from the fiscus despite requests made by management that non-revenue generating activities which are of national nature be funded by Government.
- The Authority failed to dispose of its ivory stock pile due to the continued ban on ivory trade by CITES. The ivory stock which the Authority is currently holding exceeds 80 tons.

Table 15: Statement of Comprehensive Income for period 2010 – 2015 and the year ended 31 December 2015 (extracted from 2015 ZPWMA Annual Report).

Revenue	US$ 2015	%	Average 2010 - 2015	%
Conservation Fees Land	$7,879,987	33%	$6,506,508	29%
Conservation Fees River	$1,409,160	6%	$1,136,041	5%
Accommodation	$1,720,640	7%	$1,904,477	8%
Annual registration	$507,211	2%	$722,847	3%
Permits	$1,476,176	6%	$849,916	4%
Service and Facilities	$307,692	1%	$152,616	1%
Law enforcement (fines etc.)	$224,657	1%	$215,591	1%

Revenue	US$ 2015	%	Average 2010 - 2015	%
Hunting income	$3,256,698	13%	$5,049,089	22%
Fishing permits	$561,797	2%	$941,833	4%
Leases and rentals	$2,434,676	10%	$1,880,258	8%
Parks product sales	$623,084	3%	$767,347	3%
Examinations	$116,000	0%	$70,873	0%
Projects	$349,864	1%	$248,614	1%
Other income/donations	$2,555,729	11%	$907,169	4%
Government grant	$716,000	3%	$1,141,119	5%
Total	**$24,139,371**			
Expenditure				
Operational costs	$4,801,815	16%	$5,146,091	20%
Staff costs	$20,766,023	71%	$16,311,677	64%
Marketing and promotions	$212,406	1%	$147,334	1%
Administration costs	$2,056,681	7%	$2,631,019	10%
Depreciation	$1,531,000	5%	$1,069,138	4%
Total expenditure	**$29,367,925**		**$25,305,258**	
Operating surplice/deficit	**-$5,365,082**		**-$2,810,962**	

The Authority receives considerable support from many local and international NGOs who undertake a variety of routine management activities e.g. supply and maintain artificial game water supplies, provide logistic support to law enforcement operations. This is in addition to the support provided by hunting operators that hold concessions in the Safari Areas.

6 STAKEHOLDER INVOLVEMENT IN LION MANAGEMENT AND CONSERVATION

There are several private sector initiatives that are directly or indirectly involved with lion management and conservation both inside and outside the Parks estate. These stakeholders are represented by companies from the consumptive and non-consumptive sectors of the industry.

6.1 BENEFICIARIES OF WILDLIFE BASED LAND USE

Various forms of wildlife based land use occur in Zimbabwe that benefit different segments of the community depending on the authority for the land. Table 16 summarises these broad categories. The Authority is the direct beneficiary from the use of wildlife in National Parks and Safari Areas while the Forestry Commission is the beneficiary in Forestry Areas. In terms of the Act, Communal CAMPFIRE areas are the primary beneficiaries where the income generated from hunting is shared between the Rural District Council and Community Wards (see below). Similarly, private conservancies and land owners are the primary beneficiaries.

Collectively, these different management regimes contribute to the overall conservation of the wildlife both inside and outside the Parks Estate, and is supported through the existing policy and legal framework that facilitates incentives to promote wildlife based land use.

Table 16: Direct beneficiaries from Wildlife Based Land Use

Land category	Direct Beneficiary
National Parks and Safari Areas	Zimbabwe National Parks and Wildlife Management Authority
Forestry Areas	Forestry Commission
Communal Campfire Areas	Rural District Council and Wards
Private Conservancies	Private Landowners

6.2 CONTRIBUTION OF THE PRIVATE SECTOR

A questionnaire was circulated to all safari hunting operations to gather data on:

- Area and land category where hunting takes place
- Payments in terms of concession fees
- Number of people employed
- Approximate value of investment in assets
- Approximate costs of the hunting operations
- Hunter days generated through various packages
- Indication of the prey base

Data from 18 companies that have been allocated lion on quota and offer these trophies as part of their hunting packages is summarised below (Table 17). These data indicate that

- The average hunting concession covers 1,590km^2 and generates $178,488 in concession fees annually.
- Each company on average employs 109 people of which 24 are seasonal staff (22%). Law enforcement staff make up 26% of the staff complement.
- On average, each company has invested approximately $1.3 million in fixed and moveable assets (buildings, tents, vehicles, equipment etc.).
- On average, each company incurs approximately $1 million in expenses annually, with staff wages (24%) and operating expenses (27%) forming the bulk of these costs.
- Lion safaris contribute approximately 9% (126 hunter days) to the 3-year average number of hunter days generated (1,405) with the bulk of hunter days generated from buffalo safaris (see below for more details on the financial significance of this contribution).
- On average, each hunting area supports 2,000 large mammals, 3,000 medium sized mammals and 6,000 small sized mammals. However, there are large differences between state, forestry, CAMPFIRE and conservancies areas. State areas tend to support more large animals (buffalo, giraffe) while conservancies support greater numbers of medium and small animals.
- Observations on the status of lion populations indicates that each area supports on average 5 prides of 7 animals (i.e. 35 lions) although there is a wide variation in these numbers with more prides occurring in the conservancies than on Forest and CAMPFIRE areas. In these areas, the operators report that lion are transient/migratory rather than permanent.
- All areas report incidents of human-lion conflict, including incidents of snared animals.

Table 17: Summary of 18 hunting company statistics where lion hunting occurs

Companies (N=18)	**Total**	**Average**	
Total Hunting Area (ha)	2,872,932	159,607	
Concession fee	$2,141,860	$178,488	
Number people employed			
Owner/Manager	65	4	3%
Administration	59	3	3%
Camp Maintenance	308	17	16%
Safari operations	295	17	16%
Professional Hunters	82	5	4%
Skinners	59	3	3%
Trackers	138	8	7%
Law enforcement	449	28	26%
Seasonal/Casual staff	379	24	22%
Average Staff employed/company		**109**	
Approximate Asset Value (US$)	**$21,557,610**	**$1,347,351**	
Major Expense Items			
Central Government Licenses:	$415,700	$25,981	3%
ZNWMA Fees:	$1,932,472	$128,831	13%
Community Development:	$525,378	$35,025	4%
Law Enforcement:	$1,319,562	$87,971	9%
Staff wages & Welfare:	$3,601,439	$211,849	24%
Administrative costs:	$1,870,267	$116,892	13%
Operating expenses:	$3,986,619	$249,164	27%
Management and Marketing costs	$661,974	$41,373	4%
Any other costs	$411,693	$25,731	3%
Overall costs	**$14,725,104**	**$922,818**	
Hunter days generated over 3 years			
Lion	2,137	126	9%
Leopard	4,565	269	19%
Buffalo	10,344	608	43%
Elephant	3,131	184	13%
Plains game	999	59	4%
Total Hunter days	**25,294**	**1,405**	
Prey base status			
Large mammals (Buffalo, Giraffe)	28,190	2,014	
Medium mammals (Eland, zebra, kudu, waterbuck etc.)	53,273	3,552	
Small mammals (Bushbuck, warthog, impala)	82,297	5,878	
Status of lion population			
Number of prides	71	5	
Average pride size	80	7	

Companies (N=18)	Total	Average	
Number of cubs	243	19	
Number Coalition males	89	7	
Monitoring of lion population			
Natural deaths	4	1	
Reports of Human-Lion Conflict	33	5	
Incidents of infanticide recorded	6	2	

6.3 CAMPFIRE COMMUNITY PROGRAMMES

The right to exploit and benefit from wildlife was extended to communal areas through granting of Appropriate Authority Status over their wildlife resources to Rural District Councils in 1982. The intention was to return rights of access to natural resources through legislative change, devolve responsibility and economic empowerment. The CAMPFIRE model focuses on three main criteria:

- Voluntary interest in participation by communities and their Rural District Councils (RDCs),
- Presence of wildlife populations capable of producing sustainable and economically significant revenues.
- Benefit sharing for local communities based on:
    - The number of animals harvested within a local community's area each hunting season.
    - The extent of wildlife habitat present within a local community's area annually.

Currently 58 Rural Districts have been granted the Appropriate Authority status to manage wildlife resources in their areas, however only 16 are actively engaged in some form of wildlife based land use (see Figure 5).

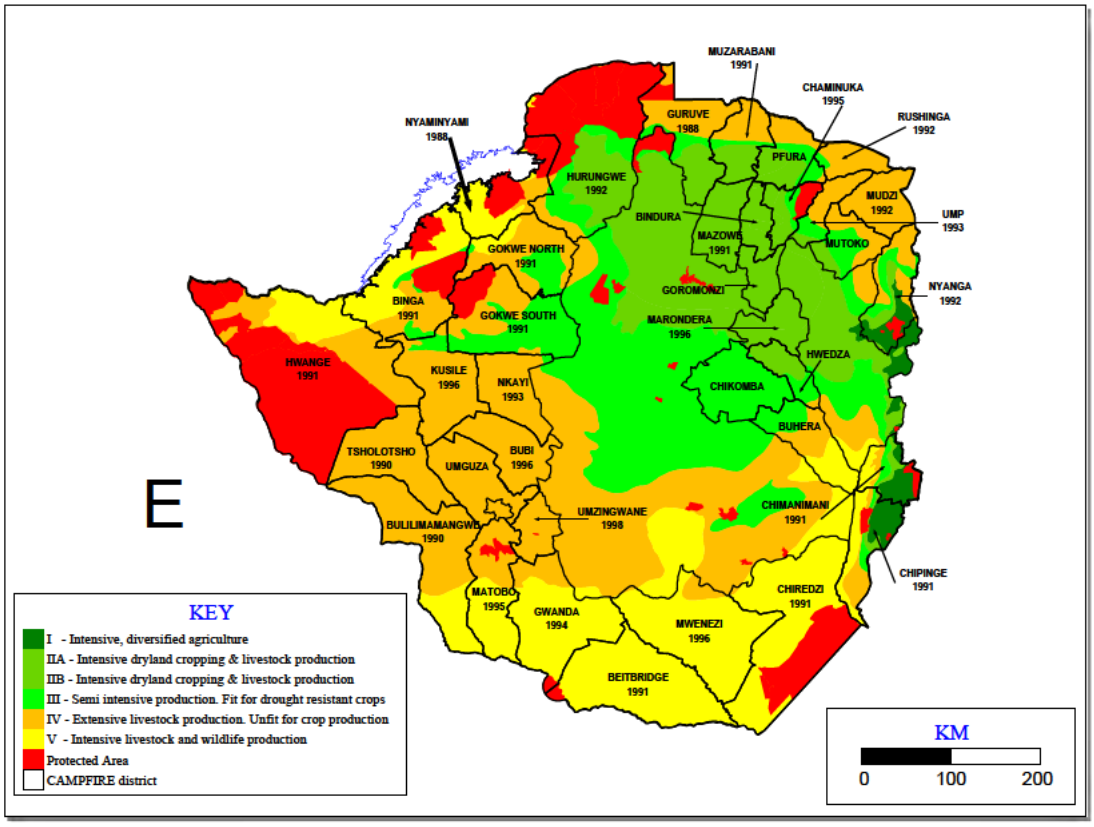


Figure 5: Map of Zimbabwe showing CAMPFIRE districts and year of establishment

The performance of ten key CAMPFIRE Districts is summarised below to illustrate the level of benefits that flow to RDCs, Wards and households, and the role that income from lion play in this process.

1. OVERALL QUOTA ALLOCATION, UTILISATION AND INCOME GENERATION FROM KEY SPECIES: All Districts: 2010 - 2015

	Elephant	Lion	Leopard	Buffalo	Hippo	Crocodile	Total
Quota	1,079	140	487	2050	602	471	
Offtake	655	45	193	908	270	305	
% Utilisation	61%	32%	40%	44%	45%	65%	
Total income N=6 years)	**$7,129,658**	**$240,000**	**$532,675**	**$2,263,150**	**$464,000**	**$441,903**	**$11,071,386**
Average/year	**$1,188,276**	**$40,000**	**$88,779**	**$377,192**	**$77,333**	**$73,651**	**$1,845,231**
Percentage	64%	2%	5%	20%	4%	4%	

The overall income generated over a 6-year period was US$11 million. An overall quota of 140 lions (average 23/year) were allocated to the CAMPFIRE programme over which 45 (32%) were utilised (8 per year). This generated US$240,000 or 2% of the overall income.

2. SOURCE OF CLIENTS AND GROSS INCOME TO SAFARI OPERATIONS:2010 - 2015

Origin of Clients	USA	Canada	South America	Europe	Asia	Middle East	Oceania	Africa	Total (N=6 years)
Total	**880**	**16**	**54**	**456**	**82**	**9**	**51**	**131**	**1679**
Percentage	51%	1%	3%	27%	5%	1%	3%	8%	
Total	**$8,624,059**	**$150,987**	**$543,003**	**$5,201,168**	**$550,062**	**$781,076**	**$394,208**	**$567,897**	**$16,812,459**
Average/year	**$1,462,508**	**$25,165**	**$90,500**	**$866,861**	**$91,677**	**$130,179**	**$65,701**	**$94,650**	**$2,802,077**
Percentage contribution	**51%**	**1%**	**3%**	**31%**	**3%**	**5%**	**2%**	**3%**	

Hunting clients from the USA are by far the most numerous (880 over 6 years) contributing 51% (or US$8.6 million) of the estimated US$16 million generated from hunting in CAMPFIRE areas from 2010 - 2015.

3. INCOME TO DISTRICTS: 2010 - 2015

	Hides (US$)	Trophy fees (US$)	Percentage of daily rate	Hunting concession fees	Photographic (lease fees/bed night levy)	Other (vehicle hire, grinding mill etc.)	Total	Average (N=6)
Total	$131,741	$10,618,127	$1,277,525	$862,721	$737,613	$731,218	$14,358,945	$2,393,158
Percentage	1%	74%	9%	6%	5%	5%		

The CAMPFIRE districts that benefit from hunting rely heavily on trophy fees (74%) as their primary source of income.

4. INCOME TO WARDS, VILLAGES AND HOUSEHOLDS: 2010 – 2015

Overall Income to CAMPFIRE Wards: 2010 - 2015						
	No Concessions	Area (ha)	Number Wards	Number Villages	Number Households	Gross Income
Total	**26**	**2,288,284**	**62**	**603**	**56,297**	**$5,946,370**
Income (n=6 YEARS)	**$228,706.55**	**$3**	**$95,909.20**	**$9,861.31**	**$105.6**	

Income generated at the District level is then disbursed to Wards. Since 2010, this is estimated to be approximately US$5.9 million. The available data shows that 62 wards representing 603 villages (or 56,297 households) received the equivalent of US$95,909/ward (or US$105/household).

These levels of income are not sufficient to make a significant impact at the individual level, and require that the Districts and Wards channel these revenues into activities that benefit the overall community. This is achieved through supporting several communal projects such as schools, clinics, water provisions etc.

5. DISTRICT EXPENDITURE AND COMMUNITY BENEFITS: 2010 - 2015

	Administration	Law Enforcement	Compensation	Management	Social Services	Other	Total
Total	**$2,486,268**	**$1,778,100**	**$67,600**	**$682,740**	**$1,084,779**	**$779,030**	**$6,878,517**
Average	**$414,378**	**$296,350**	**$11,267**	**$113,790**	**$180,796**	**$129,838**	**$1,146,420**
Overall costs	**$5,014,708**				**$1,084,77**	**$779,039**	
Percentage	**73%**				**16%**	**11%**	

At the District level, 73% of the revenues from hunting are channelled towards administration, law enforcement, compensation and general management while limited funds are used to support social services (16%).

6. WARD EXPENDITURE AND COMMUNITY BENEFITS

	Administration costs					Community Benefits				
	Meetings & Admin	Wages/salaries	Compensation schemes	Management activities	Project Management Costs	Social services	Food security	Direct cash benefits	Other	Total
Total	**$553,260**	**$815,639**	**$56,432**	**$312,178**	**$345,762**	**$2,468,216**	**$223,659**	**$216,077**	**$139,565**	**$5,302,709**
Overall costs	**$2,083,271**					**$2,907,952**			**$139,565**	
Percentage	**39%**					**55%**				

At the Ward level, where communities are directly involved, the tendency is to channel most the income towards community benefits (55%) rather than administration which is seen to be the responsibility of the local government. This means that the bulk of the income from hunting is used to support social services such as schools, clinics, irrigation schemes etc. where the impact at the community level (village, household) is far greater (Figure 6).



Figure 6: Bhemba Clinic in Ward 2 of the Tsholotsho Communal Area (top) and Masera Secondary School (Beitbridge, bottom) that are supported by funds generated through the CAMPFIRE programme

Lessons learnt

1. Quota utilisation of lion (32%) is low in CAMPFIRE areas, equating to 8 lion/year.

2. Trophy fees from key species (elephant, lion etc.) contributed $1,845,231/year to CAMPFIRE revenues:
    a. Elephant (64%) and buffalo (20%) are major contributors
    b. Lion and leopard contribute 7%

3. Income from the sale of safaris generate approximately $2,802,077/year
    a. Hunters from USA contribute 51% and Europe 31% of this income.

4. Income to Districts from a variety of wildlife related revenue streams is approximately $2,510,783/year:
    a. Trophy fees are responsible for 74% of this income, of which lion play a small role.
    b. Fees from photographic tourism are responsible for 5%.

5. Wards receive $5,830,244 (57%) from district trophy fees. These revenues are used to support a variety of social services that benefit a large proportion of the local community.

The cessation of import of lion (and elephant) trophies into the USA has had a significant impact on these revenue streams and consequently on the benefits reaching communities at the local level. These revenues cannot be replaced through alternative revenue streams.

7 Management and Administration of the Safari Hunting Industry in Zimbabwe

7.1 Performance of the industry

To fully account for earnings in the Hunting Sector, the Reserve Bank of Zimbabwe, in collaboration with all the relevant stakeholders, introduced the Tourism Receipts Accounting System (TRAS2) in January 2015. The TRAS2 is a web-based system which links Safari Operators, Zimbabwe Parks and Wildlife Management Authority, Taxidermists, Shipping Agents, International Marketing Agents and Reserve Bank for the purposes of authorizing hunts, capturing hunting data, monitoring hunting quota utilization and tracking hunted trophies.

On an annual basis, Exchange Control Division of the Reserve Bank of Zimbabwe attends the SCI Conventions to achieve the following objectives: -

1. To assess regional price differentials of same hunts at the SCI Convention and the reasons thereof;
2. To present Form TRAS2 systems updates to the users including international marketing agents;
3. To engage international marketing agents of sport-hunting (standardised international marketing agreements, payment arrangements and follow up on overdue export receipts);
4. To obtain relevant insights on governing of the hunting sector; and
5. To come up with an effective mechanism to fully account for export proceeds from the hunting sector.

7.1.1 Global earnings of the industry

The TRAS2 system was introduced in January 2014, and has since recorded a total of $44.6 million ($18.9 million in 2015 compared to $25.9 million in 2014) as shown in Figure 7. The figures are inclusive of daily rates, trophy fees and other incidental revenue. In line with other regional

countries offering safari hunting, the market is dominated by the USA (59%) and Europe (25%) with the remainder of the market taken by the Americas (Canada, Argentina etc.), Asia, Africa, Oceania and Africa (mostly South Africa). Appendix III illustrates the distribution of total hunting revenue by country of destination (Chitauro, 2016).

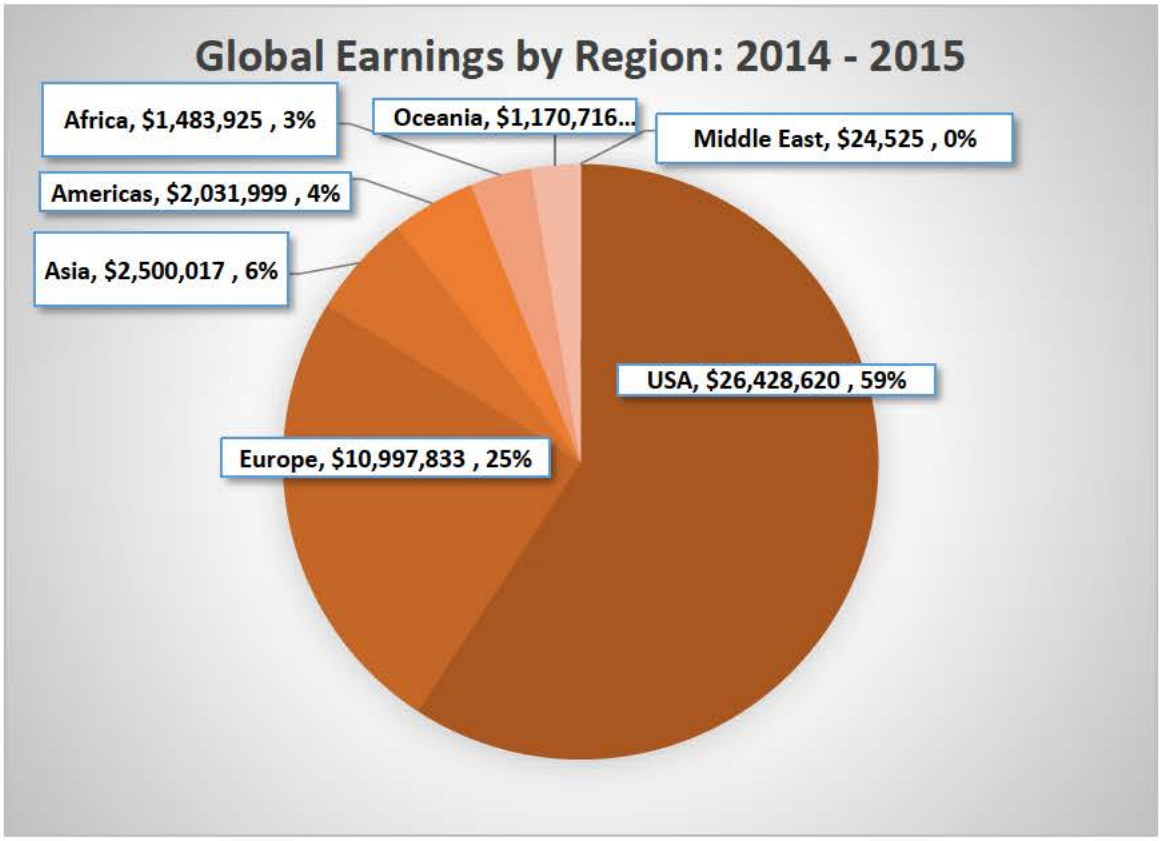


Figure 7: Breakdown of source of hunting income (2014 and 2015) from various regions in the world (adapted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2)

7.1.2 Quota allocation, Utilisation and Total Trophy Fees Earned

The total income from the sale of trophies in 2014 and 2015 is shown in Table 18. The income in 2015 (US$8.2 million) is less than that in 2014 (US$11.1 million) because of the import restrictions of elephant and lion into the USA.

Table 18 also provides data on the quotas allocated in 2015 and the number of level of utilisation. The complete list of species is provided in Appendix III (Chitauro, 2016). These data show that levels of utilisation for all species varies from 10 – 40% for most mammals and far less for birds etc.

Table 18: Summary of the revenue generated from the 11 most common species utilised for hunting, and the percentage utilisation in 2015 (adapted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2)

Species	2014	2015	Total	2015 Quota	Utilised	% Utilised
Buffalo	$2,528,559	$1,962,570	$4,491,129	1,635	482	29%
Elephant (Tusks)	$2,042,610	$1,447,090	$3,489,700	246	64	26%
Elephant (Tuskless)	$1,444,040	$229,860	$1,673,900	462	113	24%

Species	2014	2015	Total	2015 Quota	Utilised	% Utilised
Lion	**$630,950**	**$753,000**	**$1,383,950**	**82**	**49**	**59%**
Leopard	$714,100	$668,490	$1,382,590	530	151	28%
Zebra	$594,239	$555,744	$1,149,983	2,480	600	24%
Sable	$456,615	$309,260	$765,875	718	78	11%
Kudu	$341,092	$357,963	$699,055	2,503	289	12%
Waterbuck	$293,903	$256,133	$550,036	988	156	16%
Hippo	$310,321	$217,470	$527,791	303	83	27%
Impala	$277,198	$242,624	$519,822	8,594	1,261	15%
Other Species	$1,465,560	$1,287,845	$2,753,405			
Grand Total	**$11,099,187**	**$8,288,049**	**$19,387,236**			

7.1.3 Total trophy fees generated by land category

The ZPWMA allocated quotes to all owners and occupiers of land in terms of SI 26. Any person utilising wildlife on these properties is required to submit a TRAS2 form to process any export of trophies and other animal products. Approximately 262 companies/properties submitted returns in 2014 and 2015. From these data, it is possible to determine the income generated from trophy fees and daily rates per company. To protect the privacy of the individual companies, these data have been arranged to show the level of income generated by different land categories from trophy fees (Figure 8),

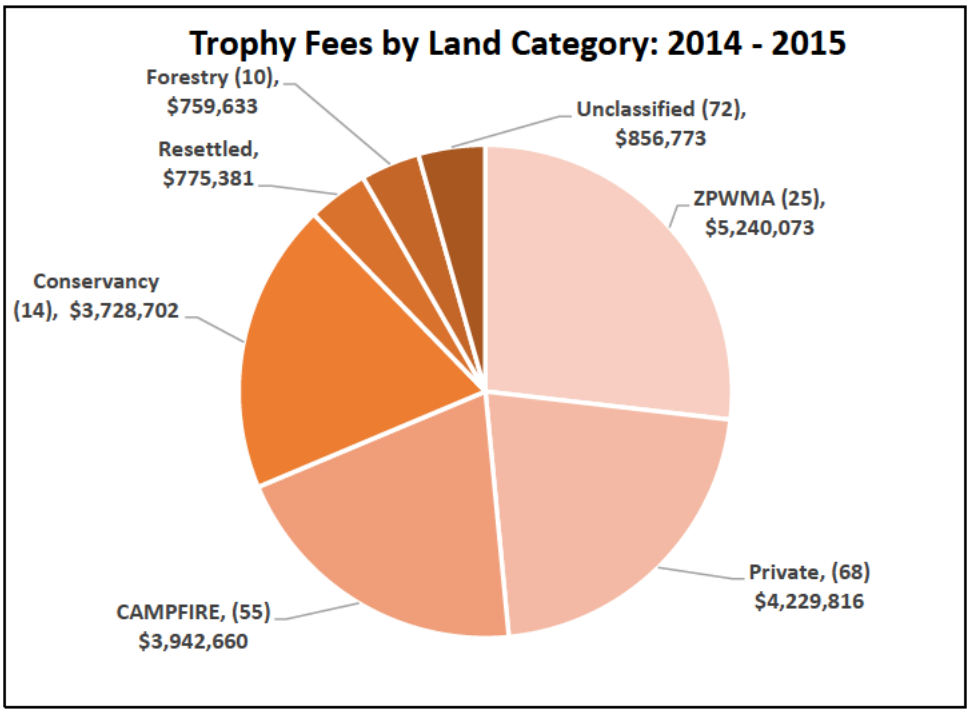


Figure 8: Hunting Trophy Fee Earnings by Land Categories (2014 - 2015). Note that from the description provided in the database, it was not possible to allocate some individual properties to a specific category. These have been recorded as unclassified (adapted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2).

Overall, approximately US$10.7 million was generated in 2014 and US$8.7 million in 2015 from the 62 species on offer. The ZPWMA represented by 25 properties that it either offers on tender to the private sector or operates as hunting areas itself generated the largest income from trophy fee sales

(US$5.2 million). The 14 Conservancies accounted for US$3.7 million while the 68 private properties are recorded as generating US$4.2 million. The CAMPFIRE areas (N=55) generated US$3.9 million.

Together with the income from daily rates (US$13,190,372 in 2014 and US$9,684,396 in 2015 (gross US$22,874,768), extracted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2), these funds are used to pay for several operational expenses including employment, law enforcement, administration and management.

7.5 Quota Setting Process

The process for quota setting follows procedures agreed to by all stakeholders (ZPWMA, 2014).

- Step 1: Allocate existing quota to each block/hunting area

The starting point for implementation of age-restrictions and adaptive quota management was to allocate existing lion quotas. This quota would then be managed adaptively in line with the age of lions hunted. In future, it is envisaged that fixed quotas for lions would fall away as quotas would be based on the age of lions hunted in the previous year.

- Step 2: Hunters complete and submit return forms and photos after each lion hunt

The data would be compiled into a database by a ZPWMA representative (currently Ms Roseline Mandisodza-Chikerema, Senior Ecologist, ZPWMA). Export permits for trophies will not be issued unless completed hunt return forms (all the required photographs and the first upper premolar) is provided to ZPWMA for aging and monitoring purposes. Furthermore, because the following year's quotas will be based on the ages of the lions hunted in the current year, operators must submit their lion hunt returns and photographs soon after the hunt. At the end of the season, all the teeth would be taken to a dentist to have x-rays conducted to allow for measurement of the size of the pulp cavity.

- Step 3: ZPWMA and Panel of experts assign an age value to each lion trophy

Lion trophies will be aged by ZPWMA, with input from lion scientists and representatives from the hunting industry at a trophy aging session. This is conducted at the end of each hunting season.

- Step 4: Calculate the next years' quotas based on a points system for the ages of lions hunted

A quota setting meeting is held where lion quotas are established for each area based on the age of lions hunted in those areas the year before. This programme commenced in 2014, and so the ages of lions hunted in 2014 will affect the lion quotas in 2015. Table 19 summaries the trend in lion quota allocations since 2002 while Table 12 provides a detailed overview of the lion trophies taken in 2015.

Table 19: Summary of lion quota allocations and offtake since 2002 (Data provided by ZPWMA)

Year	Lion Allocated Quotas	Female Offtake	Male Offtake	% Utilisation
2002	126	22	49	56%
2003	138	5	11	6%
2004	155	4	9	8%
2005	108	3	20	21%
2006	124	1	17	14%

Year	Lion Allocated Quotas	Female Offtake	Male Offtake	% Utilisation
2007	117	0	9	7%
2008	90	0	17	18%
2009	111	0	9	8%
2010	98	12	30	43%
2011	121	20	38	48%
2012	101	18	27	44%
2013	101	1	34	34%
2014	101	0	37	26%
2015	82	0	49	60%
2016	81	0	33	41%

Table 20: Analysis of lion trophies taken on various properties in 2015

Hunting Area Name	Sex	Killed Wounded	Grid Ref	Date Shot	Trophy Size
Sapi Area	M	KILLED	35l0783	03/06/2015	
Matetsi Safari Area - Unit 3	M	KILLED	307551	05/04/2015	61.31
Antoinette & Antoinette Extension	M	KILLED	187159	02/07/2015	26 7/16"
Tsholotsho District Area 2-South	M	KILLED	S1926181 E02652250	27/10/2015	25 6/8 inches
Hurungwe Safari Area - Rifa	M	KILLED	35K178113	10/05/2015	24.5
Deka Tail	M	KILLED	651 480	10/04/2015	60.38 cm
Hurungwe Safari Area - Nyakasanga	M	KILLED	s15.56.457 e029.15.584	07/06/2015	26
Msaise	M	KILLED	VN204700	14/05/2015	23
Mapari	M	KILLED	VN798124	09/06/2015	23SCI
Ngamo/Sikumi	M	KILLED	456923	09/05/2015	
Deka Safari Area	M	KILLED	278493	26/06/2015	61.5
Mbire (Guruve) South Area 2	M	KILLED	919056	09/08/2015	25.3
Bubye Valley Conservancy	M	KILLED	0194090 7625410	21/02/2015	25"
Bubye Valley Conservancy	M	KILLED	9337	29/03/2015	26"
Bubye Valley Conservancy	M	KILLED	31129	07/04/2015	25
Woodlands Farm	M	KILLED	644972	22/05/2015	25"
Bubye Valley Conservancy	M	KILLED	35K 453 159	10/05/2015	23.625
Bubye Valley Conservancy	M	KILLED	36K 908 852	25/04/2015	25"
Chewore Safari Area - North	M	KILLED	TT015643	05/06/2015	25
Bubye Valley Conservancy	M	KILLED	36K 227 593	12/05/2015	26"
Matetsi Safari Area - Unit 4	M	KILLED	4.05E+12	09/06/2015	24
Matetsi Safari Area - Unit 5	M	KILLED	865505	09/06/2015	25.25
Gunundwe	M	KILLED	822094	11/06/2015	
Bubye Valley Conservancy	M	KILLED	36K 004 971	24/06/2015	25.5625

Hunting Area Name	Sex	Killed Wounded	Grid Ref	Date Shot	Trophy Size
Bubye Valley Conservancy	M	KILLED	942 151	25/06/2015	12
Kusile District Area 1	M	KILLED	S185604.9 E0271547.4	02/07/2015	
Mokore Ranch	M	KILLED	VN110030	15/07/2015	15"
Bubye Valley Conservancy	M	KILLED	36K 229 607	29/07/2015	26"
Bubye Valley Conservancy	M	KILLED	191 623	25/07/2015	27.0625
Nyaminyami District Area 2 (Omay)	M	KILLED	657019PM	18/07/2015	24 1/8"
Matetsi Safari Area - Unit 5	M	KILLED	862 451	15/07/2015	25 8/16 inches
Matendere	M	KILLED	781021	26/07/2015	23.875
Matetsi Safari Area - Unit 1	M	KILLED	740726	13/08/2015	25
Bubye Valley Conservancy	M	KILLED	213 602	15/08/2015	15
Sango	M	KILLED	62691	23/08/2015	23.125
Sango	M	KILLED	320548	27/08/2015	
Dande Safari Area	M	KILLED	945352	13/10/2015	24in
Hurungwe Safari Area - Rifa	M	KILLED	35k062038	30/09/2015	25.25
Bedford	M	KILLED	190429	06/09/2015	
Ngamo/Sikumi	M	KILLED	456919	07/09/2015	
Bubye Valley Conservancy	M	KILLED	206 622	23/09/2015	26"
Hammond	M	KILLED	35k880103	17/10/2015	23.375
Kazuma/Panda Masuei	M	KILLED	s18.44144 & E025.64434	09/10/2015	
Nyaminyami District Area 1 (Omay)	M	KILLED	PM453354	13/11/2015	26"
Chewore Safari Area - South	M	KILLED	ST967260	25/10/2015	
Riverside Ranch	M	KILLED	35k227702	31/10/2015	24.78
Matetsi Safari Area - Unit 6	M	KILLED	18.06.55.68.25.22	03/12/2015	
Chewore Safari Area - South	M	KILLED	QN975310	06/12/2015	
Sapi Area	M	KILLED	Mtawatawa	11/06/2015	24"

7.6 POINTS SYSTEM FOR ADAPTIVELY MANAGING LION QUOTAS IN ZIMBABWE

The points system used to adaptively manage lion quotas has been developed following similar systems that have been implemented in Tanzania and northern Mozambique. The systems that are in place in Tanzania and Niassa differ slightly, but both lion quotas are set per the age of the lions harvested during the previous hunting season (Begg and Begg, 2008; Tanzania Wildlife Division 2013). The Tanzanian system is more punitive with significant quota reductions, trophy confiscation and fines for non-compliance, whereas the Niassa system is more accommodating but nevertheless can result in quota reductions if five-year-old lions are hunted. The latter was aimed at a means of accommodating the difficulty of telling five-year-old lions apart from four year olds.

After reviewing the Tanzanian and Mozambican age restriction systems and debating possible models for application in Zimbabwe, an adaptive quota management system for lion hunting based on the ages of lions hunted was agreed on in July 2013 in Harare, Zimbabwe, during a meeting hosted

by the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) and an independent non-governmental conservation organisation. The approach adopted by Zimbabwe recognises four as opposed to three key age categories (Table 21).

Table 21. Proposed points system for lion age restrictions and quota setting in Zimbabwe

	≥6 years	**No trophy**	**5 years' old**	**4 years' old**	**<4 years**	**Failure to submit hunt return/incomplete hunt returns**
For quotas of 3/more	4	3	3	2	-3	0
For quotas of 2	4	3	3	2	0	0
For quotas of 1	6	3	3	2	0	0
Quota setting process	These points are added up and divided by 3 to yield the quota for next year					

During 2013, operators were requested to submit hunt returns and photos as a trial run to get the system up and running. In 2014 operators were requested to do the same but were informed that the age of the lions hunted in 2014 would determine their lion quotas in 2015. The 2015 lion hunt results would thus also determine the 2016 quota. The key distinction of the Zimbabwean system is that the quota will not be affected if they hunt animals that are five years old. This position was adopted after considering various the population models that suggested that the hunting animals of five years of age or older is predicted to be comparatively safe from a population perspective (Whitman et al. 2007). Moreover, after reviewing aging techniques, the consensus was that professional hunters could be distinguish between lions that are five or above. The system therefore rewards operators with increased quotas if they hunt animals of six years and older, but it does not penalize them if they hunt animals of five years. Neither are they penalised if they do not shoot a lion that they have on quota, however, the quotas will be reduced if they hunt animals younger than five years or if they failed to complete hunt returns.

Lions are aged by triangulating multiple different aging characteristics, including:

- The degree of facial scarring;
- The teeth colour and degree of wear;
- The mane development (particularly regarding the shape around the ear and the mohawk);
- Through post mortem analysis of the width of the pulp cavity of the second premolar (which becomes narrower with age).

7.6.1 Results of the Adaptive Lion Quota Management System: 2013 to 2016

In 2013, only 28% of the lions hunted were 5 years or older, in 2014 that figure had risen to 49% and in 2015 to 77.3% (Figure 5). The proportion of lions hunted that were less than 5 years of age dropped overall between 2013 and 2015 (Figure 9).

In 2015 the Zimbabwe national lion hunting quota was set at 82 lions. Of this 82, only 49 were hunted in 2015, and based on the resultant score from aging the trophies, and the fact that operators chose not to hunt lions of inadequate age (see Figures 9, 10 and 11), the recommended quota for 2016 was set at 81. In 2015 there was a marked increase in the age of lions hunted. Notably, only one lion of <4 years of age was hunted and the large majority of lions were 5 years or older (Figure 9).

As was agreed upon at the 2013 lion management meeting in Harare, the CAMPFIRE areas in which lions occur are currently exempted from the age restrictions. This approach was adopted as a means of ensuring that impoverished communities obtain the opportunity to benefit from the presence of lions, recognising the potential negative impacts the species has on the livelihoods of livestock farmers.

Using these figures and estimating the average value of a lion safari at approximately US$ 80,000 then a 50% offtake would generate approximately US$ 2,800,000 annually. If management costs are approximately $150 km^2, then the lion safaris alone can support 18,600 km^2 of wildlife habitat in Zimbabwe.

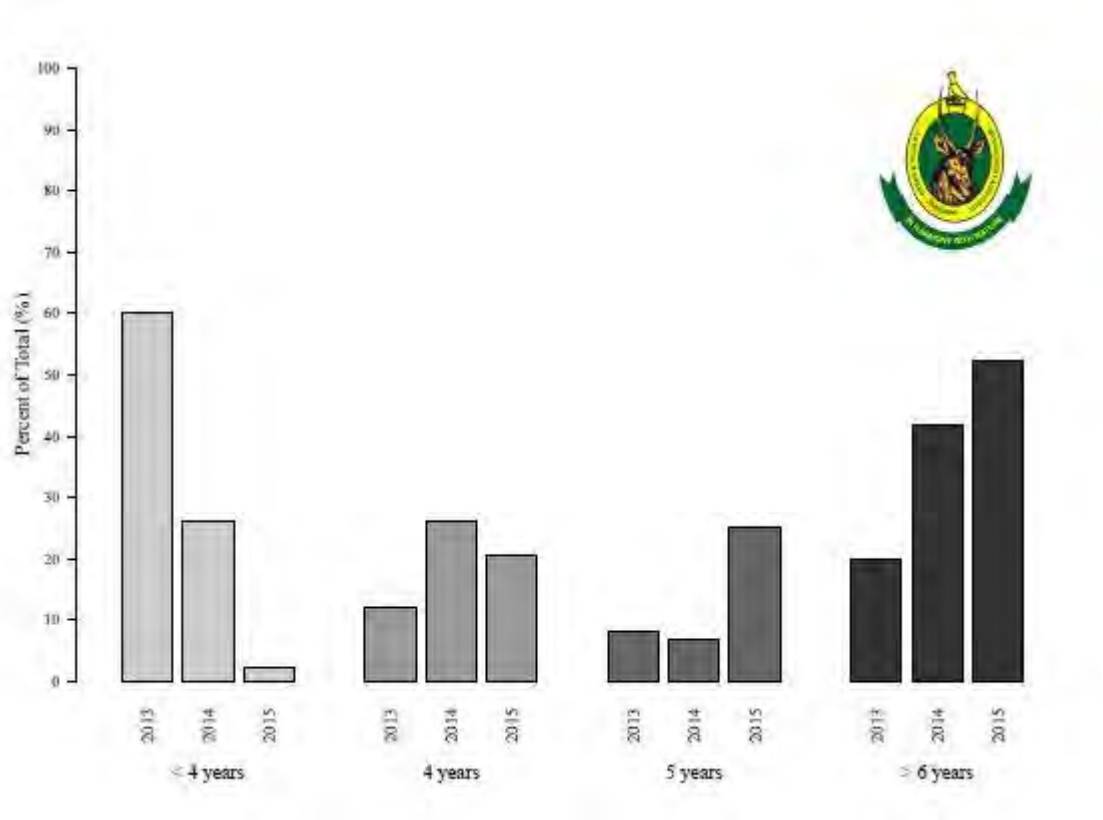


Figure 9: The percentage of lions hunted in each age class in 2013, 2014 and 2015 in Zimbabwe.

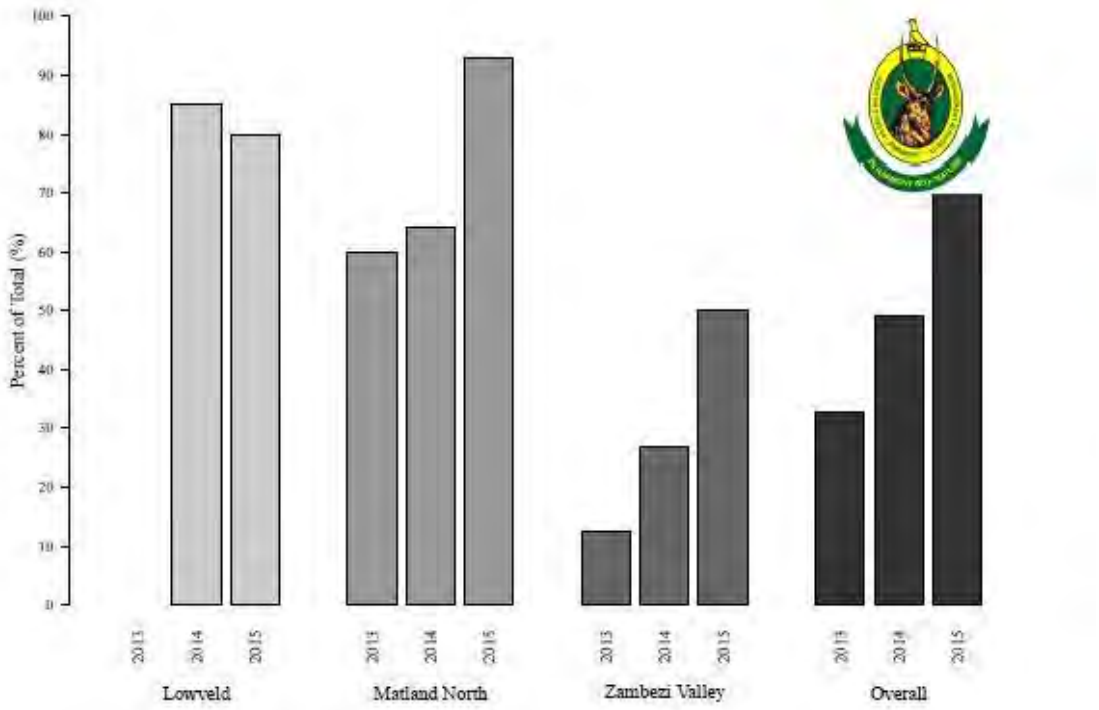


Figure 10: The proportion of lions hunted that were 5 years or older in the three main lion-hunting areas of Zimbabwe.

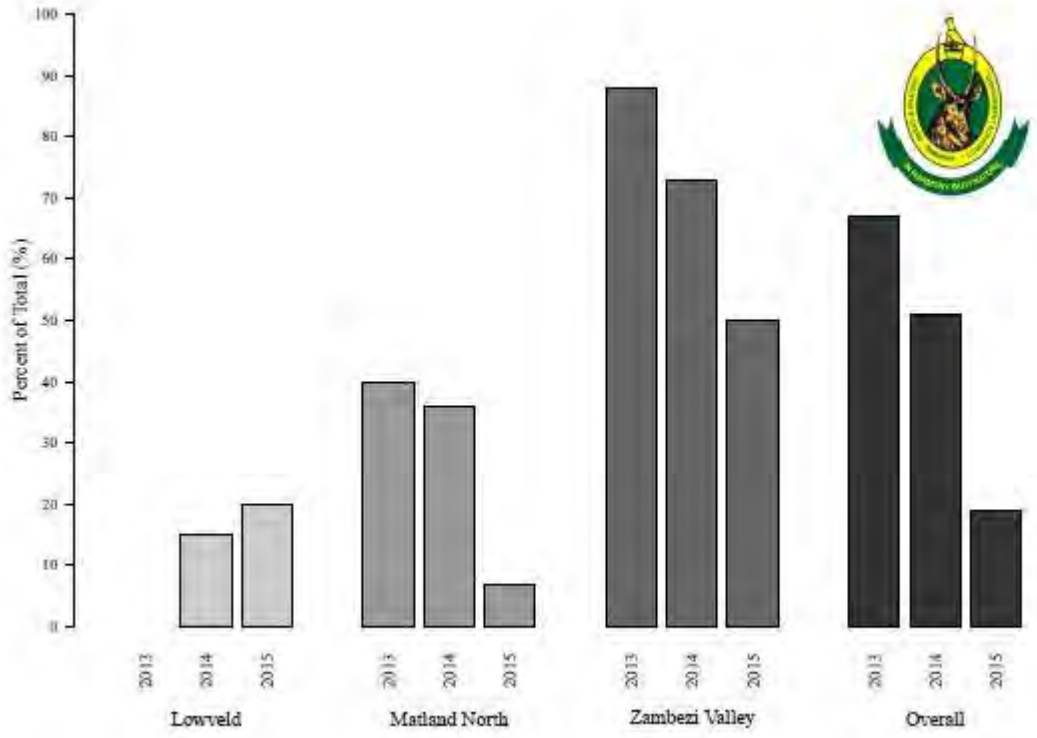


Figure 11: The proportion of lions hunted that were less than 5 years of age in the three main lion-hunting areas of Zimbabwe.

7.6.2 Case study: Safari Hunting surrounding Hwange National Park

The Hwange National Park is surrounded by hunting areas that fall under the Authority, Forestry Land, Private Land and Communal Land. The ZPWMA is responsible for setting and administrating quotas in conjunction with stakeholders for the safari areas, forestry areas, communal lands and private properties.

The Matetsi Safari Area to the north of Hwange National Park was established in the 1970s when several unsuccessful private sector mixed faming properties were expropriated, compensated and the resultant block of land turned over to safari hunting – a largely untried venture at that time on a large scale. An intensive monitoring system was set in place to gauge the effectiveness of the scheme and this continues to this day (Crossmary et al. 2013, Figure 12). The seven concessions (six given over to safari hunting) are leased on five year terms and concessionaires pay a 5 year "right to lease" fee, an annual rental, a fixed quota fee (payable if animals are shot or not) and a supplementary quota fee which allows additional animals to be bought as per need.

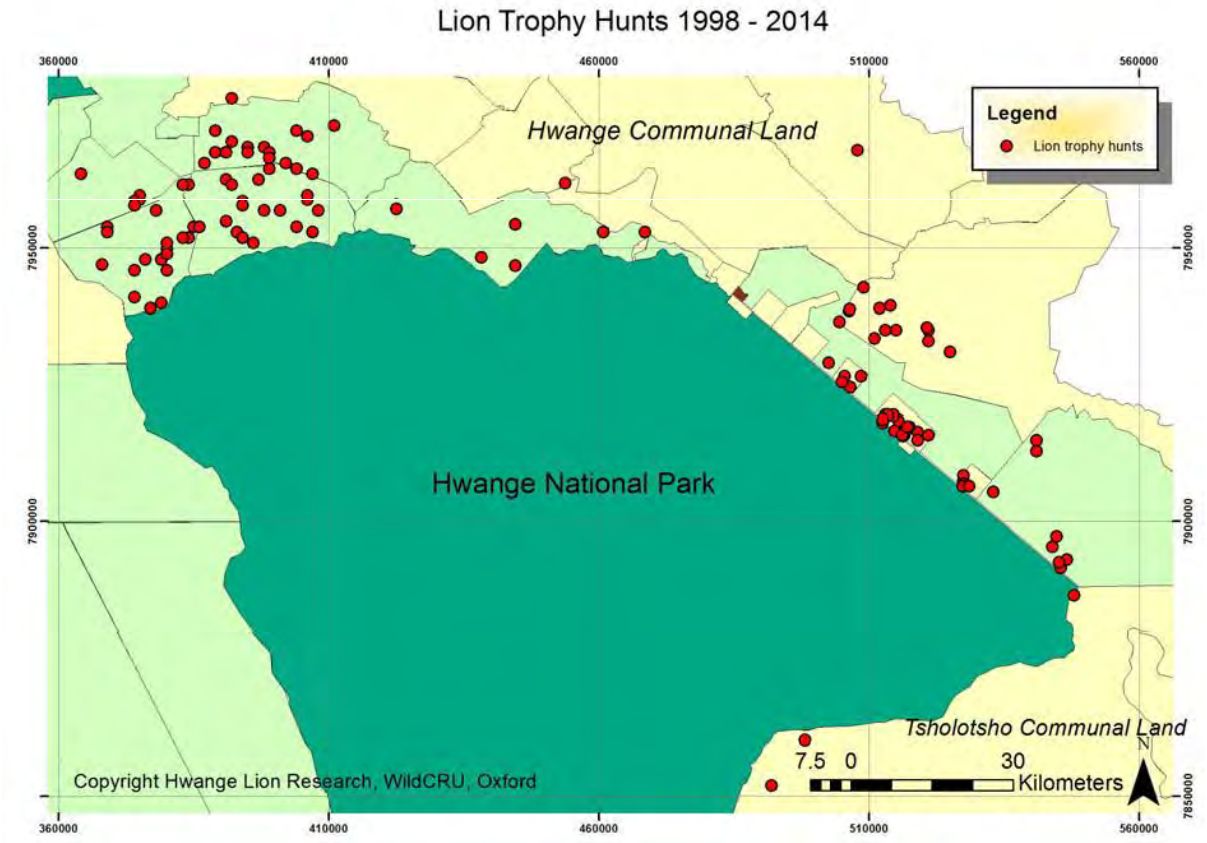


Figure 12: Record of where lion have been hunted on the land surrounding the Hwange National Park since 1998 (data extracted from the Hwange National Park Management Plan).

8 THREATS AND MITIGATION

The consensus of the scientific and animal welfare community is that the populations of lion in Africa has declined by 43% in the last two decades, with the greatest declines having occurred in west Africa. The exception to this are the populations of southern Africa, notably South Africa, Namibia, Botswana and Zimbabwe that are home to 24- 33% of the overall population has increased (Funston et. al. 2016).

Nonetheless, as is the case in other range states, the greatest threats to lion in Zimbabwe are from habitat loss, snaring and retaliatory killings where livestock are involved.

8.1 HUMAN-LION CONFLICT

The main source of illegal killing of lions is a result of Human-Lion conflict. The human population of Zimbabwe has increased since 1960 (estimated at 13 million). There is considerable pressure to convert land to agro-pastoral production, and the pressure is expected to increase. It is not unexpected therefore that the incidence of Human-Lion conflict will increase. ZPWMA records show that 200 attacks occurred on humans and 150+ on livestock (cattle, goats, sheep, dogs etc.) were killed in 2015 (see Table 13 above).

Retaliation for these livestock losses is usually done poisoning or hunting. The exact number of lions killed in this way is difficult to assess, but may number over 50/year. These indiscriminate killings pose the most significant threat to the species, and is of major concern to the management authorities. For example, the Area Manager for Hwange National Parks reported that 6 lions were killed on the Hwange National Parks boundary in 2016, and the Authority responded to several problem animal attacks on livestock.

In accordance with the Parks and Wildlife Act of 2001 when a lion attacks a human or kills livestock, it shall be eliminated. However, despite the numerous incidents reported across the country, less than 10 lions are killed through official "problem animal control" (PAC).

8.2 HABITAT LOSS

Zimbabwe supports substantial populations of lions outside of its protected areas and extensive conservancies. Moreover, despite its expanding human population, many of the protected areas are still intact however, the threat to lions from habitat loss exists in the Sebungwe and the South East Low Veld where the fragmented nature of the protected areas is compounded by an increasing human and livestock populations surrounding these areas. In these areas, habitat loss, reduction in prey populations and killing of problem lions are the major threats to long term lion survival.

Due to the large size of the protected area system in the Zambezi Valley and North West Matabeleland, threats are limited to lion range which extends into adjacent settled areas. The huge natural prey base in these protected areas, reduced killing of problem animals associated with lions preying on livestock in adjacent settled areas.

The potential and real loss of habitat and the fragmentation of range and conflicts with people in the absence of effective incentive mechanisms to maintain such habitat is probably the second greatest threat to lions after retaliatory killings. Increasing livestock numbers is reducing the available habitat in buffer areas adjacent to the protected areas, and increasing the incidents of human-lion conflicts. Lions are being more and more regarded as a liability and economic cost to rural communities. Reversing this trend is difficult under normal circumstances, and this has been made that much more difficult with the cessation of lion hunting. Integrating income from lions into rural economies, and demonstrating that lions contribute to the welfare and development of people is regarded as one strategy to mitigate against this. The involvement and empowerment of rural people in natural resource management through the CAMPFIRE programme that strives to provide economic and financial incentives through sustainable use, is one of the main driving forces behind changes in attitudes towards wildlife in communities where lion-livestock conflicts occur.

8.3 ILLEGAL TRADE IN LION PRODUCTS

Very few lions are poached in Zimbabwe (not to be confused with retaliatory killings). Records, mainly from anti-poaching reports, are for impoundment of body derivatives such as skins, teeth/claws, body

fats and bones. These may be sought after for local traditional medicinal use. Poaching mainly occurs along the boundaries of the protected areas where lions are incidentally snared as non-target prey.

The illegal trade in lions and their products (i.e. bone trade) is very insignificant. There are no records of people found in possession of illegally acquired lion specimens in Zimbabwe, and anyone found in possession of illegally acquired lion specimens is required to pay a fine US$5000 or faces a mandatory jail sentence. On conviction for lion poaching, courts may ask the accused to pay a compensation fee of US$20 000.

8.4 BUSHMEAT POACHING

Poaching for bushmeat is an important livelihood component of rural communities in Zimbabwe and a vast literature exists on this subject (see Lindsey et. al. 2015a and 2015b). Poverty stands as the major driver of illegal hunting, and the livelihoods of illegal hunters have been augmented considerably through revenue generated from bushmeat sales. Illegal hunters use bushmeat both for supplementing household protein and for economic gain.

Poaching for bushmeat does not seem to have impacted directly the overall lion's status in Zimbabwe, but more research is needed to fully understand its impact on lion. However, lions are often inadvertently caught in snares set for animals targeted by bushmeat poachers. Where possible, lions caught in snares are captured and treated (Figure 13).





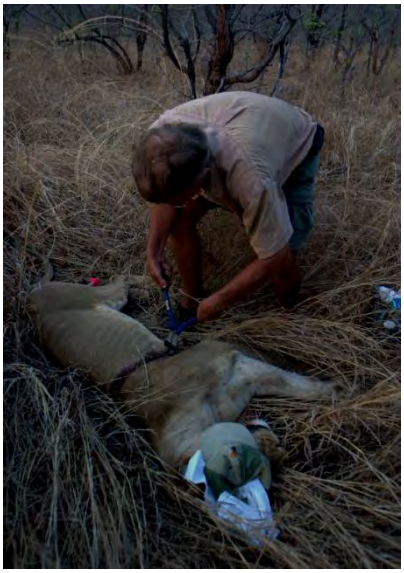




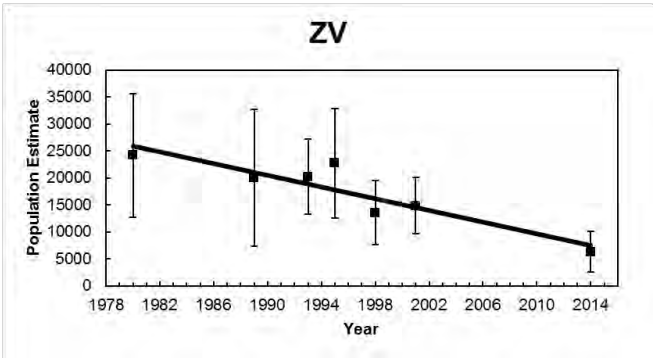
Figure 13: Young lioness being treated by the Victoria Falls Conservation Trust after a snare was removed from around the chest (Source: S. Edwards)

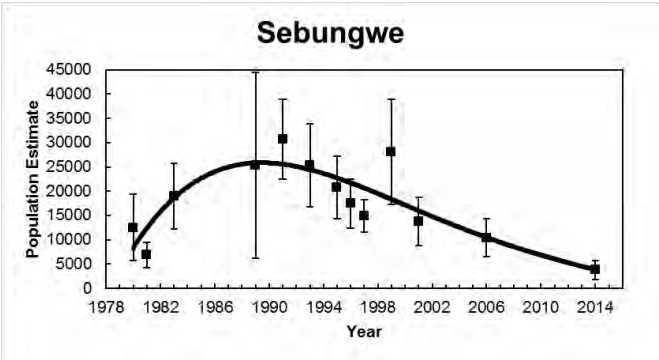
8.5 PREY ABUNDANCE

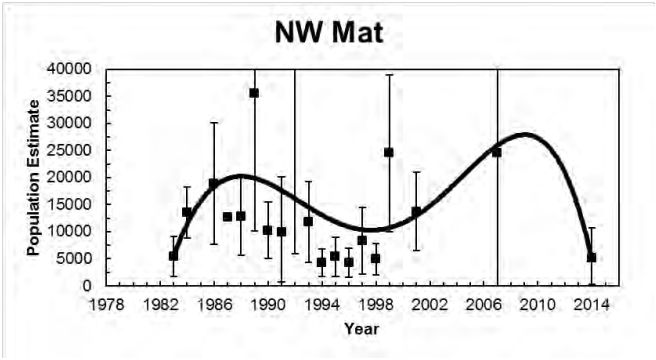
The extent to which bushmeat poaching outside of the Parks Estate is depleting lion's prey is not known. Prey abundance is still high in all protected areas where lions occur, and as abundance of prey species is highly correlated with lion density (Hayward et al 2007), data on the main prey species for lion, extracted from the 2014 aerial surveys of elephants and other large herbivores (Dunham et. al., 2015, 2015a, b, c, d) are shown in below (ZV = Zambezi Valley, NW Mat = North West Matabeleland).

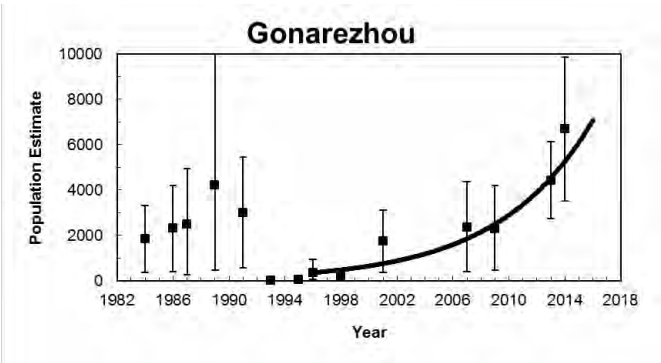
The overall long term trends show that most population status of most prey species has declined in recent years. There are many possible explanations for these declines, but probably the most critical factor has been droughts, especially that experienced in 2005.

Buffalo

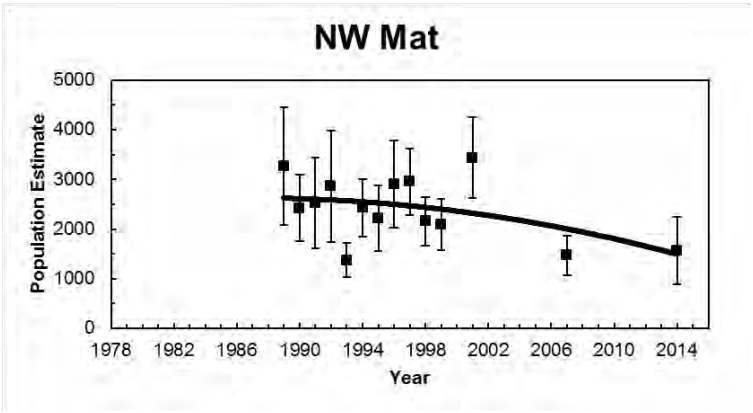

ZV
Population Estimate
40000
35000
30000
25000
20000
15000
10000
5000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

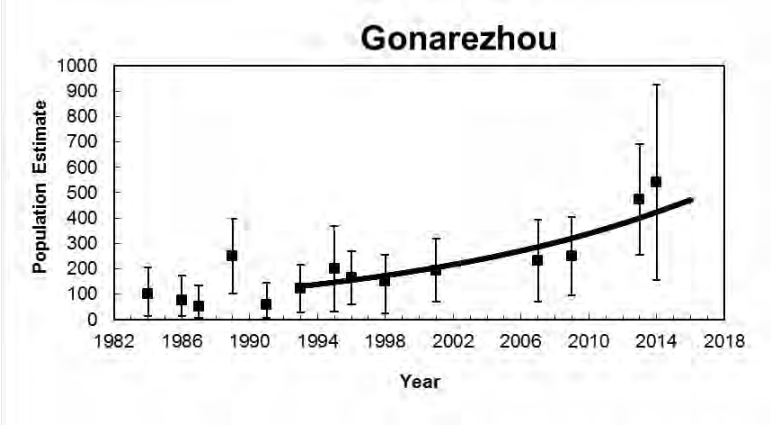

Sebungwe
Population Estimate
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


NW Mat
Population Estimate
40000
35000
30000
25000
20000
15000
10000
5000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

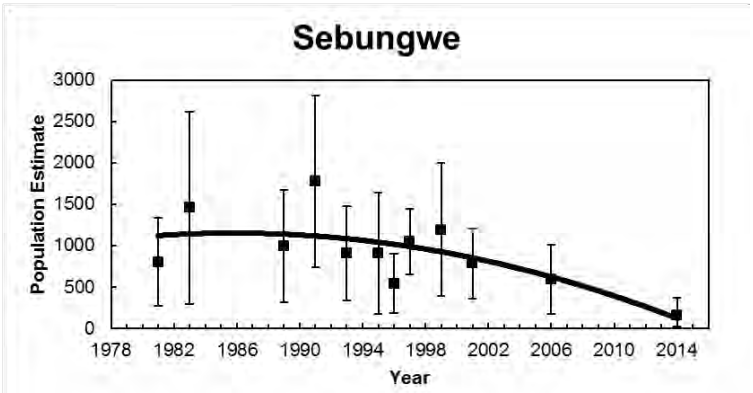

Gonarezhou
Population Estimate
10000
8000
6000
4000
2000
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

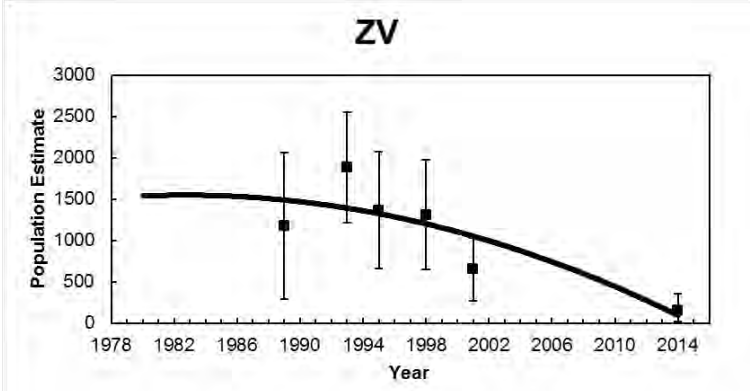
Giraffe

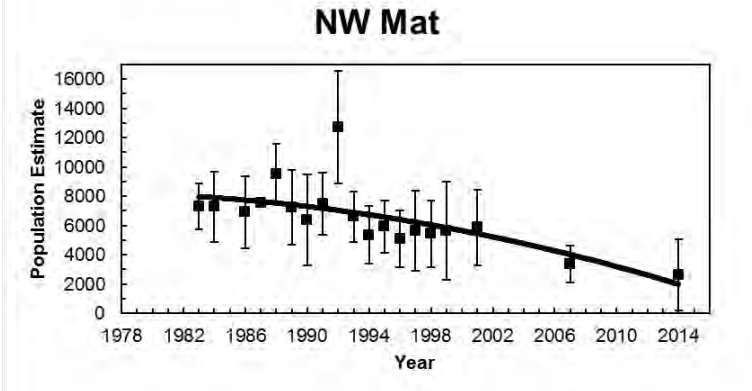

NW Mat
Population Estimate
5000
4000
3000
2000
1000
0
1978
1982
1986
1990
1994
1998
2002
2006
2010
2014
Year

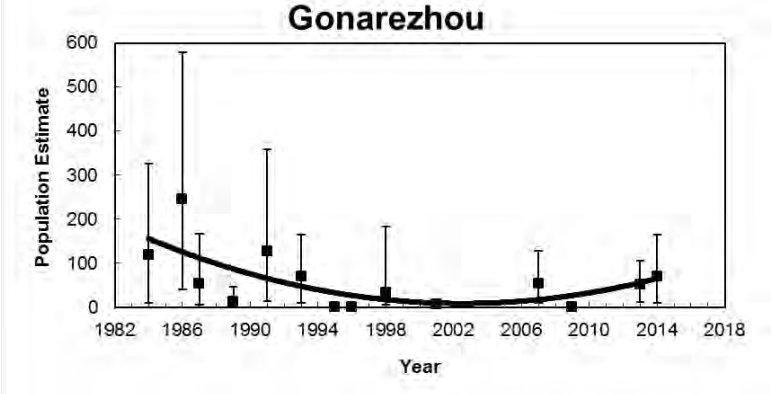

Gonarezhou
Population Estimate
1000
900
800
700
600
500
400
300
200
100
0
1982
1986
1990
1994
1998
2002
2006
2010
2014
2018
Year

Sable

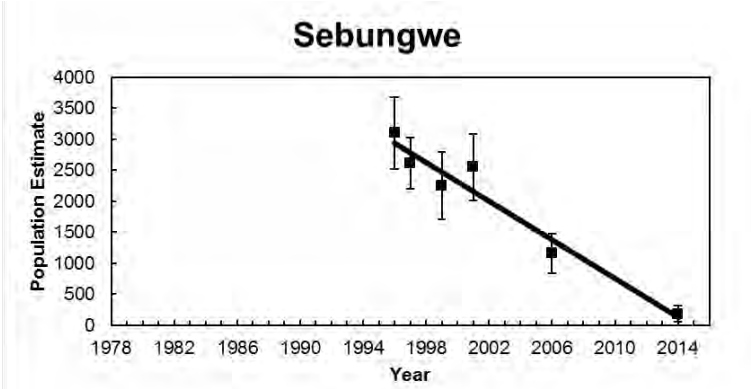

Sebungwe
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

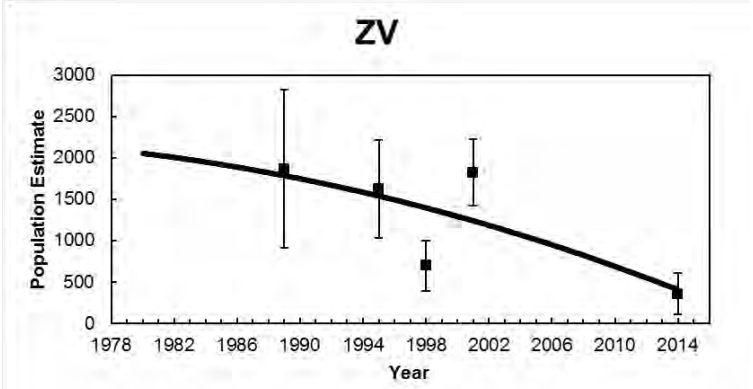

ZV
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

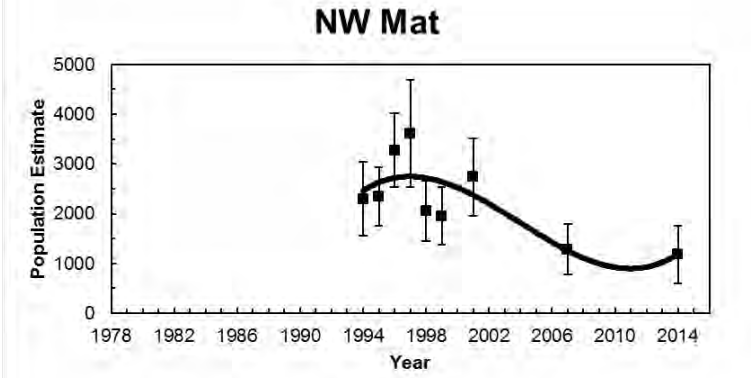

NW Mat
Population Estimate
16000
14000
12000
10000
8000
6000
4000
2000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

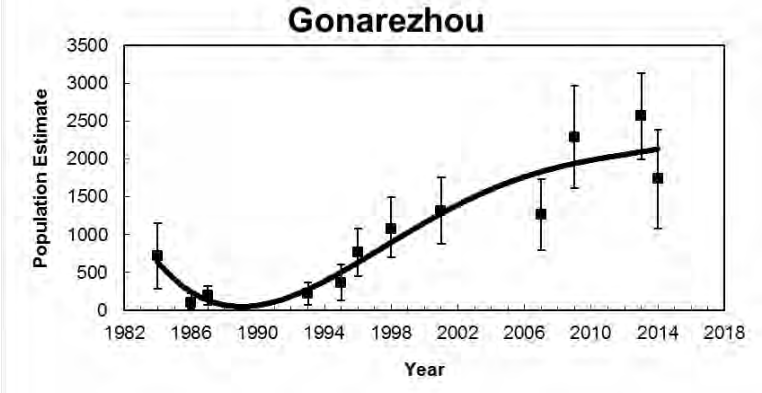

Gonarezhou
Population Estimate
600
500
400
300
200
100
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

Kudu

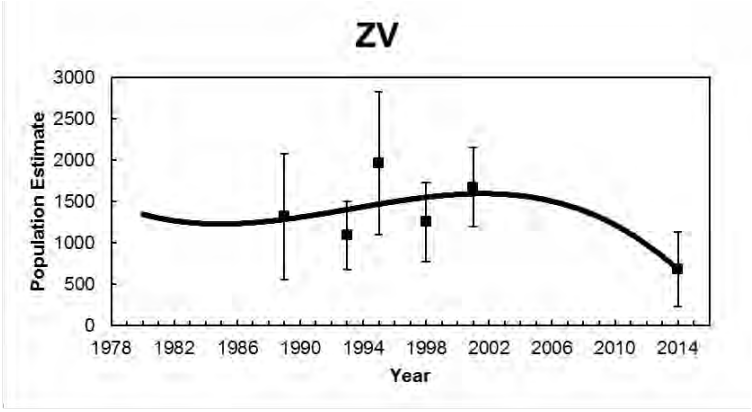

Sebungwe
Population Estimate
4000
3500
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

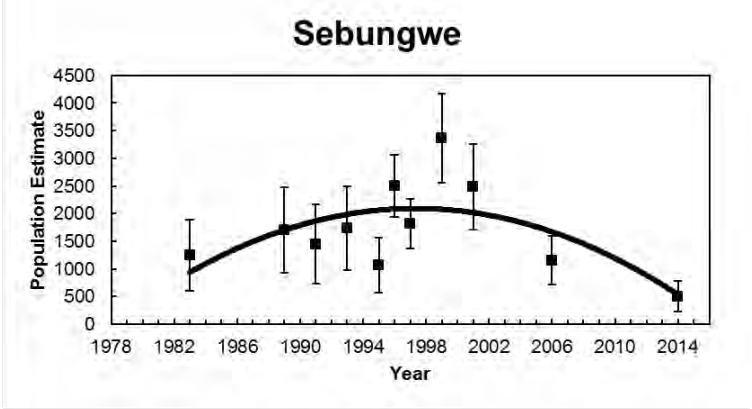

ZV
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

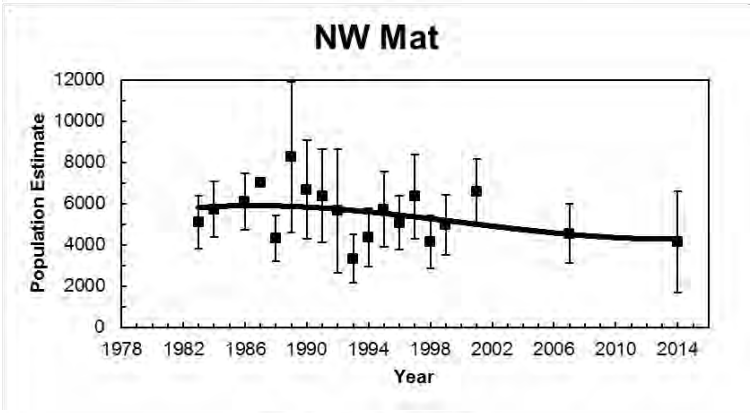

NW Mat
Population Estimate
5000
4000
3000
2000
1000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

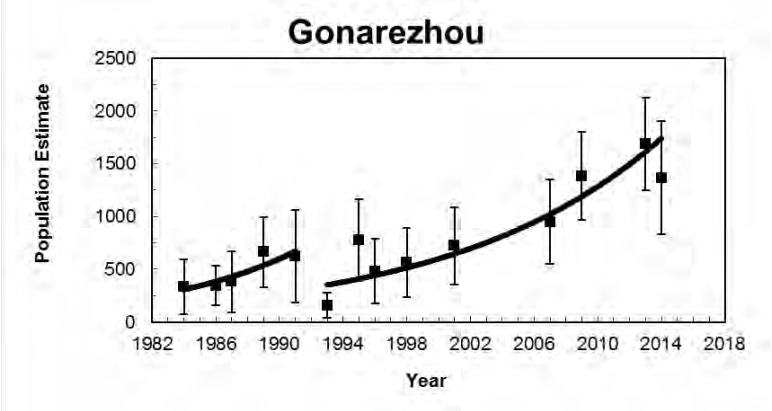

Gonarezhou
Population Estimate
3500
3000
2500
2000
1500
1000
500
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

Zebra

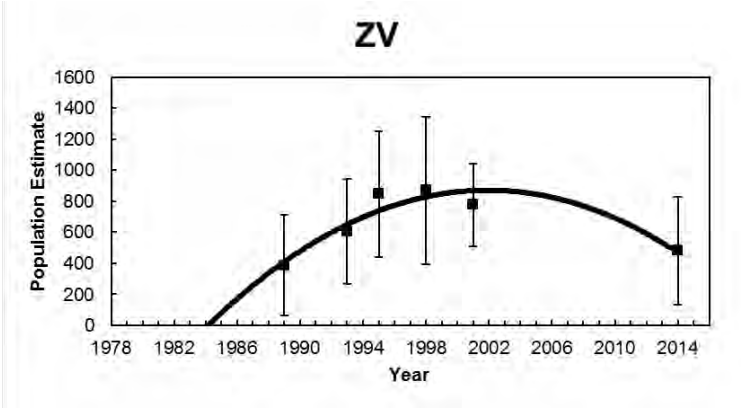

ZV
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

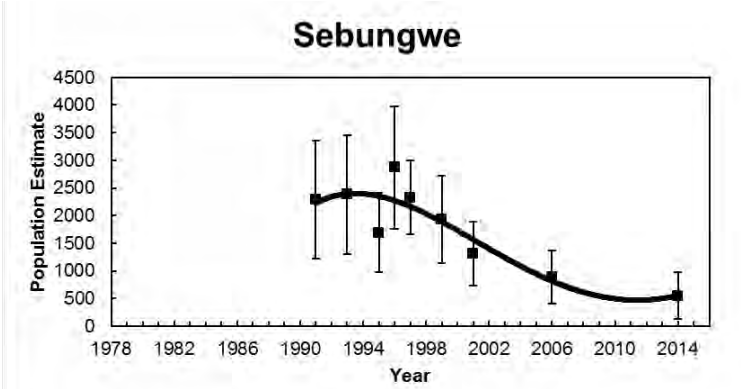

Sebungwe
Population Estimate
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

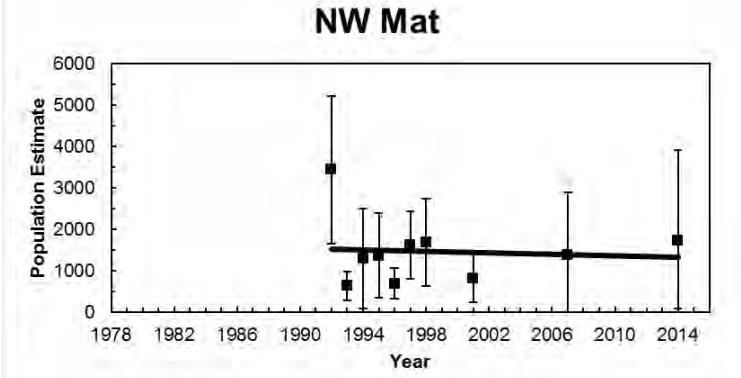

NW Mat
Population Estimate
12000
10000
8000
6000
4000
2000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

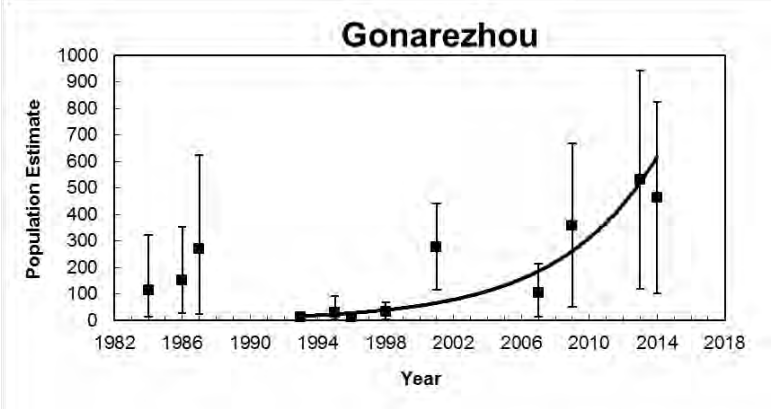

Gonarezhou
Population Estimate
2500
2000
1500
1000
500
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

Waterbuck


ZV
Population Estimate
1600
1400
1200
1000
800
600
400
200
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


Sebungwe
Population Estimate
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


NW Mat
Population Estimate
6000
5000
4000
3000
2000
1000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


Gonarezhou
Population Estimate
1000
900
800
700
600
500
400
300
200
100
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

9 ASSESSMENT OF THE ENHANCEMENT AND NON-DETRIMENT FINDINGS

The assessment of the enhancement and non-detrimental findings for lion in Zimbabwe is presented here using the "IUCN SSC GUIDING PRINCIPLES ON TROPHY HUNTING AS A TOOL FOR CREATING CONSERVATION INCENTIVES. VER. 1.0. IUCN SSC (2012)" as a guide. Zimbabwe recognises the importance of these principles to guide and manage trophy hunting as a legal, regulated conservation activity which provides a critical tool to secure a sound social, economic and ecological conservation scenario.

Biological Sustainability: Trophy hunting can serve as a conservation tool when it:

	Principle	**Remarks**
1	***Does not contribute to long-term population declines of the hunted species or of other species sharing its habitat, noting that a sustainably harvested population may be smaller than an unharvested one***	Considering the latest available estimate of lion population size in Zimbabwe (1,800 – 2,000), trophy hunting harvests a yearly mean of 2.7% of adult male lions. This figure has decreased since the establishment of age restriction rules on lion hunting. This low offtake is sustainable and generates significant financial and other benefits to ZPWMA, Communities and Private Sector.
2	***Does not substantially alter processes of natural selection and ecosystem function; that is, it maintains "wild populations of indigenous species with adaptive gene pools." This generally requires that hunting offtake produces only minor alterations to naturally occurring demographic structure. It also requires avoidance of breeding or culling to deliberately enhance population-genetic characteristics of species subject to hunting that are inconsistent with natural selection***	Safari hunting in does not substantially alter natural selection or ecosystem processes. The limited quota, as further limited by age restrictions, ensures that hunting offtakes do not negatively affect natural processes. This age-based policy was adopted in part to mitigate any social or population impacts from limited safari hunting. (Whitman et al. 2004).
3	***Does not inadvertently facilitate poaching or illegal trade of wildlife***	Safari hunting in Zimbabwe does not facilitate poaching or illegal trade. Poaching and illegal trade in lion products is currently very low suggesting that the existence of licensed, regulated hunting is helping control poaching and not facilitating it. Hunting operators are in the frontlines against poaching, and are obligated through their concession lease agreements to assistance with anti-poaching. Operators spend significant resources on this, and work in close cooperation with the ZPWMA to combat all forms of illegal wildlife trade. Even where anti-poaching is not a legal prerequisite, operators fund their own anti-poaching teams and support government rangers and community scouts e.g. in Sengwa and Dande Safari Area

	Principle	Remarks
4	***Does not artificially and/or substantially manipulate ecosystems or their component elements in ways that are incompatible with the objective of supporting the full range of native biodiversity***	Hunting in Zimbabwe has created financial incentives for the development and retention of wildlife across Safari Areas, Forestry Areas, Communal CAMPFIRE Areas and private Conservancies thereby supporting biodiversity over 145,000km^2 where hunting is a primary land use. Hunting areas on private and communal land outside of the protected areas also serve as buffer zones for many national parks and safari areas which would be converted to other land uses if these were abandoned.

Net Conservation Benefit: Trophy hunting can serve as a conservation tool when it

	Principle	Remarks
1	***Is linked to identifiable and specific parcels of land where habitat for wildlife is a priority (albeit not necessarily the sole priority or only legitimate use); and on which the "costs of management and conservation of biological diversity [are] internalized within the area of management and reflected in the distribution of the benefits from the use"***	Zimbabwe has identified Safari Areas within the Parks Estates where maintaining habitats and wildlife populations is the priority. These gazetted protected areas cover approximately 17,000km^2 where, without safari hunting, it would be difficult to secure and maintain natural ecosystems and prey bases for lions. In addition to these areas, lion occur on 66% (approximately 11,000km^2) of the land set aside as Conservancies. The operational and law enforcement costs incurred by hunting companies on a yearly basis ranges from US$300,000 to US$500,000 per hunting concession, which includes the expense of camps, salaries, anti-poaching, fuel, community assistance, etc. Many of the government's costs of maintaining Safari Areas are transferred to the private sector through the obligations of their concession agreements. Revenues from hunting in communal CAMPFIRE areas are used to support a range of social services (e.g. schools, clinics, irrigation schemes etc.) while operators cover the costs of anti-poaching, maintenance and development, and contributions to communities living nearby (e.g. through boreholes, grinding mills etc.).

		In private hunting areas and conservancies, the costs and benefits of wildlife in the area are internalized and distributed within the area of management. Critically, most of the Conservancies have elected to manage and conserve endangered species, such as black rhino, and offset the costs of this by conducting sustainable hunting of lion and other key trophy species.
2	***Produces income, employment, and/or other benefits that generate incentives for reduction in pressures on populations of target species, and/or help justify retention, enhancement, or rehabilitation of habitats in which native biodiversity is prioritized. Benefits may create incentives for residents to co-exist with such problematic species as large carnivores, herbivores competing for grazing, or animals considered to be dangerous or a threat to the welfare of humans and their personal property***	Hunting produces direct and indirect income, employment, and other benefits that generate incentives that reduce the threats to wildlife populations. Approximately US$44 million accrued to the country from the revenues of trophy hunting over the last two years. This could have been 5% higher if it were not for restrictions on the export of elephant and lion trophies. This revenue pays for the daily wildlife conservation work in all sectors of the wildlife industry, including research projects, surveys, anti-poaching, and other services. Of this amount, approximately 20% is paid directly to the ZPWMA which is then used to support its management activities, including anti-poaching budgets. Local communities benefit from hunting income through leasing the right to hunt and the sale of trophy fees in CAMPFIRE areas as well as from voluntary contributions and meat. Over the last 6 years, payments from hunting operations generated approximately US$16 million. The nature of the hunting industry does not require large numbers of people to be employed. Nonetheless, the average hunting company employs approximately 80 people on a permanent basis and 20 on a seasonal basis. This equates to approximately 3,000 people who would not otherwise secure any form of employment because of the lack of opportunities in the remote areas where hunting takes place.
3	***Is part of a legally recognized governance system that supports conservation adequately and of a system of implementation and enforcement capable of achieving these governance objectives***	All wildlife species in Zimbabwe, including the African lion, are protected under the Parks and Wildlife Act of 1996 (Chapter 20:14) as amended by Act Number 19 of 2001 which came into operation on the 1st of June 2002 through a Statutory Instrument 144C of 2002. The Act that was originally passed by Parliament in 1975 was a unique move in Africa, if not globally, that promoted the rapid development of the country's wild life industry and lead to the partial

		extension of the principle to the Communal Lands through the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in the 1980s. The Act provided a legal basis for the devolution of Authority through granting Appropriate Authority Status to the communal areas to manage the wildlife resources for their own benefit. The Act was subsequently revised in 1996 and 2001 with the latest revision paving the way for the establishment of the current Parks and Wildlife Management Authority to replace the former Department of National Parks and Wild Life Management. Following the introduction of the Parks and Wild Life (General) (Amendment) Regulations, 1998 (No.2), i.e. Statutory Instrument 26 of 1998, the administration of the wildlife industry experienced increasing centralisation of controls on wildlife management and utilisation on alienated and communal land. The Parks and Wildlife Management Authority is mandated by the Parks and Wildlife Act [Chapter 20:14], with the responsibility of conserving Zimbabwe's wildlife heritage through effective, efficient and sustainable protection and utilisation of natural resources for the benefit of present and future generations. The Authority was established to allow it to retain the revenue that it generates to fund its operations and thereby reducing its dependence on Treasury. This entailed introducing a commercial dispensation and putting in place effective revenue generation and financial management systems. The ZPWMA has the mandate to manage the entire wildlife population of Zimbabwe, whether on state, private and communal land.

Socio-Economic-Cultural Benefit

	Principle	**Remarks**
1	***Is premised on appropriate resource assessments and/or monitoring of hunting indices, upon which specific quotas and hunting plans can be established through a collaborative process. Optimally, such a process should (where relevant) include local communities and draw on local/indigenous knowledge. Such resource assessments (examples might include counts or indices of population performance***	Zimbabwe implements an adaptive quota setting quota system that uses inputs from monitoring data and input from a variety of stakeholders including ZPWMA field and research staff, local communities, hunting operators, and independent biologists. Quotas are set based on population estimates or trend analyses, monitoring data, hunt return data, research work and indices as may be reflected in various reports by field personnel.

	such as sighting frequencies, spoor counts) or hunting indices (examples might include trophy size, animal age, hunting success rates and catch per hunting effort) are objective, well documented, and use the best science and technology feasible and appropriate given the circumstances and available resources	For lions, specifically, the ZPWMA together with the Safari Operators Association (SOAZ), the Zimbabwe Professional Hunters Association (ZPHGA) and invited independent scientists (such as Panthera) review the returns from the current hunting season and assign points as per the lion aging criteria. The overall quotas allocated and actual offtake have been reduced in recent years as a precautionary measure, including implementing moratoriums in some regions where lion densities have declined. These measures, i.e., age, population trends, maximum overall numbers and levels of utilisation has resulted in lower quotas thus underlining Zimbabwe's commitment to sustainable hunting.
2	***Involves adaptive management of hunting quotas and plans in line with results of resource assessments and/or monitoring of indices, ensuring quotas are adjusted in line with changes in the resource base (caused by ecological changes, weather patterns, or anthropogenic impacts, including hunting offtake)***	Quotas are set adaptively in line with the results of monitoring trends and on regulatory compliance. If an underage lion is harvested, the quota for that area is removed in the next season to allow the population to age and to penalize the non-compliance. In this way, Zimbabwe ensures responsible and sustainable offtakes that have limited impact on the lion population.
3	***Is based on laws, regulations, and quotas (preferably established with local input) that are transparent and clear, and are periodically reviewed and updated***	Safari hunting in Zimbabwe is regulated through the National Parks and Wildlife Act and supporting Regulations that specify when, where and how animals are hunted. Both the professional hunters and the hunting client are licensed in terms of these regulations, and all returns are lodged electronically and tracked through the Reserve Bank TRAS-2 system. As described above, quotas are established in a transparent and participatory way.
4	***Monitors hunting activities to verify that quotas and sex/age restrictions of harvested animals are being met***	The monitoring of the lion hunting is carried out through the implementation of a specific database and a specific safari return form. All hunting permits issued by (and compulsorily returned to) the ZPWMA are registered on a specific database that has been developed under the auspices of the Exchange Control Division of the Reserve Bank that records all parameters related to hunting safaris, including records of lion hunting. The database is accessible to the ZPWMA who can extract reports on all lion hunting activities for all areas in the country. Since 2013, all professional hunters conducting lion hunting safaris are required to fill in the return form for both successful and unsuccessful safaris that

		captures a broad range of general information on the safari (client name, duration, date, payments etc. For the successful lion hunting safaris, additional information related to hunting effort and success, trophy skull measures (total length and width) and specified photographs are taken of the physical features (mane etc.) and upper and lower jaws. These return forms and trophy photographs are compulsory. No CITES export permit can be issued without compliance. All data forms are reviewed by the ZPWMA together with a committee appointed by the SOAZ and ZPHGA to ensure the offtakes and subsequent exports are not detrimental to the survival of the species. Zimbabwe also requires that a ZPWMA ranger accompany all lion safaris both on state land and private land.
5	***Produces reliable and periodic documentation of its biological sustainability and conservation benefits (if this is not already produced by existing reporting mechanisms).***	The Exchange Control Division of the Reserve Bank publishes a detailed report that summarises all data related to sport hunting. This includes country of origin of clients, gross income from daily rates and trophy fees (by company), average trophy and safari values, and the contribution of key species to the overall income generated through hunting. The ZPWMA also produces annual reports that highlight the performance of the hunting industry, listing the challenges that it faces. It also submits periodic reports to CITES.

Accountable and Effective Governance

	Principle	**Remarks**
1	***Is subject to a governance structure that clearly allocates management responsibilities***	The governance structure is described in the Parks and Wildlife Act and its subsidiary regulations that clearly provides for institutional arrangements and administration defining the management responsibilities within the relevant Government Authority.
2	***Accounts for revenues in a transparent manner and distributes net revenues to conservation and community beneficiaries according to properly agreed decisions;***	The equitable distribution of costs and benefits take into consideration the role of stakeholders in relation to the land category. Benefit sharing to communities under the CAMPFIRE programme is determined through an approved ratio that channels 55% of all income from hunting to the Ward level. This institution is monitored at the local level by the Rural District Councils that guide Ward

		Wildlife Committees with respect to community projects and services. At national level this is monitored by Ministry of Rural Development, Preservation and Promotion of Culture and Heritage Safari operators contribute substantially and voluntarily, over and above the prescribed fixed contribution, especially where this involves anti-poaching efforts and community developments. They provide funding, equipment and the technical expertise for repairs, transportation, and other social services (schools, boreholes). In addition, hunting companies collaborate with both ZPWMA and District anti-poaching teams to remove snares, participate in serious wildlife crime investigations and arrest poachers.
3	***Takes all necessary steps to eliminate corruption;***	Anti-corruption efforts in Zimbabwe are governed by the following legislation: • The Prevention of Corruption Act (1983); • Public Service Act (1995); • The Ombudsperson Amendment Act (1997); • Anti-Corruption Commission Bill (2004); • The Criminal law (Codification and Reform) Act (2004); • Bank Use Promotion and Suppression of Money Laundering Act (2004); • Criminal Procedure and Evidence Amendment Act (2004); and • Criminal Law (Codification and Reform) Act of 2006 The Zimbabwean Anti-Corruption Commission (ACC) was established after the passing of the Anti-Corruption Commission Bill in June 2004. The Commission is a signatory to the Southern Africa Development Community (SADC) Protocol as well as the African Union (AU) and United Nations Convention on Anti-Corruption.
4	***Ensures compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.***	The CITES Management Authority of Zimbabwe, the ZPWMA, ensures compliance of safari hunting to CITES guidelines and provisions.

10 REFERENCES

Bauer, H. Chardonnet, P. and Kristin Nowel, l. 2005. Status and distribution of the lion (*Panthera leo*) in East and Southern Africa. Background paper for the East and Southern African Lion Workshop, Johannesburg, 2006. IUCN, Pretoria.

Bauer, H. and Van der Merwe, S. 2004. Inventory of free-ranging lions *Panthera leo* in Africa. 26–31 pp. Available at: WOS:000220283600007.

Bauer, H., Chapron, G., Nowell, K., Henscheld, P., Funston,P.,Hunter, L.T.B., Macdonald, D.W. and Packer, C. 2015. Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas. www.pnas.org/cgi/doi/10.1073/pnas.1500664112

Begg, C. and Begg, K. 2008. Trophy monitoring of lion and leopard trophies in Niassa National Reserve, Mozambique: 2007 hunting season. Ratel Trust and SRN, Mozambique.

Chitauro. 2016. Status of the hunting sector in Zimbabwe. Internal report prepared by the Director of Exchange Control om behalf of the Reserve Bank of Zimbabwe. Unpublished.

Creel, S. and Creel, N.M. 1997. Lion density and population structure in the Selous Game Reserve: evaluation of hunting quotas and offtake. Afr. J. Ecol. Volume 35, pages 83 - 93

Crosmary, W.G., Loveridge, A.J., Ndaimani, H., Lebel, S., Booth, V., Côté, D. and Fritz, H. 2013. Trophy hunting in Africa: long-term trends in antelope horn size. Animal Conservation •• (2013) ••–•• © 2013 The Zoological Society of London.

Davidson, Z. and Loveridge, A. 2005. Population Estimation by Spoor Counts with Calibration Using Known Lion Density. Status report of the Gwaai ICA; Wildlife Conservation Research Unit, Oxford University.

Davidson, Z. and Romanach, S. 2007. Estimations of lion and hyena density in the Savé Valley Conservancy using two different census techniques: spoor transects and call-up stations. Report for SVC, WildCRU and University of Zimbabwe, TREP.

du Preez, B., Groom, R., Mufute, O., Mandisodza-Chikerema, R. and Booth, V. 2016. Sport-Hunting and Lion *Panthera leo* Conservation in Zimbabwe. Report prepared by the Bubiana Valley Conservation Research.

Dunham, K.M. Mackie, C.S. and Nyaguse, G. 2015a. Aerial Survey of Elephants and other Large Herbivores in the Zambezi Valley (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 118 pp.

Dunham, K.M., Mackie, C.S., Nyaguse, G. and Zhuwau, C. 2015b. Aerial Survey of Elephants and other Large Herbivores in north-west Matabeleland (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 126 pp.

Dunham, K.M., Mackie, C.S., Nyaguse, G. and Zhuwau, C. 2015c. Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 111 pp.

Dunham, K.M. & van der Westhuizen, H.F. 2015d Aerial Survey of Elephants and other Large Herbivores in Gonarezhou National Park and Save Valley Conservancy (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 115 pp.

Funston, P.J., Herrmann, E., Babupi, P., Kruiper, A., Jaggers, H., Masule, K. and Kruiper, K. 2001. Spoor frequency estimates as a method of determining lion and other large mammal densities in the Kgalagadi Transfrontier Park. (Book chapter).

Funston, P., Henschel, P., Hunter, L., Lindsey, P., Nowak, K., Vallianos, C. and Wood, K. 2016. Beyond Cecil: Africa's Lions in Crisis. Panthera and WildAid, New York and San Francisco.

Groom, R. 2008. Carnivore densities in the Savé Valley Conservancy; Results of the 2008 spoor survey. Report for Savé Valley Conservancy Technical Advisory Committee.

Groom, R. J. 2009. Carnivore Densities in Gonarezhou National Park: Results of the May/June 2009 Spoor Survey. Lowveld Wild Dog Project.

Groom, R.J. 2010. The abundance and conservation status of lions (*Panthera leo*) and spotted hyenas (*Crocuta crocuta*) in Gonarezhou National Park, Zimbabwe. Results of the 2010 call-up survey. African Wildlife Conservation Fund, unpublished report.

Groom, R.J., Funston, P.J. and Mandisodza, R. 2014. Surveys of lions *Panthera leo* in protected areas in Zimbabwe yield disturbing results: what is driving the population collapse? Oryx http://journals.cambridge.org.

Groom, R. J. and Watermeyer, J. 2015. Carnivore Densities in Gonarezhou National Park. Results of the 2015 Spoor Survey. Gonarezhou Predator Project

Groom, R. J. and Watermeyer, J. 2015a. Carnivore Densities in the Savé Valley Conservancy. Results of the 2015 Spoor Survey & Wild Dog Monitoring Project. African Wildlife Conservation Fund

Hayward, M. W., O'Brien, J., and Kerley, G.I.H., 2007. Carrying capacity of large African predators: predictions and tests. Biological Conservation, 139(1), 219-229.

IUCN/SSC. 2012. IUCN/SSC Guiding principles on trophy hunting as a tool for creating conservation incentives. Ver. 1.0. IUCN, Gland. http://cmsdata.iucn.org/downloads/iucn_ssc_guiding_principles_on_trophy_hunting_ver1_09aug2012.pdf

Loveridge, A.J. Searle, A.W., Murindagomo, F., Macdonald, F.W. 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation 134: 548 – 558

Lindsey, P. A., Balme, G., Becker, M., Begg, C., Bento, C., Bocchino, C., Dickman, A., Diggle, R. W., Eves, H., Henschel, P., Lewis, D., Marnewick, K., Mattheus, J., McNutt, J. W., McRobb, R., Midlane, N., Milanzi, J., Morley, R., Murphree, M., Opyene, V., Phadima, J., Purchase, G., Rentsch, D., Roche, C., Shaw, J., van der Westhuizen, H., van Vliet, N. and Zisadza-Gandiwa, P. 2015a. The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. FAO/Panthera/Zoological Society of London/WCS Report, Harare. 79 pages.

Lindsey, P., Taylor, W.A., Nyirenda, V., Barnes, L., 2015b. Bushmeat, wildlife-based economies, food security and conservation: Insights into the ecological and social impacts of the bushmeat trade in African savannahs. FAO/Panthera/Zoological Society of London/SULi Report, Harare. 58 pages.

Miller, J.R.B., Balme, G., Lindsey, P.A., Loveridge, A.J., Becker, M.S., Begg, C. Brink, H., Dolrenry, S., Hunt, J.E., Janssoni, I., Macdonald, D.W., Mandisodza-Chikerema, R.L., Cotterill, O.L., Packer, C., Rosengren, D., Stratford, K., Trinkel, M., White, P.A., Winterbach, C., Winterbach, H.E.K. and Funston, P.J. 2016. Aging traits and sustainable trophy hunting of African lions. Biological Conservation 201 (2016) 160–168.

Mills, M.G.L. , Biggs, H.C. and White, I.J. 1995. The relationship between rainfall, lion predation and population trends in African herbivores. Wildl. Res. 22: 75–88

Stander, P.E. (1998) Spoor counts as indices of large carnivore populations: the relationship between spoor frequency, sampling effort and true density. Journal of Applied Ecology, 35, 378-385

Seymour-Smith, J. L. and Loveridge, A. J. 2015. Mana Pools National Park Predator Survey July – October 2015.

Whitman, K.L., Starfield, A.M., Quadling, H. and Packer, C. 2007. Modeling the effects of trophy selection and environmental disturbance on a simulated population of African lions. Conservation biology: The Journal of the Society for Conservation Biology, 21(3): 591–601.

ZPWMA, 2006. Conservation Strategy and Action Plan for the Lion (*Panthera leo*) in Zimbabwe. Zimbabwe Parks and Wildlife Management Authority, Ministry of Environment and Tourism, Harare, Zimbabwe. 19 pages.

ZPWMA, 2014. Age Restrictions on Lion Trophies and the Adaptive Management of Lion Quotas in Zimbabwe.

ZPWMA, 2016. Hwange National Park Management Plan 2016 – 2016. Prepared by African Wildlife Foundation on behalf of the Zimbabwe Parks and Wild Life Management Authority, Harare.

11 APPENDICES

11.1 ANNEX I: SUMMARY OF NATIONAL PARKS ESTATE, FORESTRY, COMMUNAL AND PRIVATE LAND WHERE LION ARE KNOWN TO OCCUR

1. National Parks Estate

Type of Land	Name of Park	District	Area (hectares)	Presence of lion
NP	Chizarira	Binga	191,000	Yes
NP	Gonarezhou	Chiredzi	505,000	Yes
NP	Matusadonha	Nyaminyami	140,700	Yes
NP	Chimanimani	Chimanimani	17,110	No
NP	Mana Pools	Hurungwe	219,600	Yes
NP	Kazuma Pan	Hwange	31,300	Yes
NP	Hwange	Hwange	1,465,100	Yes
NP	Victoria Falls "A"	Hwange	1,904	No
NP	Victoria Falls "B"	Hwange	436	No
NP	Zambezi	Hwange	56,010	Yes
NP	Rhodes Nyanga	Nyanga	47,150	Migratory
NP	Rhodes Matopos	Matobo	42,400	No
Total Area National Parks (ha)			**2,717,710**	
Botanical Gardens	Pioneer Reserve	Beitbridge	38	No
Botanical Gardens	Tolo River Reserve	Beitbridge	44	No
Botanical Gardens	South Camp Reserve	Beitbridge	26	No
Botanical Gardens	Chisekera Hot Springs	Chiredzi	95	No
Botanical Gardens	Mawari Raphia Palm	Mt. Darwin	34	No
Botanical Gardens	Tingwa Raphia Pan	Mt. Darwin	290	No
Botanical Gardens	Haroni Forest	Chimanimani	20	No
Botanical Gardens	Rusitu Forest	Chimanimani	150	No
Botanical Gardens	Sebakwe Acacia Karoo	Kwekwe	60	No
Botanical Gardens	Sebakwe Great Dyke	Kwekwe	165	No
Botanical Gardens	Sebakwe Mountain Acacia	Kwekwe	53	No
Botanical Gardens	Mazowe "A"	Harare	43	No
Botanical Gardens	Mazowe "B"	Harare	3	No
Botanical Gardens	Bunga Forest	Mutare	495	No
Botanical Gardens	National Botanic Garden	Harare	67	No

Type of Land	Name of Park	District	Area (hectares)	Presence of lion
Botanical Gardens	Vumba Botanic Garden	Mutare	200	No
Botanical Gardens	Ewanrigg Botanic Garden	Goromonzi	286	No
Total Area of Botanical Gardens and Botanical Reserves:			**2,069**	
Sanctuary	Maninii Pan	Chiredzi	300	No
Sanctuary	Melsetter Eland	Chimanimani	1,800	No
Sanctuary	Mbaze Pan	Nkayi	40	No
Sanctuary	Nyamanyetsi (Nyamanechi)	Guruve	2,840	No
Sanctuary	Mushandike	Masvingo	12,900	No
Sanctuary	Rhodes - Bulawayo	Matobo	1,100	No
Total Area Sanctuaries			**18,980**	
Safari Area	Tuli	Beitbridge and Gwanda	41,600	Yes
Safari Area	Chete	Binga	108,100	Yes
Safari Area	Chipinga (Chipinge)	Chipinge	26,100	No
Safari Area	Malapati (Malipati)	Chiredzi	15,400	Yes
Safari Area	Chinsa	Gokwe	171,300	Yes
Safari Area	Hartley (Chegutu)	Chegutu	44,500	No
Safari Area	Charara	Kariba and Hurungwe	169,200	Yes
Safari Area	Hurungwe	Hurungwe	289,400	Yes
Safari Area	Doma	Makonde	94,500	Yes
Safari Area	Umfurudzi	Shamva	76,000	No
Safari Area	Dande	Guruve	52,300	Yes
Safari Area	Chelvore (Chewore)	Hurungwe	339,000	Yes
Safari Area	Sapi	Hurungwe	118,000	Yes
Safari Area	Deka	Hwange	51,000	Yes
Safari Area	Matetsi	Hwange	295,500	Yes
Total Area of Safari Areas:			**1,891,900**	
Recreational	Chibwatata	Binga	6	No
Recreational	Kavira	Binga	50	No
Recreational	Lake Kariba	Binga, Nyaminyami and Hwange	287,200	Yes

Type of Land	Name of Park	District	Area (hectares)	Presence of lion
Recreational	Ngezi	Kadoma	5,800	No
Recreational	Umfuli (Mfurudzi	Chegutu	12,700	No
Recreational	Lake Robertson (Manyame Lake)	Chegutu, Makonde and Harare	11,200	No
Recreational	Lake Cunningham	Insiza	4,172	No
Recreational	Chinhoyi Caves	Makonde	120	No
Recreational	Manjirenji	Zaka	3,400	No
Recreational	Bangala	Zaka and Masvingo	2,700	No
Recreational	Sebakwe	Kwekwe	2,600	No
Recreational	Robert McIlwaine (Chivero)	Harare	6,180	No
Recreational	Umzingwane	Umzingwane	1,233	No
Recreational	Kyle (Mutirikwi)	Masvingo	16,900	No
Recreational	Lake Matopos	Matobo	2,900	No
Total Area of Recreational Parks, Lakes and Dams			**357,161**	

Total Area National Parks (ha)	2,717,710
Total Area of Botanical Gardens and Botanical Reserves:	2,069
Total Area Sanctuaries	18,980
Total Area of Safari Areas:	1,891,900
Total Area of Recreational Parks, Lakes and Dams	357,161
Total Ha	**4,987,820**

2. Forestry Land

Land	Name	District	Area (ha)	Presence of lion
Forestry Areas	Fuller	Hwange	23,300	Yes
Forestry Areas	Panda Masuie	Hwange	33,500	Yes
Forestry Areas	Kazuma	Hwange	24,000	Yes
Forestry Areas	Mvutu	Hwange	2,100	No
Forestry Areas	Sikumi	Hwange	54,400	Yes
Forestry Areas	Gwayi	Lupane	144,265	Yes
Forestry Areas	Lake Alice	Lupane	39,000	No
Forestry Areas	Ngamo	Lupane	102,900	Yes

Land	Name	District	Area (ha)	Presence of lion
Forestry Areas	Chisengu	Lupane	4,006	No
Forestry Areas	Glencoe	Lupane	2,050	No
Forestry Areas	Lionhills	Lupane	2,747	No
Forestry Areas	Martin (i)		400	No
Forestry Areas	Martin (ii)		4,400	No
Forestry Areas	Mudima		6,355	No
Forestry Areas	Nyambewa		5,484	No
Forestry Areas	Tandai		5,450	No
Forestry Areas	Tarka		4,343	No
Forestry Areas	Gwampa	Nkayi	47,000	No
Forestry Areas	Chesa	Nkayi	14,250	No
Forestry Areas	Inseze	Nkayi	35,200	No
Forestry Areas	Inseze Extension	Nkayi	8,400	No
Forestry Areas	Umgusa	Nkayi	32,200	No
Forestry Areas	Umzibani	Nkayi	2,471	No
Forestry Areas	Kavira	Binga	28,200	Yes
Forestry Areas	Mzolo	Binga	67,200	No
Forestry Areas	Sijarira	Binga	25,600	Yes
Forestry Areas	Bembesi	Binga	55,100	No
Forestry Areas	Molo	Binga	2,900	No
Forestry Areas	Mtao	Chirumanzu	8,170	No
Forestry Areas	Chirindu	Chirumanzu	950	No
Forestry Areas	Gungunyana	Chirumanzu	1,650	No
Forestry Areas	Mafungabusi	Chirumanzu	82,100	No
Forestry Areas	Mudzongwe	Chirumanzu	1,420	No
Forestry Areas	Ungwe	Chirumanzu	567	No
Forestry Areas	Nyangu	Chirumanzu	16,600	No
Forestry Areas	York	Chirumanzu	1,455	No
Forestry Areas	Banti	Mutare	2,219	No
Forestry Areas	Stapleford	Mutare	24,600	No
Rhodes Estate	Erin	Nyanga	10,700	No
Rhodes Estate	Sauerdale North	Nyanga	214	No

Land	Name	District	Area (ha)	Presence of lion
Total Forest Areas (ha)			**927,866**	

3. CAMPFIRE Districts

District	Natural Region	Total Area (km^2)	Area of CF Wards (km^2)	Number of Wards	CF Wards	District Pop (persons)	Presence of lion
Beitbridge	5	12,935	4,595	21	6	80,946	Migratory
Binga	3,4&5	12,308	7,930	27	21	87,802	Migratory
Bubi	4	5,547	88	12	2	36,614	Migratory
Bulilimamangwe	4&5	12,574	1,530	33	10	156,641	Migratory
Chaminuka	2a,2b,3,4&5	2,752	380	26	2	94,047	No
Chimanimani	1,2a,3,4&5	3,419		28		110,836	No
Chipinge(Gazaland)	1,2a,3,4&5	5,223	408	33	2	336,893	Migratory
Chiredzi(Gaza Khomanani)	5	17,748	3,633	32	9	183,228	Yes
Chiweshe(Mazowe)	2a	4,482	375	29	5	198,319	No
Gokwe North	3,4&5	7,359	2,523	25	4	164,558	Migratory
Gokwe South	3&4	11,138	1,308	28	6	238,581	Migratory
Goromonzi	2a	2,504		26		147,126	**No**
Mbire (Guruve)	2a,3&4	7,810	4,215	28	14	135,637	Yes
Gwanda	4&5	10,792	2,283	23	6	112,984	No
Hurungwe	2a,3,4&5	19,895	2,793	40	9	246,902	Yes
Hwange	4&5	29,934	4,021	27	15	71,707	Yes
Hwedza	2b&3	998				69,981	No
Kusile(Lupane)	3&4	7,780	2,885	24	11	94,469	Migratory
Marondera	2a&2b	3,554		24		104,601	No
Matobo	4&5	7,278	1,233	26	4	89,281	No
Mudzi	4	4,222	1,009	18	2	109423	No
Mutoko	2b,3&4	4,052		29		122,941	No
Muzarabani	2a,3&4	4,322	2,540	17	9	69,851	Migratory
Mwenezi	4&5	12,933		31		101,354	Migratory
Nkayi	4	5,333	2,628	23	6	113,302	Migratory
Nyaminyami(Kariba)	4&5	6,327	3,532	16	11	27,717	Yes
Nyanga	1,2b,3&4	5,738	253	37	1	128,439	Migratory
Pfura(Mt. Darwin)	2a,2b,3&4	1,771				164,362	No
Rushinga	3&4	2,408		17		75,332	No
Tsholotsho	4	7,823	5,354	20	8	111,828	Yes
UMP Zvataida	2b,3&4	2,682	619	15	2	86,302	No
Umzingwane	4	1,074				62,954	No

District	Natural Region	Total Area (km²)	Area of CF Wards (km²)	Number of Wards	CF Wards	District Pop (persons)	Presence of lion
Zivagwe	4	2,363				65,752	No
TOTAL/AVERAGE		247,078	56,135	735	165	4,000,710	

4. Conservancies

	Name of Conservancy	District	Area (hectares)	Presence of lion
Conservancies	Malilangwe	Chiredzi	40,000	Yes
Conservancies	Save	Chiredzi	344,200	Yes
Conservancies	Chiredzi River	Chiredzi	28,500	No
Conservancies	Bubye Valley	Matabeland South	374,000	Yes
Conservancies	Bubiana	Matabeland South	130,000	No
Conservancies	Gwayi	Hwange	150,897	Migratory
Conservancies	Midlands Black Rhino	Midlands	85,000	No
Other	Matetsi Farms	Hwange	155,627	Migratory
Total Area of Conservancies			**1,308,224**	

11.2 ANNEX II: SUMMARY OF PRIMARY LEGISLATION AND REGULATIONS

11.2.1 The Policy for Wild Life of 1992

This policy provides for Government to maintain a protected area network known as the Parks and Wild Life Estate for the conservation of the nation's wild resources and biological diversity. According to the policy, government will use the Estate to promote a rurally based wild life industry and will harmonise the management of the Estate with the efforts of neighbouring communities that are developing wild life as a sustainable form of land use. The policy vests executive responsibility for the Parks and Wildlife Estate in the Department of National Parks and Wild Life Management (DNPWLM). It provides for the following categories of protected area: National Park; Safari Area; Sanctuary; Recreational Park, Botanic Reserve and Botanic Garden.

- The objectives of the Parks and Wild Life estate will be to:
- Preserve representative samples of Zimbabwe's aquatic and terrestrial flora and fauna and their physical environments;
- Protect areas of scenic beauty and special interest;
- Preserve rare, endangered and endemic species;
- Conserve water catchments;
- Provide opportunities for public education and the advancement of scientific knowledge;

and, without prejudice to any of the above:

- Encourage public use related to the enjoyment and appreciation of these areas; and
- Generate economic activity within the Estate and surrounding areas to enhance rural development.

The policy commits the DNPWLM to an adaptive management strategy in which research and monitoring are incorporated as integral components of management. It states that where sport

hunting is an objective in a protected area, quotas will be set to the maximum sustainable level at which trophy quality can be maintained and the hunting can be marketed. In terms of the policy the emphasis of tourism in parks should be low density and high quality tourism. An EIA must be carried out for major developments such as construction of roads, powerlines, buildings or dams.

With respect to Wildlife Conservation, the Policy states that the Government of Zimbabwe aims to encourage the conservation of wild animals and their habitats outside the Parks and Wild Life Estate recognising that this is only likely to be successful if wild life can be used profitably and the primary benefits accrue to people with wild life on their land. "*Recognising that much of Zimbabwe does not consist of good arable land, Government regards wild life management in all its diverse forms as a legitimate land use which may be the most appropriate or highest-valued form of development in many areas*". The policy also states that Government will take the necessary legal and enforcement measures to prevent the illegal use of wildlife.

Addressing community rights to natural resources the Policy states that government intends to "*transform land use in remote communal areas through its Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), under which rural peoples have the authority to manage their wild life and other natural resources and benefit directly from so doing*". Further government will "*ensure that wildlife is not undervalued to the people living with it by permitting them to use it sustainably for their own gain as they are able to do with other natural resources and agricultural products*".

The policy states that the mechanism for communities to gain rights over wild life will be through the granting of Appropriate Authority to Rural District Councils (under the Parks and Wildlife Management Act of 1975). For this authority to be granted, the Minister will require:

1. An acceptable management plan from councils in which objectives for wild life are stated and preliminary intentions for achieving these objectives are outlined;
2. An acceptable institutional plan which outlines clearly the methods by which councils intend a) to involve wild life producer communities in district level management and b) to devolve the decision-taking process in local wild life management and the distribution of wild life benefits to producer communities;
3. The department to assist councils in managing their wild life and to coordinate the activities of NGOs who are assisting councils;
4. The approval by the department of all annual quotas of wild life killed or sold in communal lands during the interim period while councils develop their management capacity;
5. The presentation of annual reports from Councils to the Director and to their constituents detailing the year's performance in wild life management in their district.

The policy provides for the Minister to withdraw Appropriate Authority from a council not conforming to conditions and objectives under which it was granted.

11.2.2 Wildlife Based Land Reform Policy

In 2004 there was a move to revise the Policy for Wildlife to cater for the Land Reform programme. The revised policy, known as the Wildlife-Based Land Reform Policy, has not however been formally accepted by Government. Nonetheless, it is important to summarise what was envisioned at that time since this has influenced the way the management of wildlife outside of the Parks Estate has unfolded.

The vision of this reformed policy is to ensure profitable, equitable and sustainable use of wildlife resources, particularly in areas where agricultural potential is limited. It states that "*the policy has*

been developed in the context of Zimbabwe's Land Reform Programme and is underpinned by recognition that wildlife is a viable land-use option, that it can facilitate attainment of equity objectives and that it is feasible. This policy is complemented by existing natural resources legislation and the state protected area system."

The policy also states that the key issues that were taken into consideration were:

- The State will continue to make provision for wildlife management outside the protected area system, including setting aside certain core zones for wildlife production. Wildlife should be the only permitted primary land use option in these areas.
- Outside core zones, wildlife production, amongst other land use options, will be encouraged. The most profitable and ecologically sustainable land use option must be allowed to evolve in response to changing economic influences, notwithstanding the need to ensure food security in these areas.
- The scale of wildlife operations must be allowed to vary from intensive to extensive, depending on agro-ecological settings.
- All beneficiaries of wildlife operations, whether individually or jointly, must equitably share the costs of production.
- Wildlife management responsibility and authority must be devolved to the most appropriate level for efficient resource management and production incentives must be maximized for landholders.
- Security of tenure over resources is key to successful wildlife-based land reform. These core areas should be identified.

The aims of the Wildlife-Based Land Reform Policy are listed as:

1. To facilitate the indigenisation of the wildlife sector and to ensure more equitable access by most Zimbabweans to land and wildlife resources and to the business opportunities that stem from these resources.
2. To maintain a proportion of land outside state protected areas under wildlife production.
3. To enhance diversity of land uses through wildlife production.
4. To promote secure and equitable tenure.
5. To develop and implement appropriate institutional arrangements for wildlife-based land reform.

The policy recognized that wildlife production can be at different scales, which are dependent on several factors that include the type of wildlife, management regime and ecological conditions. Three categories are highlighted in the policy:

1. Intensive production systems with captive or semi-captive species such as crocodiles and ostriches (1 – 100 hectares).
2. Semi-intensive to semi-extensive production systems with free-ranging "plains game" populations (1,000 to 10,000 hectares).
3. Extensive production systems incorporating "big game" populations (over 10,000 hectares).

The Wildlife Based Land Reform Policy promotes two land redistribution models:

1. A state leasehold approach which is based on the reallocation of leasehold leases.
    a. This approach entails the acquisition of the entire land-holding with compensation for infrastructure, wildlife, etc.,

   b. The land will be reallocated to lessees under terms and conditions that will ensure sustainable wildlife management, on-going investment and capacity-building in that area.
2. A corporate equity model that involves transfer of shares within a land-owning company.
   a. The transfer of shares will be in accordance with the Indigenisation goals and sound business principles;
   b. Proposals from stakeholders must outline realistic ways in which new entrants can increase their shareholdings well beyond an initial level, over a reasonable time scale.
   c. The proposals must make provision for immediate allocation of shareholdings to new participants.

The Policy document also acknowledges that the two approaches can be applied in combination and shall be considered on a case by case basis, and that the State may from time to time consider other approaches that meet the objectives of the Wildlife Based Land Reform Policy.

11.2.3 Parks and Wild Life Act Chapter 20:14 of 1996 as amended in 2001:

This is the pivotal Act with respect to wildlife management in Zimbabwe. The Act includes the following sections:

1. Parks and Wildlife Board
2. Parks and Wildlife Estate and Parks and Wildlife Land
3. National Parks
4. Botanical Reserves and Botanical Gardens
5. Sanctuaries
6. Safari Areas
7. Recreational Parks
8. Specially Protected Animals
9. Specially Protected Indigenous Plants
10. Indigenous plants
11. Hunting, removal, viewing and sale of animal products
12. Protection of animals and Indigenous plants on alienated land
13. Fish Conservation
14. Evidence, prevention and detection of offences and additional penalties and forfeitures
15. Inspectors, Officers, employees and advisory committees
16. General

The Act also defines the different types of land (Alienated land):

a. “Private Land” means land the ownership of which is vested in any person other than the President.
b. “State Land” means land vested in the President other than Communal Land or trust land vested in the President.
c. “Trust land” means any land, other than Communal land held in trust by the President or a statutory body or by a person, whether solely or jointly with others, by virtue of his being the holder of some office in a statutory body.

The Parks and Wildlife Act of 1975 (as amended) states that the purposes of National Parks are:

1. To preserve and protect the natural landscape and scenery.
2. To preserve and protect wild life and plants and the natural ecological stability of wild life and plant communities for the enjoyment, education and inspiration of the public.

Establishment of Protected Areas: The Act enables the President to declare National Parks on State land or Trust Land if the trustees give their consent (Section 22). The Act enables the Minister acting on the authorisation of the President to acquire land for the Parks and Wild Life Estate either compulsorily or by agreement in terms of the procedures contained in the Communal Land Act and the Land Acquisition Act. The Act gives the Minister the power to manage National Parks, control entry and authorise or restrict certain activities and carry out various conservation measures. The Act provides for the provision of facilities and services for tourists in National Parks or to lease out such facilities or services. The Act allows the Minister to issue a permit for hunting in National Parks.

The Act makes provision for the establishment of Botanical Reserves and Botanical Gardens (Section 26) on State Land or Trust Land for the preservation and protection of rare or endangered indigenous plants or representative plant communities for the enjoyment, education and benefit of the public.

A third category of protected area is a Sanctuary which may be established by the President on State Land or Trust Land (Section 31) to afford special protection to all animals or a particular species of animal in the sanctuary for the enjoyment and benefit of the public. The Minister may provide tourism facilities and services in a Sanctuary or lease facilities or services. The Minister may also issue permits for hunting or the removal of game from a sanctuary for certain purposes.

In terms of the Act the President may establish Safari Areas on State Land or Trust Land as part of the Parks and Wild Life Estate (Section 36) for the preservation and protection of the natural habitat and the wild life in these areas in order that facilities and opportunities may be afforded to the public for camping, hunting, fishing, photography, viewing of animals, bird watching and similar activities. The Minister may lease sites in safari areas for various purposes and may grant hunting or other rights. Hunting or removal of wildlife in a safari area may only take place with a permit.

The fifth category of protected area provided for by the Act is a Recreational Park (Section 41), which may be established by the President for the purpose of preserving and protecting the natural features for the enjoyment, benefit and recreation of the public. The Minister may designate areas within Recreational Parks which can be alienated or leased for the provision of tourism facilities and services.

Prospecting and mining are prohibited in National Parks, Botanical Reserves, Botanical Gardens, Sanctuaries or Recreational Parks without a permit issued by the Minister and with the consent of the Minister of Mines (Section 119). The Environmental Management Act of 2002 also makes provision for land to be acquired by the State for conservation purposes. According to Section 109 the President may acquire land or set land aside for the improvement or proper management of the environment. In the absence of an agreement with the land owner the President may acquire the land in accordance with the procedures under the Land Acquisition Act. The President may set aside any area of Communal Land for the conservation or improvement of natural resources or for the protection of irrigation works or sources of water supplies provided that no such area shall be set aside until the Minister responsible for the administration of the Communal Land Act is satisfied that suitable provision has been made elsewhere for the inhabitants who will be affected by the setting aside of the area (Section 110).

Specially Protected Animals and Plants: The Act makes provision for the Minister to declare certain animals as specially protected (Section 44). In terms of the Act, no-one may hunt, have in their possession, or sell a live specially protected animal or the meat or trophy from such an animal without a permit. The trophy of any specially protected animal must be surrendered to the state if not obtained by a permit. The Act specifies the purposes for which the Minister may issue a permit for use of

specially protected animals (Section 46), but provides the Minister with some flexibility as he/she may issue a permit for any purpose which in the opinion of the Minister is in the interests of the conservation of animals.

The Act also makes provision for the declaration of specially protected indigenous plants (Section 49). No person may pick a specially protected plant without a permit, although the owners or occupiers of land or a person acting under their authority may pick a specially protected plant for cultivation, forestry, building construction or the construction of roads and other infrastructure. No person may sell a specially protected plant without a permit unless the person is a recognised dealer in specially protected indigenous plants or a member of a recognised horticultural society and the purchase is from a member of the same or other recognised society. The Act specifies the purposes for which the Minister may issues permits for the picking or sale of specially protected indigenous plants. The Act also stipulates that no person may pick or sell indigenous plants without a permit (Section 55) provided that the appropriate authority for any land may pick or sell or authorise others to pick or sell indigenous plants (Section 56). If the Minister deems it necessary for the conservation of an indigenous plant, the Minister may prohibit the picking or selling of that plant (Section 57).

Hunting and removal of animals: The Act prohibits hunting, removal of an animal or any part of an animal or the sale of an animal without a permit unless by an appropriate authority for the land (Section 59), which is the owner of freehold land, a Rural District Council on communal land, the Forestry Commission on state forests and the DNPWLM on the parks and Wildlife Estate. The appropriate authority for the land may issue permits to others to use the wild life (except for specially protected species). If the Minister deems it necessary for the conservation of a animal, he/she may prohibit the hunting or removal of such animals in a specific area (Section 60) and may serve a notice to prohibit a specific person from hunting, conducting photographic tourism, or being in the possession of a weapon used for hunting save for self-defence. The Minister does not have to give reasons for such prohibitions. The Act enables the killing of an animal without a permit for self-defence (Section 61).

The Act prohibits anyone from conducting of hunting or photographic safaris within the parks and wild life estate or on forest land without holding a professional hunter's licence or a professional guide's licence (Section 65). No person may manufacture an article from a trophy, process a trophy or sell or otherwise dispose of a trophy or an article manufactured from a trophy from an animal that has been hunted in contravention of the Act (Section 73).

If the Minister believes it in the interests of conservation, he/she may declare any animal that is not a specially protected animal as a protected animal and any indigenous plant that is not a specially protected plant as a protected plant (Section 77) on alienated land within the area of an environment committee established in terms of the Environmental Management Act of 2002 and the Rural District Councils Act of 1988. No person may, without a permit, hunt an animal or pick an indigenous plant that has been declared protected. The Minister may also restrict the extent of hunting animals or picking of indigenous plants on alienated (private freehold) land in the area of an environment committee if the Minister believes that the hunting of animals or picking of plants is unsustainable. The Minister may authorise an environment committee to reduce the numbers of problems animals on any alienated land within its area if the number of such animals is sufficient to cause excessive damage or nuisance. Section 79 gives environment committees the power to restrict hunting on alienated land if it believes that hunting is unsustainable.

The Minister may declare any person to be the appropriate authority for any waters (Section 83) and may declare controlled fishing waters (Section 84) for which the Minister may make regulations for

the control, regulation, restriction of prohibition of fishing. Unless the Minister designates areas of water where a permit is not required, no-one except the appropriate authority for that water may fish in any water without a permit. Section 87 regulates the means of fishing by prohibiting the use of explosives, firearms and poisons. Section 88 controls the introduction into any water of fish and plants that are not native to that water. No-one except the appropriate authority for a water may fish commercially and sell the fish without a permit (Section 90). The minister may ban fishing by specific persons in any area in the interests of conservation (Section 96).

Enforcement: The Act provides for the powers of conservation officials, and police officers in relation to enforcing the Act. It provides for penalties for various offences and for the Minister to make regulations on a wide range of issues and activities. The Act provides for the highest penalties to be awarded for the unlawful killing of a rhinoceros or other specially protected game specified by the Minister in an
official notice and for the unlawful possession or trade in rhino horn, ivory or the trophy of any other specially protected animal specified by the Minister in an official notice (Section 128).

The Environmental Management Act of 2002 provides the Minister responsible for the Environment to regulate the use of wetlands. In terms of Section 113 of the Act the Minister may declare any wetland to be an ecologically sensitive area and may impose limitations on development in or around such area. Further, no person may without authorisation in terms of the Act:

a. reclaim or drain any wetland;
b. disturb any wetland by drilling or tunnelling in a manner that has or is likely to have an adverse impact on any wetland or adversely affect any animal or plant life therein;
c. introduce any exotic animal or plant species into the wetland. Section 114 enables the Minister to serve an order on the owner, occupier or user of land under which they must take measures, construct such works or refrain from specific activities in order to protect the environment.

Biological Diversity: Further the Act enables the Minister to take such measures as may be necessary for the conservation of biological diversity and the implementation of Zimbabwe's obligations under the United Nations Convention on Biological Diversity adopted in 1992 and may, in so doing (Section 116):

a. identify the components of the biological diversity of Zimbabwe;
b. determine the components of biological diversity which are threatened with extinction;
c. prepare and maintain an inventory of the biological diversity of Zimbabwe;
d. determine actual and potential threats to the biological diversity and devise such measures as are necessary for preventing, removing or mitigating the effect of those threats;
e. devise measures for better protection and conservation of rare and endemic species of wild fauna and flora;
f. develop national strategies, plans and programmes for the conservation of the biological diversity of Zimbabwe;
g. promote the integration of conservation and sustainable use of biological diversity into relevant sectoral policies, plans and programmes;
h. require in writing any developer, including the government, to integrate the conservation and sustainable utilisation of the biological diversity in any project the implementation of which has or is likely to have detrimental effects to the biological diversity of Zimbabwe;
i. protect indigenous property rights of local communities in respect of biological diversity with scientific knowledge;

j. support the integration of traditional knowledge on conservation of biological diversity with scientific knowledge;
k. prohibit or restrict access by any person to or the exportation of any component of the biological diversity of Zimbabwe.

The Minister may also take such action or measures as may be necessary for the conservation of the biological diversity of a specific locality and may:

a. promote such land use methods as are compatible with the conservation of the biological diversity of that locality;
b. select and manage environmental protection areas for the conservation of the various terrestrial and aquatic ecological systems;
c. establish and manage buffer zones near environmental protection areas;
d. prohibit or control the importation of and introduction into the wild of exotic animal and plant species;
e. identify, promote and integrate traditional knowledge into the conservation and sustainable utilisation of the biological diversity of that locality; and
f. determine special measures for the protection of species, ecosystems and habitats faced with extinction.

Community rights to natural resources: The Act provides for land holders to acquire rights over wildlife through the granting of "appropriate authority" status. Thus, the owners of private freehold land are deemed to be the appropriate authority over wildlife on their land (Section 2). Communities acquire rights over wildlife through Rural District Councils (RDCs). A 1982 amendment to the Act provides for the Minister to appoint an RDC as the appropriate authority for wild life on the communal land within the jurisdiction of the RDC (Section 108). The Act states that no person may hunt any animal on any land or remove any animal or part of an animal except in term of a permit issued by the appropriate authority for that land [Section 59(2)]. The appropriate authority may hunt any animal on the land, remove any animal or part of an animal from the land and may issue permits to others to hunt or remove animals from the land. RDCs are then expected to apply the guidelines contained in the 1992 Wildlife Policy to devolve the decision-taking process in local wild life management and the distribution of wild life benefits to producer communities (i.e. smaller and more localised groups of people with wildlife on their land). Further policy guidelines state that RDCs
are expected to distribute a percentage of income derived from wildlife use to producer communities and to allow these communities to be responsible for several wildlife management activities. Because of the existing administrative system of local government, producer communities had to be represented by Ward Development Committees (WADCOs) and Village Development Committees (VIDCOs) which are advisory bodies to Councils.

In this way, various legal entities are granted authority over wildlife outside the Parks Estate. These authorities include private land-owners (where the land is held under an agreement of purchase or lease), forest land (such as Forestry Commission estates). For Communal Land, the Rural District Councils (RDC) may be appointed the Appropriate Authority. The Minister of Environment grants this authority, with input from the Zimbabwe Parks and Wildlife Management Authority. If appropriate authority is not granted, the authority remains vested in Central Government. This Appropriate Authority clause in the Act, paved the way for the implementation of the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE)[3].

Statutory Instruments: There are several statutory instruments (SI) that regulate the wildlife sector:

[3] Note that the CAMPFIRE programme is about to undergo a comprehensive review that will impact on future policies.

- SI 362 of 1990: This legislation provides in sections 66-75 for the Regulation of Manufacture, Processing and Dealing in trophies.
- SI 76 of 1998: Parks and Wild Life (Import and Export) (Wild Life) Regulations specifically deals with Import and Export of wildlife products. This legislation was enacted to ensure compliance with CITES requirements for export and import of wild flora and fauna. These provide for the following:
    - Section 3 deals with the Control of Import and Export of wild life and trophies and lays down a general prohibition on the import into or export from Zimbabwe of any "wild life" or trophy of "wild life" except in accordance with either a certificate issued in terms of section 5 by the Director or Director of Customs, or an open general permit:
    - Section 5 deals with Permits and Certificates and is consistent with CITES legislation.
    - Section 15 deals with Offences and Penalties. Any person who contravenes any of the provisions of subsection 1 shall be guilty of an offence, and liable to a fine or imprisonment. To effectively ensure compliance, the Zimbabwe Parks and Wildlife Management Authority deployed a permanent team of officers based at all ports of exit and entry to assist border control officials in monitoring and inspection of all wildlife exports.
- SI 26 of 1998: The regulation provides for the monitoring of all hunting activities in the country to ensure compliance by all Safari Operators and international clients and to ensure that the TR2 Form. (Tourism Hunting Return Form) is duly completed.
- Trapping of Animals (Control) Act Chapter 20:21: The Act provides for the control, restriction and regulation of the construction, possession and use of certain traps for the purpose of trapping animals; to control the sale and disposal of certain animals, to include lions and to provide for matters incidental to or connected with the foregoing.
- SI 92 of 1992: Parks and Wild Life (Payment for Hunting of Animals and Fish) Notice, 2009: This instrument provides for compensation values of various wildlife forms to include animals and fish. It acts as an additional deterrent measure in matters where poaching cases are being dealt with in accordance with the law. The compensation value for illegal hunting of lion is USD 5 000, 00.
- SI 93 of 2009: Parks and Wild Life (Payment for Trapping of Wild Animals) Notice, 2009. This instrument provides for the payment of compensation to the state or game owners in the event that one is convicted for illegally trapping wild animals on various land categories. The compensation value for illegal hunting of lion is USD 5 000, 00.
- SI 40 Of 1994: Parks and Wildlife (Appropriate Authorities for Communal Land) Notice, 1994. This SI facilitates the granting of Appropriate Authority status to various Rural District Councils. This legislation devolved authority to Rural District Councils and gave rights to local communities to sustainable utilize wildlife and other natural resources in their areas of jurisdiction.

11.2.4 The Rural District Councils Act Chapter [29:13] 2002

The Rural District Councils Act is important in the wildlife sector as it provides for a legal entity (in Communal Lands) responsible for wildlife resources. Since the land in Communal areas is not privately owned by the communities and given that most of the communities do not constitute a legal entity, the Appropriate Authority status is conferred to the Rural District Councils (RDCs). Thus the RDCs act as custodians of the wildlife resources on behalf of the communities.

Efforts are now underway in some areas to form Community Development Trusts. There is scope for these Community Development Trusts to be used as vehicles to further devolve authority from the District level to the sub-district level, which will provide more income at a community level and therefore increase conservation support from the community as they will have a true vested interest.

The feasibility of granting Appropriate Authority to these Trusts in Zimbabwe needs to be assessed and piloted. The major challenge with these Trusts is that of financial sustainability as they do not have adequate funds to cater for their activities. Capacity-building of all Trust members is also a key requirement to ensure institutional sustainability.

In the Rural District Councils Act, there are three key terms that will be described further: Ward, Ward Development Committee and Communal Land. According to the Act, a "Ward" (an administrative unit) means a ward into which a council area is divided or re-divided. Several villages make up a ward. In the Act, a "Ward Development Committee" means a village development committee established in terms of Section 58 of the Act. A Ward Committee is made up of members who are elected from the community to represent the community in discussions/meetings with the Rural District Council. The Act further defines three different types of Wards. These are, Commercial Ward, Communal Ward and Resettlement Ward. The Commercial Ward is a large-scale commercial ward or a small-scale commercial ward. A Communal Ward is a ward consisting wholly or mainly of Communal Land. A Resettlement Ward is a ward consisting wholly or mainly of Communal Land (as in the case of the Communal Ward). It is important to establish whether in practice, the RDCs make
this distinction of the wards or whether they are all considered simply just as wards.

The "Communal Land" is defined as any land that is Communal Land in terms of the Communal Land Act [Chapter 20:04]; and any other land that was within the area of a district council on the 19th August 1988.

11.2.5 The Forest Act of 1948

This Act establishes the Forestry Commission and places demarcated forests under its control. The commission is responsible for the control, management and exploitation of state forests including the leasing of timber harvesting rights. The Act also gives the Minister the power to regulate the commercial use of timber from indigenous trees on other land.

As the appropriate authority for the Forest Areas, the Commission is also responsible for the management and conservation

11.3 Annex III: Analysis of Total Revenue by Country of Destination

Destination	2014	2015	Total
United States	$14,485,835	$11,942,785	$26,428,620
Russian Federation	$1,444,729	$861,925	$2,306,654
China	$1,416,196	$441,759	$1,857,955
Germany	$1,100,534	$698,450	$1,798,984
Canada	$620,852	$474,935	$1,095,787
South Africa	$513,070	$576,035	$1,089,105
France	$825,975	$158,291	$984,266
Australia	$671,527	$259,136	$930,663
Spain	$488,616	$321,064	$809,680
Austria	$519,322	$201,073	$720,395
India	$302,653	$241,741	$544,394
United Kingdom	$357,317	$183,888	$541,205
Italy	$181,956	$343,197	$525,153
Hungary	$418,824	$104,262	$523,086
Mexico	$252,263	$266,543	$518,806

Destination	2014	2015	Total
Norway	$300,645	$119,831	$420,476
Denmark	$132,690	$194,435	$327,125
Switzerland	$171,991	$123,828	$295,819
Sweden	$196,575	$80,014	$276,589
Ukraine	$80,432	$163,604	$244,036
Czech Republic	$104,450	$137,456	$241,906
Neatherlands	$89,042	$105,227	$194,269
Nigeria	$171,830	$0	$171,830
Bulgaria	$21,865	$123,469	$145,334
Argentina	$106,529	$24,888	$131,417
Finland	$65,768	$63,223	$128,991
Brazil	$56,785	$59,886	$116,671
Honduras	$104,683	$0	$104,683
Poland	$38,911	$62,015	$100,926
New Zealand	$17,880	$81,127	$99,007
Mauritius	$56,225	$36,945	$93,170
Chile	$91,374	$0	$91,374
Belgium	$9,340	$80,355	$89,695
Portugal	$78,470	$0	$78,470
Columbia	$77,944	$0	$77,944
Slovakia	$69,420	$0	$69,420
Botswana	$59,401	$0	$59,401
Pakistan	$54,208	$0	$54,208
Namibia	$20,298	$18,862	$39,160
Latvia	$37,611	$0	$37,611
Estonia	$12,078	$23,586	$35,664
Slovenia	$20,620	$11,200	$31,820
Kenya	$14,302	$16,957	$31,259
Dominican Republic	$30,463	$0	$30,463
Belarus	$0	$29,430	$29,430
Kazakhstan	$0	$28,460	$28,460
Romania	$0	$20,112	$20,112
United Arab Emirates	$19,629	$0	$19,629
Lao Peoples Democratic Republic	$15,000	$0	$15,000
Bolivia	$0	$11,553	$11,553
Lithuania	$9,164	$0	$9,164
Costa Rica	$5,900	$0	$5,900
Qatar	$4,896	$0	$4,896
Grand Total	**$25,946,088**	**$18,691,547**	**$44,637,635**

11.4 ANNEX IV: ANALYSIS OF TOTAL REVENUE BY SPECIES

Species	$2,014	$2,015	Total	2015 Quota	Utilised	% Utilised
Buffalo	$2,528,559	$1,962,570	$4,491,129	1,635	482	29%
Elephant (Tusks)	$2,042,610	$1,447,090	$3,489,700	246	64	26%
Elephant (Tuskless)	$1,444,040	$229,860	$1,673,900	462	113	24%
Lion	$630,950	$753,000	$1,383,950	82	49	59%
Leopard	$714,100	$668,490	$1,382,590	530	151	28%
Zebra	$594,239	$555,744	$1,149,983	2,480	600	24%
Sable	$456,615	$309,260	$765,875	718	78	11%
Kudu	$341,092	$357,963	$699,055	2,503	289	12%
Waterbuck	$293,903	$256,133	$550,036	988	156	16%
Hippo	$310,321	$217,470	$527,791	303	83	27%
Impala	$277,198	$242,624	$519,822	8,594	1,261	15%
Crocodile	$284,650	$202,705	$487,355	211	70	33%
Eland	$179,470	$187,990	$367,460	1,659	132	8%
Wildebeest	$180,665	$170,350	$351,015	2,189	220	10%
Giraffe	$158,385	$157,410	$315,795	880	135	15%
Nyala	$130,840	$117,175	$248,015	174	38	22%
Bushbuck	$116,011	$94,936	$210,947	1,082	125	12%
Warthog	$98,975	$89,820	$188,795	3,060	208	7%
Hyeana	$75,648	$54,503	$130,151	1,702	118	7%
Klipspringer	$44,130	$40,441	$84,571	823	59	7%
Bush Pig	$18,226	$30,370	$48,596	1,972	69	3%
Tsessebe	$19,800	$19,500	$39,300	186	15	8%
Baboon	$24,909	$13,664	$38,573	8,017	264	3%
Reedbuck	$23,265	$12,731	$35,996	371	20	5%
Steenbok	$13,790	$15,070	$28,860	927	31	3%
Jackal	$9,656	$15,889	$25,545	2,179	105	5%
Civet	$8,850	$11,368	$20,218	1,034	29	3%
Grysbok	$9,435	$8,585	$18,020	632	31	5%
Eland	$16,750	$0	$16,750	1,659	132	8%
Genet	$6,020	$14,183	$20,203	1,136	38	3%
Duiker, Grey	$2,774	$12,523	$15,297	2,005	53	3%
Duiker, Blue	$7,991	$0	$7,991	-	-	-
Honey Badger	$3,681	$3,625	$7,306	622	15	2%
Wild Cat	$3,160	$4,180	$7,340	812	19	2%
Guinea Fowl	$5,496	$968	$6,464	29,174	121	0%
Porcupine	$4,123	$1,473	$5,596	857	9	1%
Serval	$2,670	$2,410	$5,080	536	6	1%
Egyptian Goose	$3,025	$60	$3,085	4	-	0%
Cheetah	$2,560	$0	$2,560	42	-	0%
Ant Bear	$900	$1,651	$2,551	39	6	15%
Francolin	$1,166	$609	$1,775	22,449	109	0.5%

Species	2014	2015	Total	2015 Quota	Utilised	% Utilised
Dove	$1,321	$418	$1,739	34,485	63	0.2%
Monkey, Vervet	$885	$800	$1,685	3,677	15	0.4%
Ostrich	$1,200	$0	$1,200	14	-	0%
Mongoose	$508	$690	$1,198	279	3	1%
Sandgrouse	$456	$688	$1,144	8,088	78	1%
Oribi	$500	$500	$1,000	82	2	2%
Duiker, Red	$950	$0	$950	-	-	-
Caracal	$900	$0	$900	351	-	0%
Bushbaby	$850	$0	$850	-	-	-
Bontebok	$700	$0	$700	-	-	-
Waterfowl	$0	$400	$400	40	2	5%
Springhare	$60	$120	$180	-	-	-
Gemsbok	$105	$0	$105	6	-	0%
Hyrax	$75	$20	$95	371	1	0.3%
Duck	$29	$20	$49	10,779	13	0.1%
Aardwolf	$0	$0	$0	-	-	-
Blesbok	$0	$0	$0	40		0%
Rabbit	$0	$0	$0	252	-	0%
Hare	$0	$0	$0	138	3	2%
Lichtenstein's Hartebeest	$0	$0	$0	5	-	0%
Red Hartebeest	$0	$0	$0	7	-	0%
Grand Total	**$11,099,187**	**$8,288,049**	**$19,387,236**			

Republic of Zimbabwe

Enhancement and Non-Detrimental Findings for

Panthera leo in Zimbabwe

Zimbabwe Parks and Wildlife Management Authority



October 2016

Contents

1 Introduction 1
2 Status and Distribution of Lion in Zimbabwe 2
2.1 The extent of lion distribution in Zimbabwe 2
2.2 Minimum population of lion in Zimbabwe 5
2.2.1 Captive Breeding Facilities 7
3 Conservation and Management 7
3.1 Policy And Legislation 7
3.2 The Zimbabwe Parks and Wildlife Management Authority 8
3.3 Conservation Strategy and Action Plan for Lion 9
3.3.1 National Lion Captive Breeding Policy 14
4 Population Trend Data For Key Lion Populations In Zimbabwe 14
4.1 Lion survey techniques 15
4.2 Results of regional lion surveys 15
4.2.1 Gonarezhou National Park 15
4.2.2 Save Valley Conservancy 16
4.2.3 Bubiana Valley Conservancy 16
4.2.4 Mana Pools National Park 17
4.2.5 Hwange National Park 17
4.2.6 Zambezi National Park and Units 6 and 7 19
4.2.7 Chizarira National Park and Chirisa/Sengwa Safari Area 19
5 Conservation in Zimbabwe 19
5.1 Staff Establishment 20
5.2 Transport operations 20
5.3 Law enforcement 21
5.3.1 Illegal Harvesting of Wildlife 21
5.3.2 Illegal trophy hunting – the “Cecil” effect 22
5.4 Human Wildlife Conflict 23
5.4.1 Case Study of Human- Lion Conflict from Hwange National Park 24
5.5 Trend in Financial Performance of the Authority 26
6 Stakeholder involvement in lion management and conservation 27
6.1 Beneficiaries of Wildlife Based Land Use 27
6.2 Contribution of the Private Sector 28
6.3 CAMPFIRE Community programmes 30
7 Management and Administration of the Safari Hunting Industry in Zimbabwe 34
7.1 Performance of the industry 34
7.1.1 Global earnings of the industry 34

7.1.2 Quota allocation, Utilisation and Total Trophy Fees Earned 35
7.1.3 Total trophy fees generated by land category 36
7.5 Quota Setting Process 37
7.6 Points system for adaptively managing lion quotas in Zimbabwe 39
7.6.1 Results of the Adaptive Lion Quota Management System: 2013 to 2016 40
7.6.2 Case study: Safari Hunting surrounding Hwange National Park 43
8 Threats and Mitigation 43
8.1 Human-lion conflict 44
8.2 Habitat loss 44
8.3 Illegal Trade in Lion Products 44
8.4 Bushmeat Poaching 45
8.5 Prey Abundance 46
9 Assessment of the Enhancement and Non-Detriment Findings 53
10 References 60
11 Appendices 63
11.1 Annex I: Summary of National Parks Estate, Forestry, Communal and Private Land where lion are known to occur 63
11.2 Annex II: Summary of primary legislation and regulations 68
11.2.1 The Policy for Wild Life of 1992 68
11.2.2 Wildlife Based Land Reform Policy 69
11.2.3 Parks and Wild Life Act Chapter 20:14 of 1996 as amended in 2001: 71
11.2.4 The Rural District Councils Act Chapter [29:13] 2002 76
11.2.5 The Forest Act of 1948 77
11.3 Annex III: Analysis of Total Revenue by Country of Destination 77
11.4 Annex IV: Analysis of Total Revenue by Species 79

1 INTRODUCTION

The United States Fish and Wildlife Service (USFWLS) made a ruling in terms of its Endangered Species Act of 1973 (ESA) that the status of the southern and eastern African lion subspecies (*Panthera leo melanochaita*) is threatened (see http://www.regulations.gov). This ruling, which came into effect on January 22, 2016, now requires that the importation of all trophy lion from Zimbabwe will require an import permit. The decision whether to issue an import permit will in future be based on a Non-Detrimental Finding (NDF) that takes into consideration four main factors outlined under 50 CFR 17.22 and 17.32. These are:

- What direct and indirect impacts would occur on the wild population?
- Would issuing a permit conflict with any known programs intended to conserve the species?
- Would the purposes of the permit reduce the threat of extinction facing the species?
- What are the opinions of experts?

In addition to these factors USFWLS will also take into consideration the IUCN Species Survival Commission (SSC) *Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0* (IUCN/SSC 2012). This document identifies five guiding principles of a hunting program that creates "*incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources*" and recognizes that trophy hunting can contribute to biodiversity conservation and the conservation of the hunted species.

These are:

- **Biological sustainability** i.e. the hunting program:
  - Cannot contribute to the long-term decline of the hunted species
  - It should not alter natural selection and ecological function of the hunted species or any other species that share the habitat
  - It should not inadvertently facilitate poaching or illegal trade in wildlife by acting as a cover for such illegal activities
  - It should also not manipulate the ecosystem or its component elements in a way that alters the native biodiversity.

- **Net Conservation Benefit** i.e. the biologically sustainable hunting program should be:
  - Based on laws, regulations, and scientifically based quotas, established with local input, that are transparent and periodically reviewed
  - It should produce income, employment, and other benefits to create incentives for reducing the pressure on the target species
  - It should create benefits for local residents to co-exist with the target species and other species

- **Socio-Economic-Cultural Benefit** i.e. a well-managed hunting program can serve as a conservation tool when:
  - It respects the local cultural values and practices
  - It involves and benefits residents in an equitable manner
  - It adopts business practices that promote long-term economic sustainability

- **Adaptive Management: Planning, Monitoring, and Reporting** i.e. can the hunting programme enhance the species when it is based on appropriate resource assessments and monitoring (e.g., population counts, trend data), upon which specific science-based quotas can be established. Resource assessments should be objective, well documented, and use

the best science available. Adaptive management of quotas, based on the results of resource assessments and monitoring, is essential

- **Accountable and Effective Governance** i.e. a biologically sustainable trophy-hunting program should be subject to a governance structure that clearly allocates management responsibilities. The program should account for revenues in a transparent manner and distribute net revenues to conservation and community beneficiaries, and take steps when needed to eliminate corruption and ensure compliance with national and international requirements and regulations.

To address the points raised above, a systematic review of the status of lion in Zimbabwe has been undertaken with the full cooperation of stakeholders from the Government, Private Hunting Sector, Community NGOs and research organisations to demonstrate that the lion populations in Zimbabwe are being managed sustainably for benefit of both the conservation of the species and that the management programme is also providing economic incentives for local communities to protect and expand lion habitats. In doing so this assessment addresses the following issues:

- That the Zimbabwe hunting industry is based on sound scientific information and identifies mechanisms that would arrest the loss of habitat or increase available habitat (where feasible) and ensuring adequate protection from human encroachment.
- Demonstrate that there are government incentives in place to encourage habitat protection by private landowners and communities and incentives to local communities to reduce human-wildlife conflicts.
- Demonstrate that hunting concessions are managed to ensure the long-term survival of the listed species and its habitat.
- That trophy hunting provides financial assistance to the Zimbabwe Parks and Wildlife Management Authority, including the communal CAMPFIRE programme and private sector, to carry out various wildlife management programmes. It will also highlight how local communities directly and indirectly benefit from the presence of lion in their areas.
- Finally, this document will demonstrate how the participation of U.S. hunters in the Zimbabwe hunting industry contribute to the overall management of lion within the country.

2 Status and Distribution of Lion in Zimbabwe

Bauer et al (2015) summarise time series data for 47 lion populations across West, Central, East and Southern Africa where regular survey data are available. Using a Bayesian state space model to estimate growth rate-λ for each population, this study concludes that lion populations are declining everywhere across Africa, except in four southern countries (Botswana, Namibia, South Africa, and Zimbabwe). The population models indicate a 67% chance that lions in West and Central Africa will decline by one half, while estimating a 37% chance that lions in East Africa will also decline by one-half over two decades. It is concluded that almost all lion populations that historically exceeded ~500 individuals are declining, *but lion conservation is successful in southern Africa, in part because of the proliferation of reintroduced lions in small, fenced, intensively managed, and funded reserves.* This statement reflects the situation in Zimbabwe where lion populations in the conservancies have flourished under sound management regimes. They have also recovered rapidly in instances where appropriate actions have been taken to arrest unsustainable practices (i.e. Hwange) and where protected areas are receiving adequate funding (i.e. Gonarezhou).

2.1 The extent of lion distribution in Zimbabwe

The Zimbabwe Parks and Wildlife Management Authority (ZPWMA) is responsible for managing one of the largest estates in the country which constitutes approximately 5 million hectares of land or 13%

of the Zimbabwe's total land area (see Table 1 below). The bulk of Zimbabwe's wildlife occurs within the Parks Estate which includes 11 national parks, 16 safari areas, 16 recreational parks, 6 sanctuaries, 12 botanical reserves and 3 botanical gardens, all spread across the country, among other wildlife tourism related activities (Parks and Wildlife Act 2001 Chapter 20:14).

Wildlife populations also occur on the state Forest Areas, Communal CAMPFIRE areas and private conservancies dedicated to wildlife-based land use (Figure 1). Table 1 below provides a summary of these different categories, and whether they support lion populations (see Annex 1 for the details of each area).

Table 1. Summary of the National Parks Estate, CAMPFIRE, Forestry and Conservancies where lion populations are resident

Land Category		**Presence of Lion**				**Total (ha)**	**Total (km^2)**
		Yes (ha)	**%**	**No (Ha)**	**Migratory (Ha)**		
Parks Estate	National Parks	2,608,710	96	61,850	47,150	2,717,710	27,177
	Safari Area	1,745,300	92	146,600	-	1,891,900	18,919
	Botanical gardens	-	-	2,069	-	2,069	21
	Sanctuary	-	-	18,980	-	18,980	190
	Recreational	-	-	357,161	-	357,161	3,572
Forestry		436,165	47	491,701	-	927,866	9,279
CAMPFIRE		8,953,700	36	5,435,100	10,319,000	24,707,800	247,078
Private Conservancies		758,200	66	243,500	150,897	1,152,597	11,526
Matetsi Farms		-	-	-	155,627	155,627	1,556
Total Ha		**14,502,075**		**6,756,961**	**10,672,674**	**31,931,710**	**319,317**
Total km^2		**145,021**		**67,570**	**106,727**	**319,317**	
Percentage		**45%**		**21%**	**33%**		

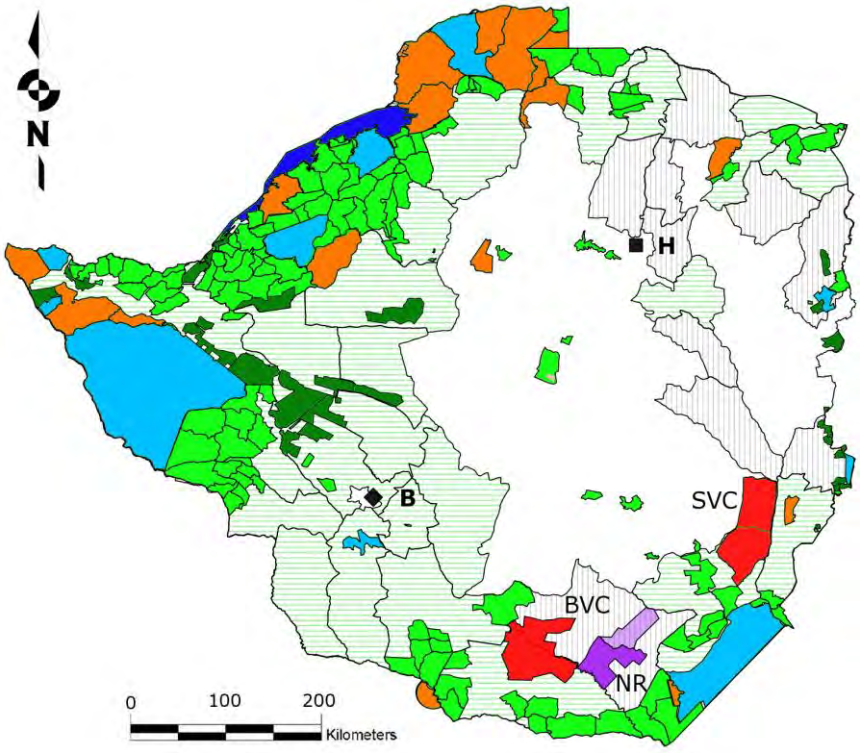


Figure 1: Map of Zimbabwe's main wildlife areas: [i] National Parks are represented in light blue; [ii] Safari areas are represented in orange; [iii] Forestry areas are represented in dark green; [iv] Community and Private wildlife areas are represented in light green; [v] Communal Land (CAMPFIRE Areas) in which sport-hunting may occur is represented by light green horizontal stripes; [vi] Communal Land in which sport-hunting does not occur is represented by grey vertical stripes. [vii] The Bubye Valley [BVC] and Savé Valley [SVC] Conservancies are represented in red. [viii] The Nuanetsi Ranch [NR] on which sport-hunting takes place is represented in dark purple (light purple represents the Nuanetsi Ranch cattle area); [ix] Lake Kariba is represented in dark blue. Harare (the capital city) is represented by a black square and letter '**H**'. Bulawayo is represented by a black diamond and letter '**B**'. Sport-hunting may occur in areas: ii, iii, iv, v, vii & viii (from du Preez, B. Groom, R., Mufute, O., Mandisodza-Chikerema, R. and Booth, V. (2016).

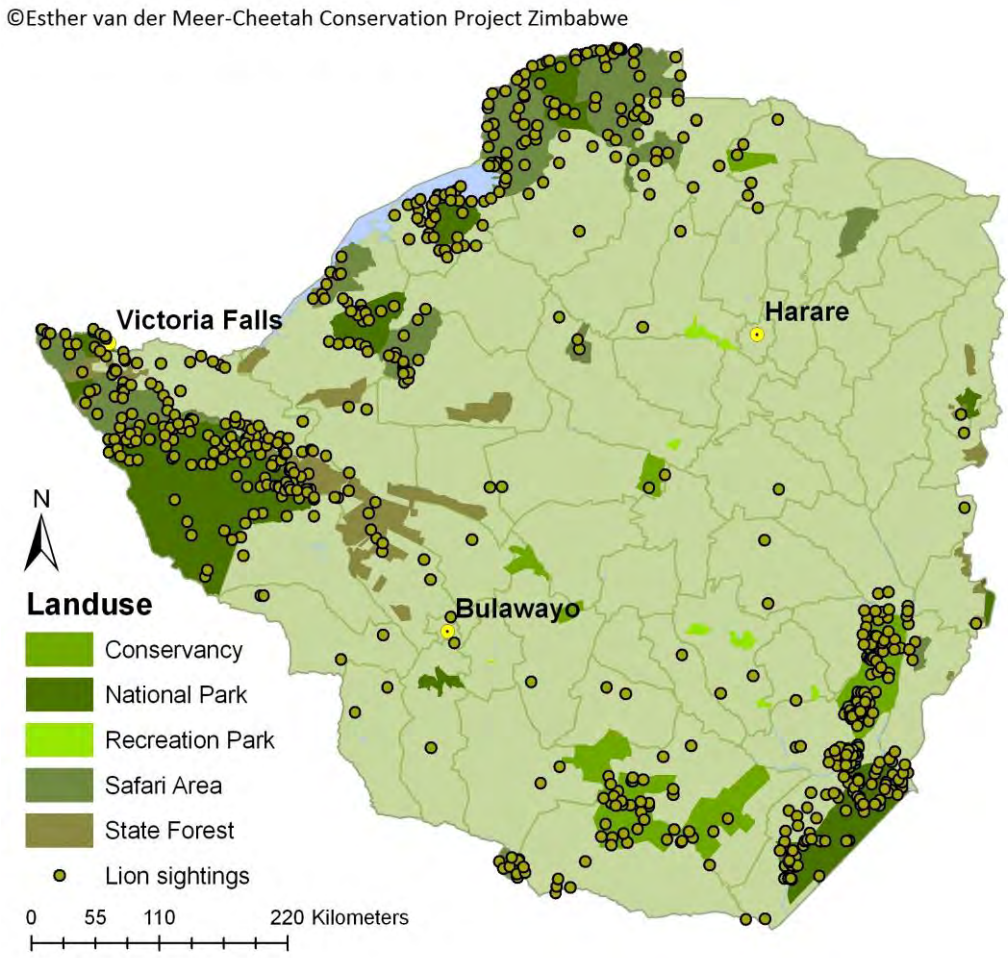


Figure 2: Range of African Lion Distribution in Zimbabwe

There are approximately 319,317 km^2 of land where some form of wildlife based land use is practiced in Zimbabwe. Lion occur permanently in 45% of this available range (c. 145,00km^2), with the majority occurring in State protected national parks (96%) and safari areas (92%). Lion also occur permanently in 47% of the State forest areas and 66% of privately owned Conservancies. The CAMPFIRE areas comprise approximately 247,000km^2 and lion occur in 36% of these areas. Lion are transient in CAMPFIRE, Conservancy and resettled areas adjacent to the major protected areas, and move across the border into Zambia, Mozambique, South Africa and Botswana (Figure 2).

There are two established Transfrontier Conservation Areas (TFCAs), the Great Limpopo Transfrontier Park (GLTP) which includes Gonarezhou National Park, and the Limpopo/Shashe TFCA. Other TFCAs that are at various stages of development are the Kavango-Zambezi (KAZA), Lower Zambezi-Mana Pools, Zimbabwe-Mozambique-Zambia (ZiMoZa) and Chimanimani.

2.2 Minimum population of lion in Zimbabwe

The minimum number lion that occur in approximately 51,642km^2 of land where reliable survey data are available is estimated to be c.1,917 (range 1,800 – 2,000) and is summarised in Table 2. The Western sector of the country dominated by Hwange National Park and the surrounding safari areas, forest areas, communal areas and private conservancies supports c.737 lion (or 38% of the overall population). The Southern sector dominated by the two major conservancies (Save and Bubye) and

Gonarezhou National Park supports c. 896 lions (48%) while the Central and Northern sectors of the country support c.284 lions (15%).

Table 2: Estimated minimum population of Wild Lion populations in Zimbabwe – September 2016 (Data compiled from a variety of reports)

REGION	AREA	AREA (km^2)	Estimated Number of Lions	Percentage
Western	Hwange NP	14,900	559	38%
	Matetsi Units 1-5	1,934	59	
	Matetsi Units 6-7 and Zambezi NP	1,585	67	
	Kazuma Pan NP	313	20	
	Kazuma Forest	240		
	Panda Masuie Forest	355		
	Matetsi ECA	1,556	15	
	Ngamo and Sikumi Forest	1,386	6	
	Gwaai Conservancy	927	22	
	Hwange Communal Land	392	2	
	Tsholotsho buffer adjacent HNP	1,275	7	
Subtotal		**24,863**	**737**	
Central	Chizarira NP	1,948	31	4%
	Chirisa SA	1,713		
	Omay	1,865	10	
	Matusadona NP	1,427	31	
Subtotal		**6,953**	**72**	
Northern	Chewore North and South	1,648	45	11%
	Dande	1,155	21	
	Hurungwe (Nyakasanga and Rifa)	1,709	32	
	Charara/Mukuti	1,692	20	
	Mana Pools	1,287	94	
Subtotal		**7,491**	**212**	
Southern	Gonarezhou National Park	5,053	125	48%
	Malilangwe	400	37	
	Bubye Valley Conservancy	3,440	450	
	Save	3,442	284	
Subtotal		**12,335**	**896**	
Overall Total		**51,642**	**1,917**	

2.2.1 Captive Breeding Facilities

Currently there are only two properties registered as captive lion breeders (Lion and Cheetah Park, and Antelope Park) and < 10 non-registered captive lion breeding operations (Table 3). Most of these centres keep lions for non-consumptive tourism and environmental education purposes with only a few keeping lions as pets. Altogether there are 345 lions held in captivity.

Table 3: Record of lions held in captivity – September 2016

Property	TOTAL
Doddieburn	13
Lion & Cheetah Park	40
Sentinel	2
Vhuka	5
Antelope Park	114
Safari Par, Masuwi Lodge (Lion Encounter)	4
Mhondoro Game Park	2
Chedgelow Farm	9
Chengeta	5
Turk Mine	6
Bally Vaughan	8
Mwanga Lodge	8
Masvingo	17
Karoi	2
Oscro	10
Simply Wild	19
Sondelani	9
Ruwazi	7
Imire	2
Makado Ranch	2
Chipangali	32
Crocodile Farm, Victoria Falls	1
Kuimba Shiri	2
Pamuzinda	6
Shearwater	10
Inyathi Ecogame Park	10
Total	**345**

3 Conservation and Management

3.1 Policy And Legislation

The Ministry of Environment, Water and Climate has a comprehensive suite of policies and legislation that provides the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) with a mandate to conserve and protect all fauna and flora in the country.

The legal framework is enshrined in the National Legislation and associated Regulations that are informed by the Wildlife Policy (1992) that seeks to maintain a protected area network for the conservation of the nation's wild resources and biological diversity. Amongst others it seeks to create

economic activity to enhance rural development and encourages the conservation of wild animals and their habitats outside the protected areas.

The ZPWMA is established by the Parks and Wildlife Act of 1996 (Chapter 20:14) as amended by Act Number 19 of 2001 which came into operation on the 1st of June 2002 through a Statutory Instrument 144C of 2002. The Act provides for the:

- Establishment of a Parks and Wildlife Board;
- Confers functions and imposes duties on the Board;
- Establishment of national parks, botanical reserves, botanical gardens, sanctuaries, safari areas and recreational parks;
- The preservation, conservation, propagation or control of wildlife, fish, and plants of Zimbabwe and the protection of her natural landscape and scenery;
- Conferment of privileges on owners and occupiers of alienated land as custodians of wildlife, fish and plants;
- Giving of certain powers to environment committees (formerly intensive conservation area committees); and matters incidental to or connected with the foregoing.

The Act that was originally passed by Parliament in 1975 was unique in that it provided a legal basis for the devolution of Authority to private landowners over all wildlife on their land which resulted in in the rapid development of the country's wild life industry. It also paved the way for the partial extension of this principle to the Communal Lands through the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in the 1980s that granted Appropriate Authority Status to the communal areas to manage the wildlife resources for their own benefit.

The Act was subsequently revised in 1996 and 2001 with the latest revision paving the way for the establishment of the current Parks and Wild Life Management Authority to replace the former Department of National Parks and Wild Life Management.

The legal and regulation framework applicable to the conservation and protection of lion and all other species includes:

- Parks and Wildlife Act; Chapter 20:14 (1996) as amended in 2001.
- Environmental Management Act; Chapter 20:27.
- Forest Act; Chapter 19:05.
- Statutory Instrument 362 of 1990: Parks and Wildlife (General) Regulations, 1990.
- Statutory Instrument 76 of 1998: Import and Export of Wildlife Products.
- Statutory Instrument 40 of 1994: Parks and Wildlife Act (General) Amendments.
- Statutory Instrument 26 of 1998: Parks & Wildlife Act (General) Amendment.
- Statutory Instrument 92 of 2009: Compensation Values for Wildlife.
- Statutory Instrument 93 of 2009: Compensation Values for Trapping of Animals.
- Trapping of Animals Control Act 20.16.

A summary overview of these instruments is provided in Annex II.

3.2 The Zimbabwe Parks and Wildlife Management Authority

The Parks and Wildlife Management Authority is mandated by the Parks and Wildlife Act [Chapter 20:14] with the responsibility of conserving Zimbabwe's wildlife heritage through effective, efficient and sustainable protection and utilisation of natural resources for the benefit of present and future generations. The Authority was established to allow it to retain the revenue that it generates for

funding its operations and thereby reducing its dependence on Treasury. This entailed introducing a commercial dispensation and putting in place effective revenue generation and financial management systems.

The ZPWMA has the mandate to manage the entire wildlife population of Zimbabwe, whether on state, private and communal land. Vision, mission and core values of ZPWMA are as follows:

Vision: *To be the world leader in sustainable conservation*.

Mission: *To conserve Zimbabwe's wildlife heritage through effective, efficient and sustainable utilisation of natural resources for the benefit of present and future generations and stakeholders*

Core Values: Teamwork, Commitment, Transparency, Professionalism, Integrity, Accountability, Fairness, in harmony with nature.

While private landowners may utilise the wildlife on their land, they are still accountable to the ZPWMA for the welfare of the wildlife in terms of Statutory Instrument 26 of 1998, which, among other things, states that "*No person shall permit any person who is not ordinarily resident in Zimbabwe to hunt on any land for which he is the appropriate authority any animals other than those entered on the authority to hunt…*'

3.3 Conservation Strategy and Action Plan for Lion

A *Conservation Strategy and Action Plan for the Lion (Panthera leo) in Zimbabwe* was prepared in 2006 by the ZPWMA, local and international NGOs. This was in response to the proposal submitted by Kenya at the 13th Conference of the Parties to the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) calling for the transfer of the lion population from Appendix II to Appendix I. The Parties recommended a detailed examination of the issues surrounding the conservation of the African lion, through a series of regional workshops.

IUCN responded to this and together with other key stakeholders, organised the first workshop in 2005 which involved the 14 West and Central African lion range states. The second workshop brought together 15 lion range states from Eastern and Southern African in January 2006 (Bauer, Chardonnet and Nowell, 2005). Each workshop included the Directors of Wildlife Conservation Departments and their technical advisors, safari operators, community leaders, non-governmental organisations involved in conservation, as well as researchers on the African lion.

The workshops came up with several recommendations which included:

- The need for African lion range States to follow up the workshops by developing and implementing national lion management plans.
- The need for a Pan African Conservation strategy to form the basis of a region wide collaboration in the conservation of the lion and which would also form the basis for the management of other wildlife species on regional scale.

Responding to the first recommendation, the ZPWMA, together with IUCN, convened a workshop in November 2006 to develop a national lion conservation strategy and action plan for Zimbabwe attended by conservation NGOs, the private sector, and Rural District Councils (RDCs), as well as ZPWMA and IUCN (Conservation Strategy and Action plan for the Lion (*Panthera leo*) In Zimbabwe, 2006).

The deliberations of this workshop identified the following issues related to lion conservation in Zimbabwe:

- Management and research including technical advice, policy formulation and management interventions
- Capacity needs as reflected by adequate human, financial and material resources
- Mitigation of human-wildlife conflict
- Socio-economic costs and benefits of long-term lion conservation
- Communication and information dissemination for key decision makers at different levels
- Framework for captive breeding of lions
- Trade and regulations to ensure non-detriment findings related to trade in all lion related products
- Regional collaboration to strengthen bilateral and regional lion conservation strategies

The analysis of these issues led to the formulation of the conservation strategy whose vision is that *Lions (*are*) conserved and managed sustainably for their aesthetic, cultural and ecological values, and the socio-economic development of Zimbabwe*. The immediate objective of this strategy is *to secure and where possible, restore as many viable lion populations as possible in Zimbabwe whilst mitigating their negative impacts and enhancing their value for the benefit of people through sustainable use*.

Three broad targets were identified to achieve this objective:

1. Ensure the persistence of key lion populations and other important populations including those of doubtful viability;
2. Human and livestock loss reduced, and
3. Optimize wildlife conservation-related net benefits to local communities

Table 4 summaries the progress with achieving the results identified in the strategy:

Table 4: Summary of implementation progress of the 2006 lion conservation strategy.

Output 1. Lion Management - Lion populations, their habitats and wild prey effectively conserved and managed in collaboration with local stakeholders	
Target 1.1 Establish a baseline survey and monitoring programme for identified lion populations and their range inside and outside the Parks & Wildlife Estate	Baseline surveys have been completed for the Parks Estate using monitoring protocols for key variables (populations, habitats, prey). Selected surveys undertaken of areas outside National Parks in conservancies and some communal land and forest areas.
Target 1.2 Maintain and strengthen capacity for lion conservation, management, monitoring and research within PWMA and amongst other key stakeholders	Carnivore research programmes undertaken by NGOs (Mana, Matusadona, Gonarezhou, Zambezi and Hwange NPs, Matetsi, Chirisa SA) and research institutions (Bubye and Save Conservancies) in various parts of the country. Personnel trained in data collection and capture, management, lion aging and analysis.
Target 1.3 Identify and implement best management standards and practice for all trophy hunted lion populations, ensuring their viability and sustainable, equitable and adaptively managed trophy quotas	Quota setting methodology reviewed and annual quotas and offtakes analysed considering population changes, trophy quality and levels of PAC over time. Trophy hunting database in place and in process of being refined to provide cost-effective system for collation, entry, analysis, reporting and feedback to key stakeholders in the wildlife industry (ZPWMA, RDCs, SOAZ, ZPHGA, conservation NGOs, Researchers etc.). System of fixed and optional quotas reviewed and age-based criteria for male trophy animals in place and functioning.
Target 1.4 Develop and implement a national lion captive breeding management policy	Policy in place (see discussion below).
Target 1.5 Develop and implement co-management frameworks for wildlife management	Collaborative national lion action plans to co-management lion populations in place for NW Matabeleland and SE Lowveld, including three conservancies (Bubye Valley, Save and Malilangwe).
Target 1.6 The geographic distribution range of the lion population expanded	Conservancies and neighbouring communities are working together to maintain existing geographic distribution of lion populations. Zimbabwe proactive in the KAZA and GLTFCA programmes.
Output 2. Lion Research - Information for effective and adaptive lion conservation management generated	
Target 2.1 Initiate targeted research on lion ecology, management and mitigation of conflict	Extensive research programmes focussing on lion ecology and biology undertaken in Hwange, Bubye, Save, Malilangwe, Matusadona, Chizarira and Chirisa. ZPWMA have cooperated with NGOs, such as Panthera, to develop cost-effective age determination methods for lions. Key threats to lion populations, with focus on human-lion conflict, snaring and poisoning, undertaken and continually monitored.
Output 3. Mitigation - Human-lion related conflicts minimized and, where possible, eliminated	

Target 3.1 Develop and establish databases on lion/human conflict	Data on Problem Animal Control (PAC) reports on lion related problems collated.
Target 3.2 Identify and implement methods to reduce and mitigate livestock losses and lion attacks on humans	Approaches to mitigate livestock losses and lion attacks on humans being tested and implemented in Hwange. Methods to mitigate lion attacks on livestock being implemented as appropriate at selected sites (e.g. Tsholotsho).
Target 3.3 Trained and properly staffed PAC Units established to conduct rapid response, restrained and precisely targeted problem animal control	PAC Units at ZPWMA field station and/or RDC levels partially established.
Target 3.4 Incidents of human-lion conflict reduced by at least 30% in 5 years while also reducing retaliatory killing	Specific awareness and education package on lion conservation and management developed and implemented in Matusadona, Hwange and Gonarezhou regions.
Output 4. Socio- Economic - The costs and benefits of long-term lion management equitably distributed	
Target 4.1 Complete an inventory of stakeholders directly affected by lion conservation	Stakeholder groups (e.g. local communities, CAMPFIRE RDC representatives, commercial safari hunting operators (SOAZ, ZPHGA), tourism operators (ZATSO) identified. Financial impacts of lion conservation and extent and magnitude of socio-economic impacts on each stakeholder group completed.
Target 4.2 Deliver appropriate training and capacity building to prioritised stakeholders	Representative stakeholder groups in some regions identified (Hwange, Matusadona, Gonarezhou). Limited training undertaken. Implement adaptive programme across four wildlife regions
Target 4.3 Agree and implement collaboratively developed area-specific lion management plans with identified stakeholder groups in each wildlife region within 5 years	In progress. Hwange NP Management Plan approved.
Target 4.4 Implement transparent mechanisms to equitably distribute lion-related/generated income to identified stakeholders (groups and/or communities)	Scale of income generated from lion conservation reviewed and use of funds to encourage protection of lion populations reach local stakeholders undertaken (see CAMPFIRE generated revenues)
Output 5. Regulations - Effective regulation of consumptive lion utilisation ensured	
Target 5.1 Implement approved policy and practice at national and local levels regarding problem animal control (PAC) of lions within 2 years	Current policy and practice regarding problem animal control of lion reviewed, at national and local levels. PAC offtakes reconciled with trophy hunting quota offtake to ensure that the overall offtake (i.e. total quota) is sustainable.
Output 6. Communication, Awareness and Information Dissemination	

Target 6.1 To carry out awareness programmes in 50% of the districts in Zimbabwe within the next three 3 years	Awareness programmes initiated at a national level, with professional hunters, communities and NGO community. Awareness campaigns being carried out by the Extension and Interpretation Unit in all the regions.
Target 6.2 Create lion conservation and management information units within one year	Databases established at some key research centres using dedicated external research programmes (e.g. WILDCRU).
Output 7. Regional and Trans-Boundary Collaboration	
Target 7.1 Undertake an inventory of national strategies for lion management	Done.
Target 7.2 Encourage the development of national lion conservation strategies where these are missing &/ or incomplete	National lion conservation strategies discussed at AWCF (meeting held under auspices of KAZA).
Target 7.3 Develop an integrated and harmonised lion management strategy for Transfrontier Conservation Areas (TFCAs)	Lion conservation strategies for SADC discussed at AWCF meeting held under auspices of KAZA.
Target 7.4 Implement lion conservation strategy and management plan	Strategy under review.

3.3.1 National Lion Captive Breeding Policy

A target of the Conservation Strategy and Action Plan for the Lion in Zimbabwe was to develop and implement a National Lion Captive Breeding Management Policy. This was achieved in 2011 when the ZPWMA met with lion breeders, keepers and animal welfare organizations to define the purpose of breeding and keeping lions; identify and discuss issues related to breeding and keeping of lions in captivity and to chart the way forward on the breeding and keeping of lions in captivity.

The objectives of the policy are to provide a national approach and minimum standards to all aspects relating to the management of captive bred lions including the role of captive bred lions upon reaching maturity and regulate the import and export of captive bred lions. The policy also defines the measures to protect the genetic integrity of indigenous lion populations. The use and welfare of captive bred lions is monitored by a captive lion inspection team.

In terms of this policy, lions that are kept in captivity for species conservation and commercial purposes are subject to the following conditions:

1. No permit for the keeping of lions in captivity will be issued before the facility has been inspected and approved by ZPWMA as a Captive Lion Holding Facility.
2. Lions may not be allowed to breed in captivity unless the holding facility is registered as a Captive Lion Breeding Centre. If a breeding permit is not issued, it is the responsibility of the owner to ensure that the animals do not breed. If breeding occurs without a permit the owner will be fined and the animals are subject to confiscation and possible destruction by ZPWMA.
3. Lions may not be captured from the wild population and kept in captivity unless the animal is orphaned or injured and is captured with the purpose of rehabilitating the animal and returning it to the wild within as short a time as possible.
4. Captive bred lions may not be released into the wild or transferred from the facility without prior permission from ZPWMA, and are subject to an approved release plan.

No lion can be transported without the necessary internal and national permits and without being micro-chipped, and all transportation of live animals must comply with CITES Resolution Conf. 10.21(Rev. CoP 14). To safeguard the integrity of the indigenous gene pool, no import permits will be issued for non-indigenous lions. Any lion that are to be transported must be issued a certificate of health by a competent veterinarian confirming that the premises of origin has been free from anthrax, panleukopenia and canine distemper for six months, and that each predator is free from diseases such as FIV, BTB or any other disease which may threaten local populations. The animal should also have been vaccinated for rabies and treated with a broad spectrum de-wormer and acaricide.

It is an offence to export lions from Zimbabwe without a ZPWMA export permit, and all export permit will only be considered if the exporting facility holds a current permit to keep captive lions. Moreover, an export permit will only be issued if the importing facility, in the country of import, conforms to regulations laid out in this policy document.

4 Population Trend Data For Key Lion Populations In Zimbabwe

Zimbabwe has in recent years taken proactive actions to enhance the conservation of lion populations both inside and outside the protected areas. These have included implementing moratoriums on hunting, reducing quotas, implementing an age-based hunting regulation and undertaking independent monitoring programmes conducted by international research institutions. Emerging from this is evidence that by implementing appropriate regulatory, management and monitoring actions, coupled with raising awareness, the lion populations respond rapidly and recover to near

former levels. The section below summarises the data from key range areas both inside and outside the National Parks Estate to substantiate this.

4.1 LION SURVEY TECHNIQUES

The population estimates of lions in Zimbabwe are determined through carnivore spoor surveys, systematic lion collaring and call-up surveys. With the strategy to maintain the wilderness values of most protected areas, there is low road penetration in the parks estates, however all suitable roads are used as transects, and in areas of suitable substrate, spoor surveys have shown to be an effective and efficient means to assess wildlife densities (Stander 1998, Fuston et al. 2001, Davidson and Romanach 2007). Patrol reports, field observations by ZPWMA rangers and other sightings by tour operators and tourists also contribute to the knowledge of the status of lions in Zimbabwe's protected areas. Similarly, the occurrence of lion in Safari Areas is recorded by resident safari operators, including those operating in CAMPFIRE areas.

4.2 RESULTS OF REGIONAL LION SURVEYS

Lion population surveys provide indices of abundance that can be used to determine spatial distribution, as well as temporal trends in population numbers. The results of the different survey methods are used to generate information for setting sustainable lion trophy hunting quotas and for population management.

4.2.1 Gonarezhou National Park

Spoor count surveys of the Gonarezhou National Park have been conducted since 2009 using the same methodology to obtain direct estimates of lion populations to compared actual lion densities with potential density estimates (Groom, 2009, Groom et. al. 2014). Table 5 below illustrates the growth of the lion population in the Park (Groom and Watermeyer, 2015).

Table 5: Population estimates of lion in the whole of Gonarezhou National Park (extrapolated from survey area) from 2009 – 2015 (Groom and Watermeyer, 2015).

2009	2010	2011	2012	2013	2014	2015
31	45	72	64	77	116	125

As with many lion populations anthropogenic factors can be key drivers of lion population dynamics, and in areas with high human impact lion numbers may be significantly lower than those predicted by prey biomass models. This was found to be the case in the Gonarezhou National Park. Groom et. al. (2014) concluded that high hunting quotas either within or around the protected area were the most likely cause of the low lion numbers, with quotas in some areas being as high as seven lions per 1,000km^2 in some years. Other factors included persecution, poisoning and problem animal control, as well as disease and competition with spotted hyaenas (*Crocuta crocuta*).

Following decisions to halt lion hunting, and reducing human-lion conflict, the lion population responded and steadily increased, reaching a density of 2.5 lions / 100km^2 in 2014 (as compared with 0.6 / 100km^2 in 2009). Relative to other populations (average over Kruger NP, Hwange NP, Selous GR and Serengeti NP = 9.6 lions / 100km^2) this is still low, suggesting the population could continue to increase further. Groom et. al. (2015) conclude that the lack of artificial water in Gonarezhou means that natural carrying capacity will be lower but based on prey biomass availability predictions of lion carrying capacity could support between 200 and 300 lions (Groom 2010). It is therefore still possible that the lion population in the park could at least double before reaching carrying capacity (especially because prey biomass is now greater than it was in 2010 – see Section 8.5 below).

4.2.2 Save Valley Conservancy

The African Wildlife Conservation Fund carries out an annual large carnivore spoor survey to assess population trends of the carnivores in the Savé Valley Conservancy (SVC) to aid management decisions. A standardised methodology is used to ensure consistency through time and comparability with other studies. Since 2008, the spoor surveys have been done using the same roads and the same observer. The results of these surveys are provided in Table 6 showing that the lion population has increased from 40 in 2005 to 284 in 2015 (Groom and Watermeyer, 2015, du Preez et al, 2016).

Table 6: Population estimates of lion in the whole of Savé Valley Conservancy from 2005 – 2015

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
40	50	52	76	114	143	105	130	115	182	284

The lion population has increased substantially in the last two years, and there are now an estimated 284 lions in the whole of the conservancy. This is a notable increase since the 2013 estimate of 115 lions and 2014 estimate of 182, and is perhaps a latent effect of no hunting for over several years. Of the 149 lion tracks encountered, 28% were big adult males with 53% identified as females/juveniles and 15% as young cubs (3% of tracks were unidentified). The number of lions in SVC equates to a density of 11.7 lions/100km². This is slightly higher than other population estimates of 9.6 lions/100km² (average over Kruger, Hwange, Selous and Serengeti).

4.2.3 Bubiana Valley Conservancy

After originally being eradicated by cattle ranchers in the area, 13 lions were reintroduced to the Bubye Valley Conservancy in 1999, and four young males broke into the Conservancy that same year. From the original 17 animals present in 1999, the Bubye Valley Conservancy lion population was estimated at approximately 280 individuals in 2009 when robust population surveys were initiated by a team from the University of Oxford Wildlife Conservation Research Unit (WildCRU), and this population has continued to grow. Today it is estimated that there are over 500 lions on the Bubye Valley Conservancy (Figure 3, du Preez et. al., 2016).

The exponentially increasing Bubye Valley Conservancy lion population currently exists at one of the highest densities in Africa (~0.190 lions/km^2: du Preez et al. 2015, du Preez et al. 2016), greater than that of the Serengeti, Tanzania (0.10 lions/km^2), Selous, Tanzania (0.080 – 0.130 lions/km^2: Creel and Creel 1997), Kruger National Park, South Africa (0.096 – 0.112 lions/km^2: Mills et. al. 1995), and Hwange National Park, Zimbabwe (0.027 lions/km^2: Loveridge et. al. 2007). This equates to the largest contiguous lion population in Zimbabwe.

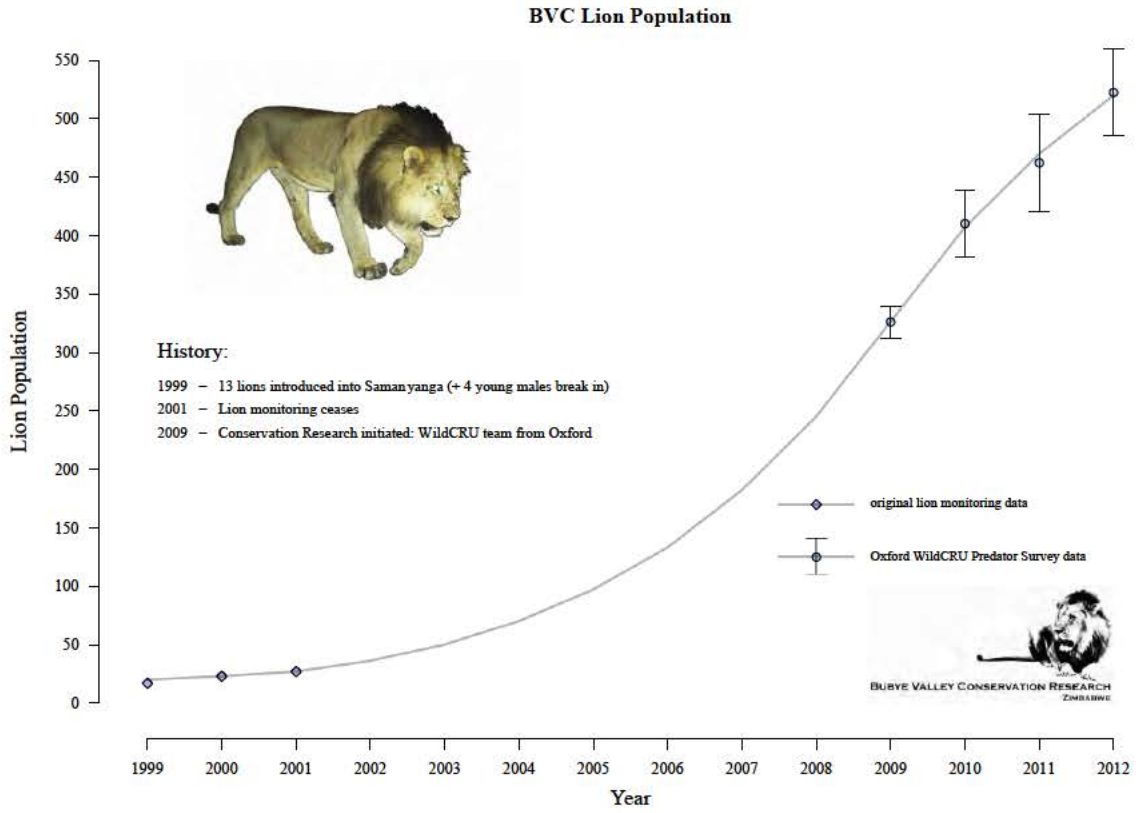


Figure 3: The Bubye Valley Conservancy lion population has increased exponentially since the original reintroduction of the species to the conservancy in 1999.

4.2.4 Mana Pools National Park

In conjunction with ZPWMA, Zambezi Society and the Cheetah Conservation Project, the Wildlife Conservation Research Unit (WILDCRU) based in Oxford (U.K.) conducted a camera trap and spoor count survey of Mana Pools National Park with the objective of:

- To undertake park wide surveys to estimate population density, distribution and habitat occupancy of common predator species in Mana Pools National Park.
- To contribute to Cheetah Conservation Project Zimbabwe's (CCPZ) cheetah monitoring protocol.
- To provide presence/absence data on all the larger mammal species.

A Facebook page was also created for the survey that was regularly updated on the progress of the survey (Facebook.com/Mana Pools Survey 2015).

The preliminary results of this survey identified 67 individual lions from the 267 images captured. When combined with the spoor count surveys, the population was estimated at 94 lions at a density of 4.5 lion/km^2 (Seymour-Smith and Loveridge, 2015),

4.2.5 Hwange National Park

The Hwange Lion Research Project undertaken by the Wildlife Conservation Research Unit (WILDCRU, Oxford University) works in association with the Zimbabwe Parks and Wildlife Management Authority. Since 1999 this project has identified over 600 lions and currently monitors approximately 15 prides and 12 male coalitions in a 5,000km^2 study area. This is one of the most intensive and long-term lion

projects in Africa. A key finding of this research programme has been to demonstrate that the way lion trophy hunting is managed can rapidly improve the status of lion populations by implementing a biologically sustainable system of allocating quotas. This project has also increase the understanding of human related impacts on lion populations (and vice-versa) along the park boundary. More recent research is focussed on understanding connectivity between Hwange NP and other areas such as parks in Botswana and in Zimbabwe.

This project was initiated because there was a perception that levels of sport hunting of male lions' in the hunting concessions surrounding the Hwange National Park were having a negative impact on the conservation of the population (Loveridge, et. al. 2007). Data collected between 1999 and 2004 suggest that this was indeed the case and this contributed to a suspension of sport hunting of lions in the area surrounding the Park between 2005 and 2009. This was a crucial shift in management policy for this species and an important step towards sustainable management and conservation of lions. Following the imposition of the hunting moratorium, lion densities increased (Figure 4).

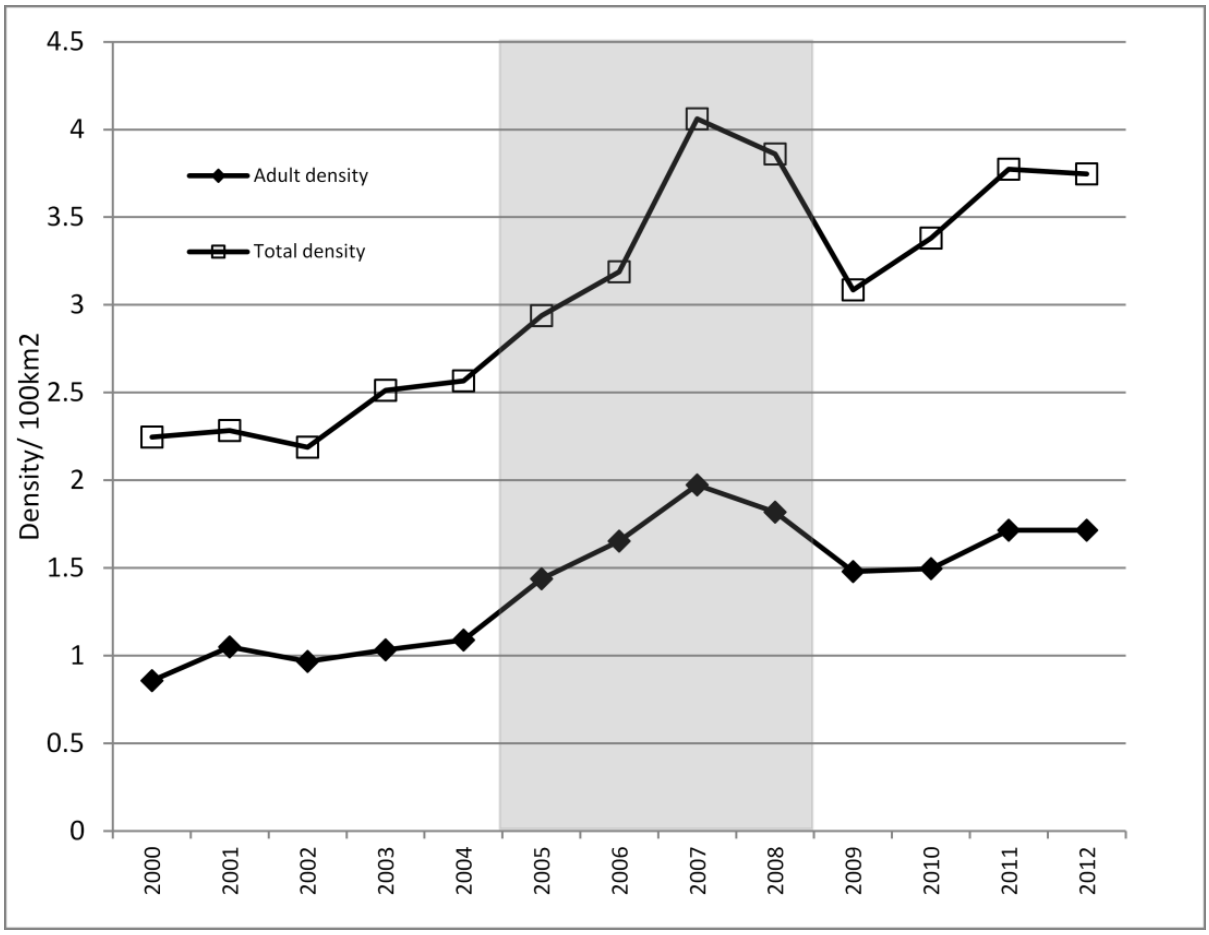


Figure 4: Lion densities in the Hwange area between 2000 and 2012

Following the lifting of the moratorium, and by implementing strict monitoring and hunting guidelines, the overall Hwange lion population has continued to show a positive trend, and is now estimated at over 550 animals.

4.2.6 Zambezi National Park and Units 6 and 7

Victoria Falls Wildlife Trust (VFWT) in collaboration with ZPWMA and the Hwange Lion Research Project has recently completed both spoor count transects and a camera trap surveys in Zambezi National Park, and Units 6 and 7 of the Matetsi Safari Area. The preliminary results of these surveys show that the lion population has increased since 2013 to approximately 67 (Rodger Parry, pers comm.).



Coalition males, Zambezi National Park, June 2016 (*Photo credit: Jessica Dawson, Victoria Falls Wildlife Trust)*

4.2.7 Chizarira National Park and Chirisa/Sengwa Safari Area

A survey was undertaken jointly by the Zimbabwe Parks and Wildlife Management Authority and the African Lion and Environmental Research Trust in September 2015 (Dr Norman Monks pers comm.). The survey area consisted of the 1,910 km^2 Chizarira National Park (a non-hunting area) and the adjoining 1,713 km^2 Chirisa/Sengwa Safari Area (a hunting area). No large carnivore counts using the call-up method had previously been conducted in these contiguous protected areas.

The survey method used the standardized protocol of audio broadcasts of a buffalo calf in distress. Spoor counts were not used for these surveys since previous research had shown that the call-up method was more precise, took less time, and was less costly to complete to achieve accurate results. Up to three stations were sampled nightly commencing just after sunset.

Twelve call-up sites were sampled. Response to the call-up stations by lions was low with only 2 of the 12 stations visited. The population abundance was estimated to be 31.6 (0.872 lion 100/km^2), suggesting a decline of 68.4% since 2004 when estimates of lion numbers were provided to Bauer and van der Merwe, (2004).

5 CONSERVATION IN ZIMBABWE

Zimbabwe Parks and Wildlife Management Authority (ZPWMA) falls under the Ministry of Environment, Water and Climate and it was established under the Parks and Wildlife Act of 1996 (Chapter 20:14) as amended by Act Number 19 of 2001. The rationale behind the establishment of the Authority was to allow it to retain all the revenue it generates to be ploughed back into conservation. The functions of the Authority are provided for in detail in section 4 of the Parks and Wildlife Amendment Act Number 19 of 2001. The Act gives the Authority power to control, manage and maintain Zimbabwe's wildlife resources.

Its **vision** is "*To be a World Leader in sustainable conservation*" and its **mission** is "*To conserve Zimbabwe's wildlife heritage through protection and sustainable utilisation of natural resources for the benefit of present and future generations*."

5.1 STAFF ESTABLISHMENT

The staff strength at the beginning of January 2015 was 2,043 and ended at 2,044 on 31, December 2015 (2015 Annual Report (unpublished). Fifty (50) rangers were recruited in 2015. The following is the staff status report as at 31st December, 2015 (Table 7).

Table 7: Summary Staff Establishment by Region

Position	Grade	HQ	VMU	Northern	Western	Southern	Central	Total
Executive	F & E	3	0	0	0	0	0	**3**
Department Managers/Sectional Heads	D3-D5	19	0	3	4	3	3	**32**
Ecologists/ Area Managers/Officers	D1-D2	11	1	19	19	13	4	**67**
Snr Rangers /Officers	C1-C5	29	6	64	89	49	34	**271**
Rangers/Clerical	B2-B5	33	12	507	461	310	197	**1,520**
Gen. Hands / Lodge Attendants	B1	2	2	30	66	33	17	**150**
TOTAL		**97**	**21**	**623**	**639**	**408**	**255**	**2,043**

The current remuneration levels have remained low with the lowest paid worker receiving a gross salary of $375 per month. The last salary increase of 23% was in January, 2014. A comparison with other Parastatals within the same parent ministry, shows that the Authority has the lowest salary scales.

5.2 TRANSPORT OPERATIONS

As indicated in Table 8, the total cost of operating the Parks transport fleet was is $1,547,172.82 (excluding insurance and licensing) in 2015. The existence of old and obsolete vehicles in the fleet increases costs as most of them require major component replacements thereby increasing vehicle downtime.

Table 8: Overall travel and fuel consumed by Region

Station	Km travelled	Fuel Consumed		Repairs & Maintenance Cost ($)	Total Cost ($)
		Litres	Cost ($)		
Head Office	1,489,294	190,644	272,620	136,419	409,039
Northern	1,429,260	149,577	213,895	147,113	361,007
Southern	1,075,077	110,111	157,458	59,548	217,006
Western	1,313,263	142,012	203,077	161,120	364,196
Central	392,885	47,995	68,632	127,288	195,920
TOTAL	**5,699,779**	**640,339**	**$915,684**	**$631,486**	**$1,547,172.**

Table 9 below summarises the status of the Authority's vehicle fleet as of 2015. Out of the fleet complement of 316 (including tractors and motor cycles), only 70% are in sound condition.

Table 9: Number of vehicles per region

Region	Runners	Non-Runner	Total	% of Non-Runner
Head Office	41	6	47	13
Northern	53	19	72	26
Southern	30	21	51	41
Western	80	39	119	33
Central	17	10	27	37
Total	**221**	**95**	**316**	**30**

The Authority also owns three aircraft: Bell Jet Ranger and Robinson R22 Beta 11 helicopters, and a Cessna 185. The Jet Ranger is based at Hwange National Park and is used for game capture and law enforcement. The remaining aircrafts are non-operational.

5.3 LAW ENFORCEMENT

A major component of the Authority's mandate is law enforcement. This has become increasingly more important with the escalation in illegal wildlife trade, particularly involving elephant and rhino. The Authority has an establishment of 2,146 rangers however by the end 2015, there were 1,448 rangers in post (67%). Of the 1,448 rangers in post, 1,004 are deployable for anti-poaching operations.

The level of effort of law enforcement over the last 3 year is summarised in Table 10. In 2015 there were 2,139 incursions detected, and arrest of 1,354 local and 129 foreign poachers. The number of armed contacts declined from 26 in 2014 to 23 in 2015, and number of poachers killed declined from 13 in 2014 to 11 in 2015. Recoveries made in the field included 25 rifles, 276 rounds of ammunition, 496 pieces of elephant ivory, 4 rhino horns and 5,133 wire snares.

Table 10: Detections, Arrests and Recoveries for 2013, 2014 and 2015

Year	No of Incursions	No of contacts		Number of poachers				Recoveries					Other recoveries and arrests		
				Killed		Arrested									
		Armed	Visual	Local	Foreign	Local	Foreign	Rifles	Ammunition	Ivory	Rhino horn	Snares	Gold	Poachers Camp	Dogs
2013	1842	27	344	9	0	1421	131	20	945	436	5	4415	93	264	180
2014	1571	26	362	10	3	4161	94	20	163	202	19	4864	221	186	272
2015	2139	23	356	6	5	1354	129	25	276	496	4	5133	134	339	167

5.3.1 Illegal Harvesting of Wildlife

Commercial wildlife poaching involving both local and foreign nationals continues to plague Zimbabwe, especially with respect to elephant and rhino located in the Zambezi Valley, Sebungwe, North-West Matabeleland, South-East Lowveld. The species targeted are shown in Table 11 and 12. Note that 21 lions were killed illegal between 2013 – 2015, with 6 animals killed through snaring in the area adjacent to Hwange National Park in 2015.

Table 11: Trends in wildlife poaching in the parks estate

Year	Illegally killed wildlife										
	Elephant	Buffalo	**Lion**	Kudu	Zebra	Impala	Warthog	Nyala	Eland	Crocodile	Waterbuc k
2013	293	65	**12**	65	21	67	22	5	6	2	15
2014	176	44	**2**	34	8	65	26	2	5	3	15
2015	317	78	**7**	76	21	92	46		9	17	6
2016*	101	23	**0**	23	22	54	12	1	4	1	5
Total	**807**	**210**	**21**	**200**	**72**	**278**	**106**	**8**	**24**	**23**	**41**

*To September 2016

Table 12: Illegally killed wildlife 2015 in the four regions

Region	Elephant	Buffalo	**Lion**	Kudu	Sable	Zebra	Croc	Impala	Eland	Warthog	B/Buck	waterbuck
Central	46	30	**0**	16	0	6	1	28	0	17	7	
Northern	75	6	**0**	6	0	0	0	0	0	0	0	0
Southern	65	38	**1**	42	0	9	4	31	4	25	1	6
Western	131	4	**6**	12	1	6	12	33	5	4	1	0
Total	**317**	**78**	**7**	**76**	**1**	**21**	**17**	**92**	**9**	**46**	**9**	**6**

5.3.2 Illegal trophy hunting – the "Cecil" effect

Professional hunter Theodor Bronkhorst was arrested for allegedly illegally hunting of a lion popularly known as 'Cecil' with a foreign client on Antoinette and Antoinette farm in Gwayi River Conservancy (which is adjacent to Hwange National Park). The same case involved Umguza Rural District Council in alleged illegal quota transfer[1]. At the time of writing, this case has not been brought before the court, and is still under judicial review[2].

The Authority immediately implemented the following measures in response to this incident:

- Hunting of lions, leopards and elephant in areas outside of Hwange National Parks required confirmation and authorization in writing by the Director-General of the Zimbabwe Parks and Wildlife Management Authority, and all hunts are to be accompanied by the Authority's staff whose costs will be met by the landowner.
- Bow hunting was suspended except with confirmation and authorization in writing by the Director-General of the Zimbabwe Parks and Wildlife Management Authority.
- Members of the hunting fraternity were reminded that it was illegal for quotas to be transferred from one hunting area to another. Any case of quota transfer would be regarded as poaching, and the Authority will not hesitate to arrest, prosecute, and ban for life any persons including professional hunters, clients and land owners who were caught on the wrong side of the law.

[1] This system facilitated the transfer of a quota from one property to another has since been suspended by the Authority.

[2] Note: This case has been dismissed by the court on 12th November 2016.

- 2015 hunting quotas and permits for Antoinette and Antoinette farm, Railway farm 33, Umguza Rural District Council and Kusile Rural District Council were suspended.
- Professional hunters' license for Theodor Bronkhorst was suspended.

5.4 Human Wildlife Conflict

The Authority is called upon to deal with human-wildlife conflict (HWC) issues across the country, and this continues to be a challenge. A total of 863 reports of problem wild animals causing threat to human life and property were received in 2015 compared to 1,637 reports in 2014 (Table 13). From these incidents, a total of 39 human fatalities by crocodiles, elephants, lions and buffaloes were recorded in 2015 compared to the 27 fatalities in 2014.

Table 13: Trends of Human and Wildlife Conflict Incidents

Year	Total Reports Received	People killed	People Injured	Cattle killed	Goats killed
2013	1 088	21	16	67	65
2014	1 637	27	24	217	129
2015	863	39	23	232	213
Total	**3 588**	**87**	**63**	**516**	**407**

The scale and species involved in HWC is summarised in Table 14. The authority received 200 problem lion reports and responded to 177. One person was killed by lion, and 206 livestock. The Authority elected to capture problem lion (6) rather than destroy the animals.

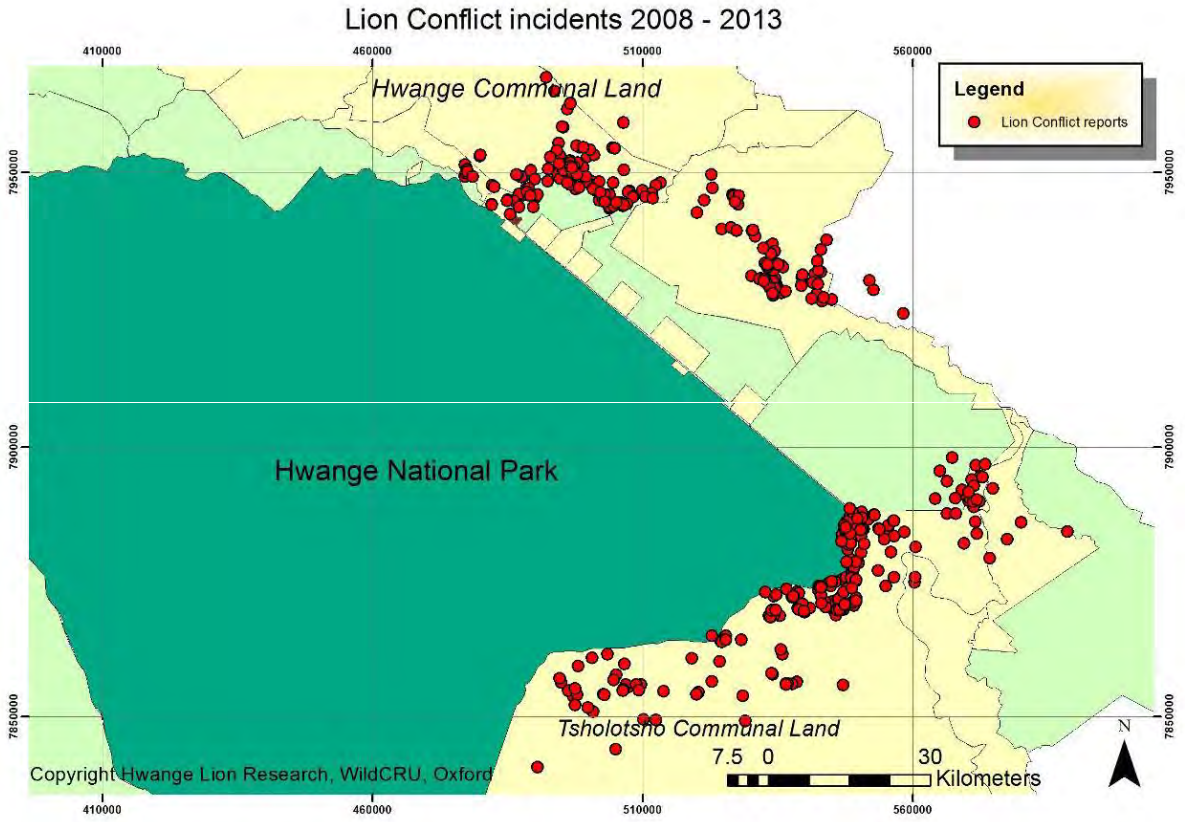
Table 14: Scale of countrywide human wildlife conflict in 2015.

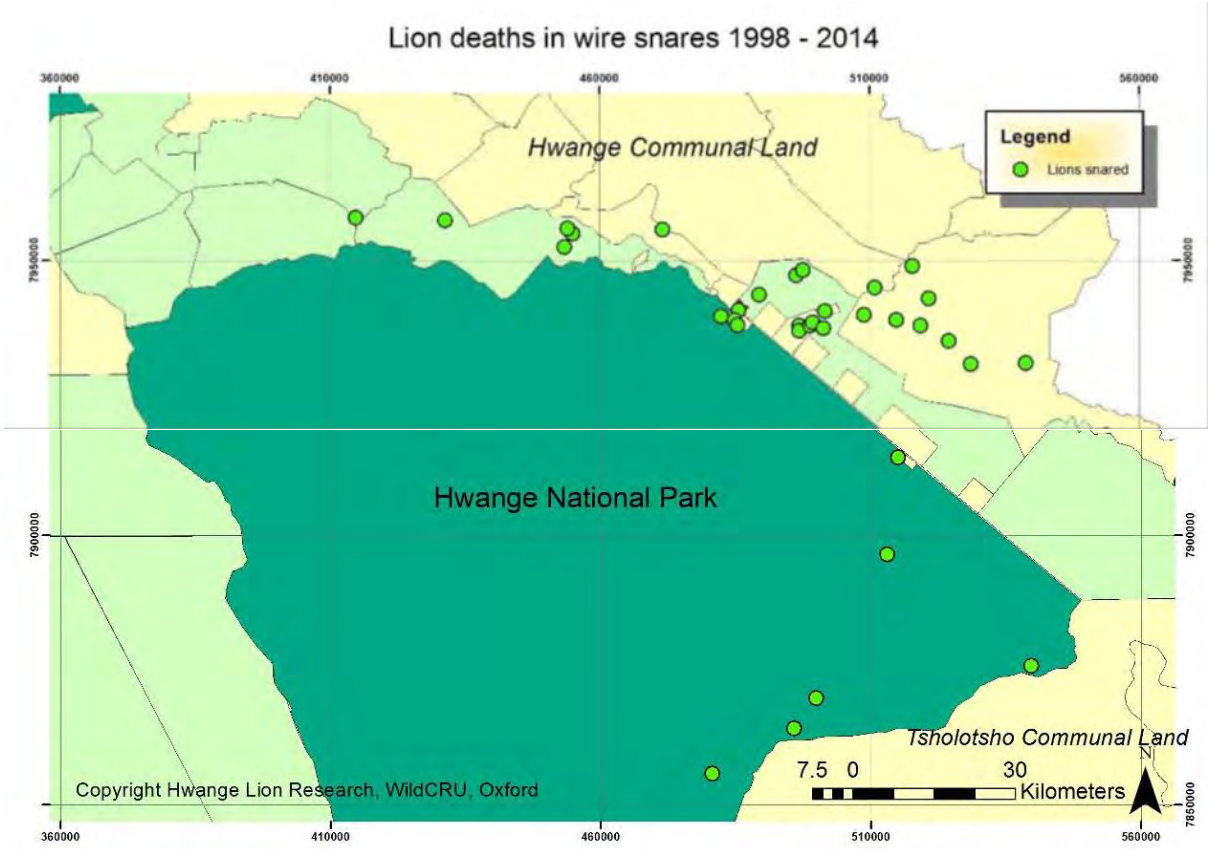
Species	Nature of problem	No of reports received	Reports attended	Number of animals eliminated		People		Livestock killed		
				Killed	Captured	Killed	injured	Cattle	Donkeys	Goats
Baboons	Damage to infrastructure, crop raiding, threat to humans	109	105	51	48	0	0		0	0
Buffalo	Threat to human life and crop raiding	46	40	0	15	2	1		0	0
Elephant	Threat to human life, crop raising, destroying property	216	177	0	38	4	5	0	0	0
Hippo	Threat to human life and crop raiding	131	87	0	34	0	0	0	0	0
Crocodile	Threat to human life and killing livestock	106	85	39	9	27	14	16	1	47
Hyenas	Killing livestock	36	18	0	7	0	0	68	2	54
Leopard	Killing livestock	19	11	0	1	0	0	32	0	33
Lion	**Threat to human life and livestock killing**	**200**	**177**	**0**	**6**	**1**	**0**	**115**	**12**	**79**
Total		**863**	**700**	**90**	**158**	**34**	**20**	**231**	**15**	**213**

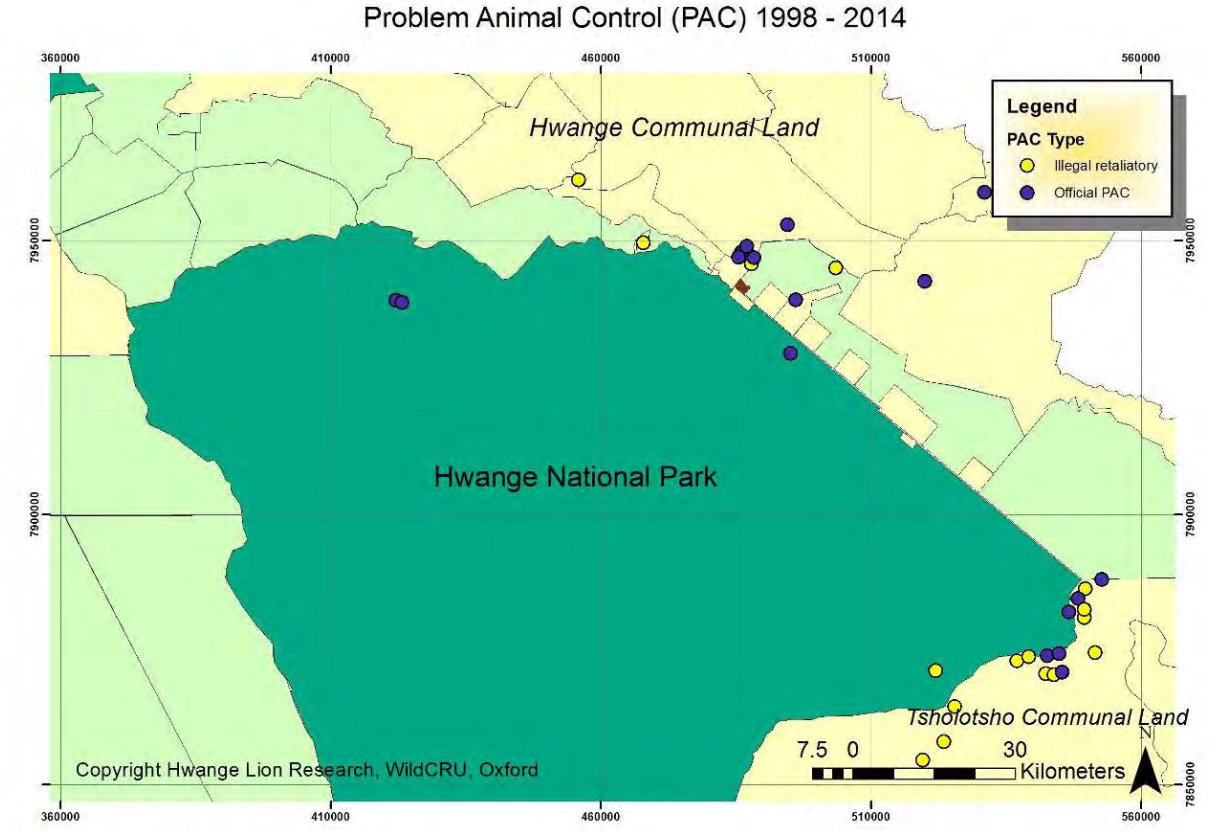
5.4.1 Case Study of Human- Lion Conflict from Hwange National Park

The following information has been extracted from the Hwange National Park Management Plan (ZPWMA, 2016) and is provided here to illustrate the challenges facing the management of lion populations residing adjacent to communal and commercial properties. Variations of the scenario described here apply to other areas of the country where hyaenas and lions are the most problematic carnivores in the communal areas adjacent to protected areas. Hyaenas are perceived to be more of a problem than lions as they account for large numbers of livestock (cattle, goats and sheep). The data presented here has been extracted from the WildCru Lion Research project in Hwange and considers only lions.

Since its inception in 2007 a significant component of the WildCru Lion Research project has focused on understanding the ecological and human socio-economic factors of conflict between the local agro-pastoralist people residing in Tsholotsho and Hwange Communal Land and lions. The project developed an intensive reporting system to record conflicts and has undertaken a detailed survey to record the baseline data on human wildlife conflict at the household level. Between 2007 and 2013 a total of 1,113 conflict incidents were recorded in the Hwange area in which 915 head of stock was lost to lions.







To mitigate this conflict, the project has initiated the "Long Shields Guardian Programme" whereby communities are notified of movements of collared into their areas via cell phone who then motivate the community to take appropriate action (i.e. moving the cattle, chase the lions etc.). In 2013 alone,

1,850 warnings were passed to the "Long Shields". In addition, the project is working on improving bomas and husbandry techniques as another way to lessen the conflict between lions and people, and although these actions may reduce the incidents of livestock marauding lions, cattle deaths still occur resulting in retaliatory killings or action on the part of National Parks to destroy the animals.

5.5 Trend in Financial Performance of the Authority

The average Income and Expenditure for the period 2010 – 2015 is shown in Table 15 that highlights the inability of the Authority to generate adequate revenue to cover both the capital and operating requirements. The average total income over this period is US$22.4 million (range US$16.5 – US$29.3 million). For the period ending December 2015, the Authority generated total revenue of $24,1million, which is 32% below the anticipated budget of $35.5 million. This includes a government grant of $716 000 and a donation of vehicles and equipment worth $2,1 million from the Government of China.

The average total expenditure for the period 2010 – 2015 is US$25.3 million (range US$18.1 – US$30.7 million). The Authority has thus incurred a loss of approximately US$2.8million/year. For the year ended December 2015, the Authority incurred a loss of US$5,4 million including depreciation.

The Authority is dependent on income from Conservation Fees (i.e. entry fees to Parks etc.) that accounted for 39% in 2015 (average 34%/year), hunting (13% in 2015) and leases (10% in 2015, Table 15).

Although individual salaries remained low, staff costs in 2015 were $20,7 million which is 71% of total revenue raised (average 64%). This is unsustainably high and leaves very limited resources for operation (16%), marketing (1%) and administrative expenses (7%, Table 15).

The major reasons for the budget deficits in the past six years can be attributed to:

- Declining income from hunting – this has been exacerbated by the recent bans imposed on elephant trophy imports into the United States by US Fish Wildlife Service (USFWS) and the much-publicised death of *Cecil the lion* that had a negative effect on revenue generated from hunting.
- Government Grant – The Authority has not received meaningful funding from the fiscus despite requests made by management that non-revenue generating activities which are of national nature be funded by Government.
- The Authority failed to dispose of its ivory stock pile due to the continued ban on ivory trade by CITES. The ivory stock which the Authority is currently holding exceeds 80 tons.

Table 15: Statement of Comprehensive Income for period 2010 – 2015 and the year ended 31 December 2015 (extracted from 2015 ZPWMA Annual Report).

Revenue	US$ 2015	%	Average 2010 - 2015	%
Conservation Fees Land	$7,879,987	33%	$6,506,508	29%
Conservation Fees River	$1,409,160	6%	$1,136,041	5%
Accommodation	$1,720,640	7%	$1,904,477	8%
Annual registration	$507,211	2%	$722,847	3%
Permits	$1,476,176	6%	$849,916	4%
Service and Facilities	$307,692	1%	$152,616	1%
Law enforcement (fines etc.)	$224,657	1%	$215,591	1%

Revenue	US$ 2015	%	Average 2010 - 2015	%
Hunting income	$3,256,698	13%	$5,049,089	22%
Fishing permits	$561,797	2%	$941,833	4%
Leases and rentals	$2,434,676	10%	$1,880,258	8%
Parks product sales	$623,084	3%	$767,347	3%
Examinations	$116,000	0%	$70,873	0%
Projects	$349,864	1%	$248,614	1%
Other income/donations	$2,555,729	11%	$907,169	4%
Government grant	$716,000	3%	$1,141,119	5%
Total	**$24,139,371**			
Expenditure				
Operational costs	$4,801,815	16%	$5,146,091	20%
Staff costs	$20,766,023	71%	$16,311,677	64%
Marketing and promotions	$212,406	1%	$147,334	1%
Administration costs	$2,056,681	7%	$2,631,019	10%
Depreciation	$1,531,000	5%	$1,069,138	4%
Total expenditure	**$29,367,925**		**$25,305,258**	
Operating surplice/deficit	**-$5,365,082**		**-$2,810,962**	

The Authority receives considerable support from many local and international NGOs who undertake a variety of routine management activities e.g. supply and maintain artificial game water supplies, provide logistic support to law enforcement operations. This is in addition to the support provided by hunting operators that hold concessions in the Safari Areas.

6 STAKEHOLDER INVOLVEMENT IN LION MANAGEMENT AND CONSERVATION

There are several private sector initiatives that are directly or indirectly involved with lion management and conservation both inside and outside the Parks estate. These stakeholders are represented by companies from the consumptive and non-consumptive sectors of the industry.

6.1 BENEFICIARIES OF WILDLIFE BASED LAND USE

Various forms of wildlife based land use occur in Zimbabwe that benefit different segments of the community depending on the authority for the land. Table 16 summarises these broad categories. The Authority is the direct beneficiary from the use of wildlife in National Parks and Safari Areas while the Forestry Commission is the beneficiary in Forestry Areas. In terms of the Act, Communal CAMPFIRE areas are the primary beneficiaries where the income generated from hunting is shared between the Rural District Council and Community Wards (see below). Similarly, private conservancies and land owners are the primary beneficiaries.

Collectively, these different management regimes contribute to the overall conservation of the wildlife both inside and outside the Parks Estate, and is supported through the existing policy and legal framework that facilitates incentives to promote wildlife based land use.

Table 16: Direct beneficiaries from Wildlife Based Land Use

Land category	Direct Beneficiary
National Parks and Safari Areas	Zimbabwe National Parks and Wildlife Management Authority
Forestry Areas	Forestry Commission
Communal Campfire Areas	Rural District Council and Wards
Private Conservancies	Private Landowners

6.2 CONTRIBUTION OF THE PRIVATE SECTOR

A questionnaire was circulated to all safari hunting operations to gather data on:

- Area and land category where hunting takes place
- Payments in terms of concession fees
- Number of people employed
- Approximate value of investment in assets
- Approximate costs of the hunting operations
- Hunter days generated through various packages
- Indication of the prey base

Data from 18 companies that have been allocated lion on quota and offer these trophies as part of their hunting packages is summarised below (Table 17). These data indicate that

- The average hunting concession covers 1,590km^2 and generates $178,488 in concession fees annually.
- Each company on average employs 109 people of which 24 are seasonal staff (22%). Law enforcement staff make up 26% of the staff complement.
- On average, each company has invested approximately $1.3 million in fixed and moveable assets (buildings, tents, vehicles, equipment etc.).
- On average, each company incurs approximately $1 million in expenses annually, with staff wages (24%) and operating expenses (27%) forming the bulk of these costs.
- Lion safaris contribute approximately 9% (126 hunter days) to the 3-year average number of hunter days generated (1,405) with the bulk of hunter days generated from buffalo safaris (see below for more details on the financial significance of this contribution).
- On average, each hunting area supports 2,000 large mammals, 3,000 medium sized mammals and 6,000 small sized mammals. However, there are large differences between state, forestry, CAMPFIRE and conservancies areas. State areas tend to support more large animals (buffalo, giraffe) while conservancies support greater numbers of medium and small animals.
- Observations on the status of lion populations indicates that each area supports on average 5 prides of 7 animals (i.e. 35 lions) although there is a wide variation in these numbers with more prides occurring in the conservancies than on Forest and CAMPFIRE areas. In these areas, the operators report that lion are transient/migratory rather than permanent.
- All areas report incidents of human-lion conflict, including incidents of snared animals.

Table 17: Summary of 18 hunting company statistics where lion hunting occurs

Companies (N=18)	**Total**	**Average**	
Total Hunting Area (ha)	2,872,932	159,607	
Concession fee	$2,141,860	$178,488	
Number people employed			
Owner/Manager	65	4	3%
Administration	59	3	3%
Camp Maintenance	308	17	16%
Safari operations	295	17	16%
Professional Hunters	82	5	4%
Skinners	59	3	3%
Trackers	138	8	7%
Law enforcement	449	28	26%
Seasonal/Casual staff	379	24	22%
Average Staff employed/company		**109**	
Approximate Asset Value (US$)	**$21,557,610**	**$1,347,351**	
Major Expense Items			
Central Government Licenses:	$415,700	$25,981	3%
ZNWMA Fees:	$1,932,472	$128,831	13%
Community Development:	$525,378	$35,025	4%
Law Enforcement:	$1,319,562	$87,971	9%
Staff wages & Welfare:	$3,601,439	$211,849	24%
Administrative costs:	$1,870,267	$116,892	13%
Operating expenses:	$3,986,619	$249,164	27%
Management and Marketing costs	$661,974	$41,373	4%
Any other costs	$411,693	$25,731	3%
Overall costs	**$14,725,104**	**$922,818**	
Hunter days generated over 3 years			
Lion	2,137	126	9%
Leopard	4,565	269	19%
Buffalo	10,344	608	43%
Elephant	3,131	184	13%
Plains game	999	59	4%
Total Hunter days	**25,294**	**1,405**	
Prey base status			
Large mammals (Buffalo, Giraffe)	28,190	2,014	
Medium mammals (Eland, zebra, kudu, waterbuck etc.)	53,273	3,552	
Small mammals (Bushbuck, warthog, impala)	82,297	5,878	
Status of lion population			
Number of prides	71	5	
Average pride size	80	7	

Companies (N=18)	Total	Average	
Number of cubs	243	19	
Number Coalition males	89	7	
Monitoring of lion population			
Natural deaths	4	1	
Reports of Human-Lion Conflict	33	5	
Incidents of infanticide recorded	6	2	

6.3 CAMPFIRE COMMUNITY PROGRAMMES

The right to exploit and benefit from wildlife was extended to communal areas through granting of Appropriate Authority Status over their wildlife resources to Rural District Councils in 1982. The intention was to return rights of access to natural resources through legislative change, devolve responsibility and economic empowerment. The CAMPFIRE model focuses on three main criteria:

- Voluntary interest in participation by communities and their Rural District Councils (RDCs),
- Presence of wildlife populations capable of producing sustainable and economically significant revenues.
- Benefit sharing for local communities based on:
  - The number of animals harvested within a local community's area each hunting season.
  - The extent of wildlife habitat present within a local community's area annually.

Currently 58 Rural Districts have been granted the Appropriate Authority status to manage wildlife resources in their areas, however only 16 are actively engaged in some form of wildlife based land use (see Figure 5).

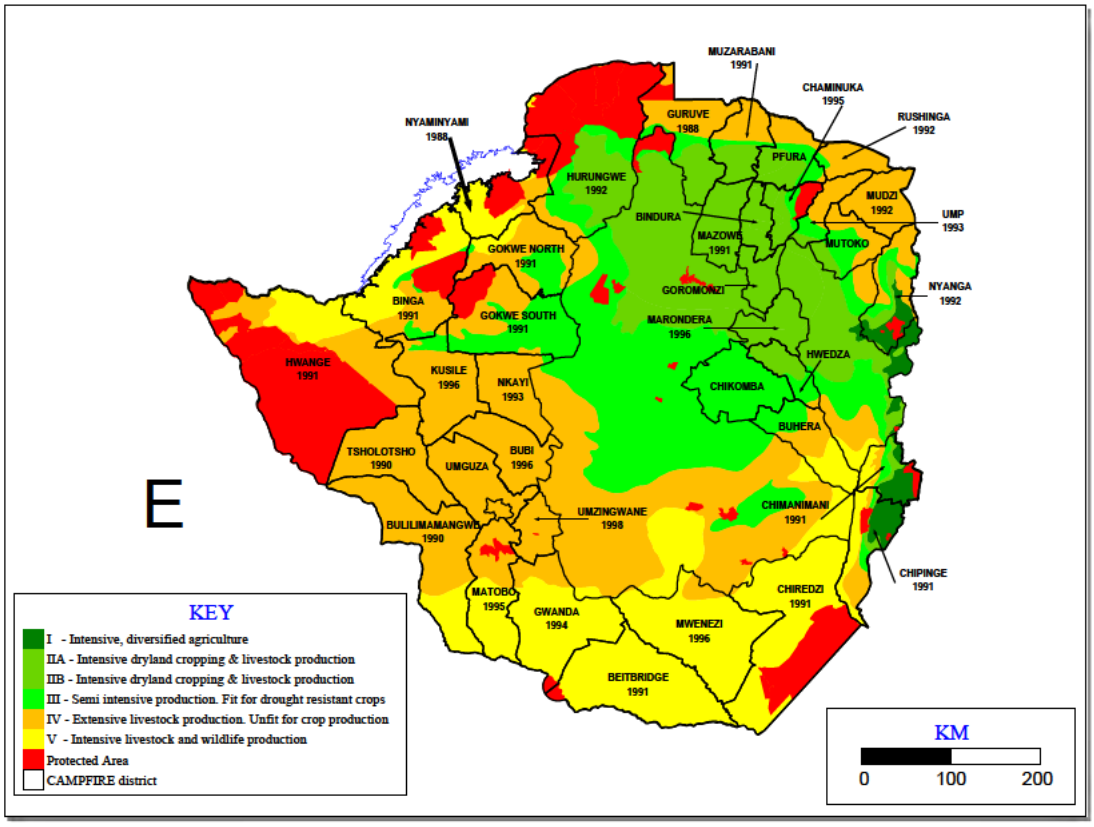


Figure 5: Map of Zimbabwe showing CAMPFIRE districts and year of establishment

The performance of ten key CAMPFIRE Districts is summarised below to illustrate the level of benefits that flow to RDCs, Wards and households, and the role that income from lion play in this process.

1. **OVERALL QUOTA ALLOCATION, UTILISATION AND INCOME GENERATION FROM KEY SPECIES: All Districts: 2010 - 2015**

	Elephant	Lion	Leopard	Buffalo	Hippo	Crocodile	Total
Quota	1,079	140	487	2050	602	471	
Offtake	655	45	193	908	270	305	
% Utilisation	61%	32%	40%	44%	45%	65%	
Total income N=6 years)	**$7,129,658**	**$240,000**	**$532,675**	**$2,263,150**	**$464,000**	**$441,903**	**$11,071,386**
Average/year	**$1,188,276**	**$40,000**	**$88,779**	**$377,192**	**$77,333**	**$73,651**	**$1,845,231**
Percentage	64%	2%	5%	20%	4%	4%	

The overall income generated over a 6-year period was US$11 million. An overall quota of 140 lions (average 23/year) were allocated to the CAMPFIRE programme over which 45 (32%) were utilised (8 per year). This generated US$240,000 or 2% of the overall income.

2. **SOURCE OF CLIENTS AND GROSS INCOME TO SAFARI OPERATIONS:2010 - 2015**

Origin of Clients	USA	Canada	South America	Europe	Asia	Middle East	Oceania	Africa	Total (N=6 years)
Total	**880**	**16**	**54**	**456**	**82**	**9**	**51**	**131**	**1679**
Percentage	51%	1%	3%	27%	5%	1%	3%	8%	
Total	**$8,624,059**	**$150,987**	**$543,003**	**$5,201,168**	**$550,062**	**$781,076**	**$394,208**	**$567,897**	**$16,812,459**
Average/year	**$1,462,508**	**$25,165**	**$90,500**	**$866,861**	**$91,677**	**$130,179**	**$65,701**	**$94,650**	**$2,802,077**
Percentage contribution	**51%**	**1%**	**3%**	**31%**	**3%**	**5%**	**2%**	**3%**	

Hunting clients from the USA are by far the most numerous (880 over 6 years) contributing 51% (or US$8.6 million) of the estimated US$16 million generated from hunting in CAMPFIRE areas from 2010 - 2015.

3. **INCOME TO DISTRICTS: 2010 - 2015**

	Hides (US$)	Trophy fees (US$)	Percentage of daily rate	Hunting concession fees	Photographic (lease fees/bed night levy)	Other (vehicle hire, grinding mill etc.)	Total	Average (N=6)
Total	$131,741	$10,618,127	$1,277,525	$862,721	$737,613	$731,218	$14,358,945	$2,393,158
Percentage	1%	74%	9%	6%	5%	5%		

The CAMPFIRE districts that benefit from hunting rely heavily on trophy fees (74%) as their primary source of income.

4. INCOME TO WARDS, VILLAGES AND HOUSEHOLDS: 2010 – 2015

Overall Income to CAMPFIRE Wards: 2010 - 2015						
	No Concessions	Area (ha)	Number Wards	Number Villages	Number Households	Gross Income
Total	**26**	**2,288,284**	**62**	**603**	**56,297**	**$5,946,370**
Income (n=6 YEARS)	**$228,706.55**	**$3**	**$95,909.20**	**$9,861.31**	**$105.6**	

Income generated at the District level is then disbursed to Wards. Since 2010, this is estimated to be approximately US$5.9 million. The available data shows that 62 wards representing 603 villages (or 56,297 households) received the equivalent of US$95,909/ward (or US$105/household).

These levels of income are not sufficient to make a significant impact at the individual level, and require that the Districts and Wards channel these revenues into activities that benefit the overall community. This is achieved through supporting several communal projects such as schools, clinics, water provisions etc.

5. DISTRICT EXPENDITURE AND COMMUNITY BENEFITS: 2010 - 2015

	Administration	Law Enforcement	Compensation	Management	Social Services	Other	Total
Total	**$2,486,268**	**$1,778,100**	**$67,600**	**$682,740**	**$1,084,779**	**$779,030**	**$6,878,517**
Average	**$414,378**	**$296,350**	**$11,267**	**$113,790**	**$180,796**	**$129,838**	**$1,146,420**
Overall costs	**$5,014,708**				**$1,084,77**	**$779,039**	
Percentage	**73%**				**16%**	**11%**	

At the District level, 73% of the revenues from hunting are channelled towards administration, law enforcement, compensation and general management while limited funds are used to support social services (16%).

6. WARD EXPENDITURE AND COMMUNITY BENEFITS

	Administration costs					Community Benefits				
	Meetings & Admin	Wages/salaries	Compensation schemes	Management activities	Project Management Costs	Social services	Food security	Direct cash benefits	Other	Total
Total	**$553,260**	**$815,639**	**$56,432**	**$312,178**	**$345,762**	**$2,468,216**	**$223,659**	**$216,077**	**$139,565**	**$5,302,709**
Overall costs	**$2,083,271**					**$2,907,952**			**$139,565**	
Percentage	**39%**					**55%**				

At the Ward level, where communities are directly involved, the tendency is to channel most the income towards community benefits (55%) rather than administration which is seen to be the responsibility of the local government. This means that the bulk of the income from hunting is used to support social services such as schools, clinics, irrigation schemes etc. where the impact at the community level (village, household) is far greater (Figure 6).



Figure 6: Bhemba Clinic in Ward 2 of the Tsholotsho Communal Area (top) and Masera Secondary School (Beitbridge, bottom) that are supported by funds generated through the CAMPFIRE programme

Lessons learnt

1. Quota utilisation of lion (32%) is low in CAMPFIRE areas, equating to 8 lion/year.

2. Trophy fees from key species (elephant, lion etc.) contributed $1,845,231/year to CAMPFIRE revenues:
    a. Elephant (64%) and buffalo (20%) are major contributors
    b. Lion and leopard contribute 7%

3. Income from the sale of safaris generate approximately $2,802,077/year
    a. Hunters from USA contribute 51% and Europe 31% of this income.

4. Income to Districts from a variety of wildlife related revenue streams is approximately $2,510,783/year:
    a. Trophy fees are responsible for 74% of this income, of which lion play a small role.
    b. Fees from photographic tourism are responsible for 5%.

5. Wards receive $5,830,244 (57%) from district trophy fees. These revenues are used to support a variety of social services that benefit a large proportion of the local community.

The cessation of import of lion (and elephant) trophies into the USA has had a significant impact on these revenue streams and consequently on the benefits reaching communities at the local level. These revenues cannot be replaced through alternative revenue streams.

7 Management and Administration of the Safari Hunting Industry in Zimbabwe

7.1 Performance of the industry

To fully account for earnings in the Hunting Sector, the Reserve Bank of Zimbabwe, in collaboration with all the relevant stakeholders, introduced the Tourism Receipts Accounting System (TRAS2) in January 2015. The TRAS2 is a web-based system which links Safari Operators, Zimbabwe Parks and Wildlife Management Authority, Taxidermists, Shipping Agents, International Marketing Agents and Reserve Bank for the purposes of authorizing hunts, capturing hunting data, monitoring hunting quota utilization and tracking hunted trophies.

On an annual basis, Exchange Control Division of the Reserve Bank of Zimbabwe attends the SCI Conventions to achieve the following objectives: -

1. To assess regional price differentials of same hunts at the SCI Convention and the reasons thereof;
2. To present Form TRAS2 systems updates to the users including international marketing agents;
3. To engage international marketing agents of sport-hunting (standardised international marketing agreements, payment arrangements and follow up on overdue export receipts);
4. To obtain relevant insights on governing of the hunting sector; and
5. To come up with an effective mechanism to fully account for export proceeds from the hunting sector.

7.1.1 Global earnings of the industry

The TRAS2 system was introduced in January 2014, and has since recorded a total of $44.6 million ($18.9 million in 2015 compared to $25.9 million in 2014) as shown in Figure 7. The figures are inclusive of daily rates, trophy fees and other incidental revenue. In line with other regional

countries offering safari hunting, the market is dominated by the USA (59%) and Europe (25%) with the remainder of the market taken by the Americas (Canada, Argentina etc.), Asia, Africa, Oceania and Africa (mostly South Africa). Appendix III illustrates the distribution of total hunting revenue by country of destination (Chitauro, 2016).

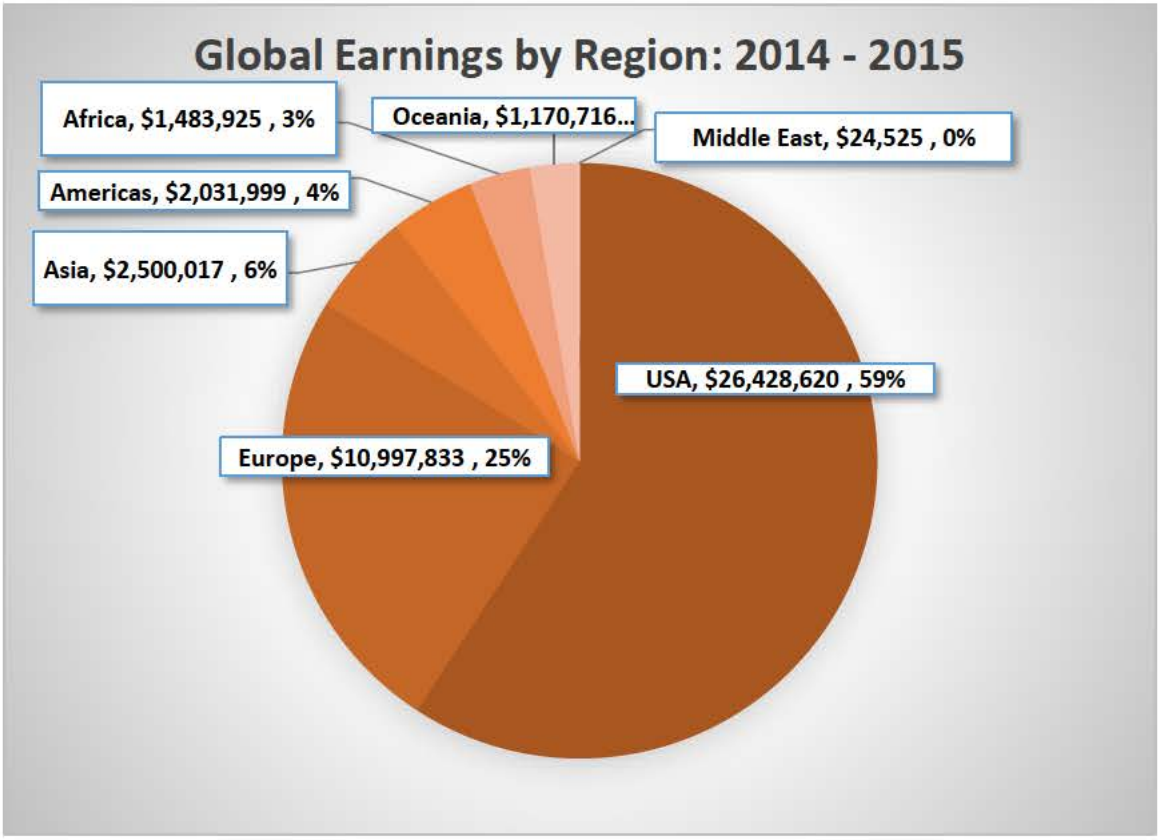


Figure 7: Breakdown of source of hunting income (2014 and 2015) from various regions in the world (adapted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2)

7.1.2 Quota allocation, Utilisation and Total Trophy Fees Earned

The total income from the sale of trophies in 2014 and 2015 is shown in Table 18. The income in 2015 (US$8.2 million) is less than that in 2014 (US$11.1 million) because of the import restrictions of elephant and lion into the USA.

Table 18 also provides data on the quotas allocated in 2015 and the number of level of utilisation. The complete list of species is provided in Appendix III (Chitauro, 2016). These data show that levels of utilisation for all species varies from 10 – 40% for most mammals and far less for birds etc.

Table 18: Summary of the revenue generated from the 11 most common species utilised for hunting, and the percentage utilisation in 2015 (adapted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2)

Species	2014	2015	Total	2015 Quota	Utilised	% Utilised
Buffalo	$2,528,559	$1,962,570	$4,491,129	1,635	482	29%
Elephant (Tusks)	$2,042,610	$1,447,090	$3,489,700	246	64	26%
Elephant (Tuskless)	$1,444,040	$229,860	$1,673,900	462	113	24%

Species	2014	2015	Total	2015 Quota	Utilised	% Utilised
Lion	**$630,950**	**$753,000**	**$1,383,950**	**82**	**49**	**59%**
Leopard	$714,100	$668,490	$1,382,590	530	151	28%
Zebra	$594,239	$555,744	$1,149,983	2,480	600	24%
Sable	$456,615	$309,260	$765,875	718	78	11%
Kudu	$341,092	$357,963	$699,055	2,503	289	12%
Waterbuck	$293,903	$256,133	$550,036	988	156	16%
Hippo	$310,321	$217,470	$527,791	303	83	27%
Impala	$277,198	$242,624	$519,822	8,594	1,261	15%
Other Species	$1,465,560	$1,287,845	$2,753,405			
Grand Total	**$11,099,187**	**$8,288,049**	**$19,387,236**			

7.1.3 Total trophy fees generated by land category

The ZPWMA allocated quotes to all owners and occupiers of land in terms of SI 26. Any person utilising wildlife on these properties is required to submit a TRAS2 form to process any export of trophies and other animal products. Approximately 262 companies/properties submitted returns in 2014 and 2015. From these data, it is possible to determine the income generated from trophy fees and daily rates per company. To protect the privacy of the individual companies, these data have been arranged to show the level of income generated by different land categories from trophy fees (Figure 8),

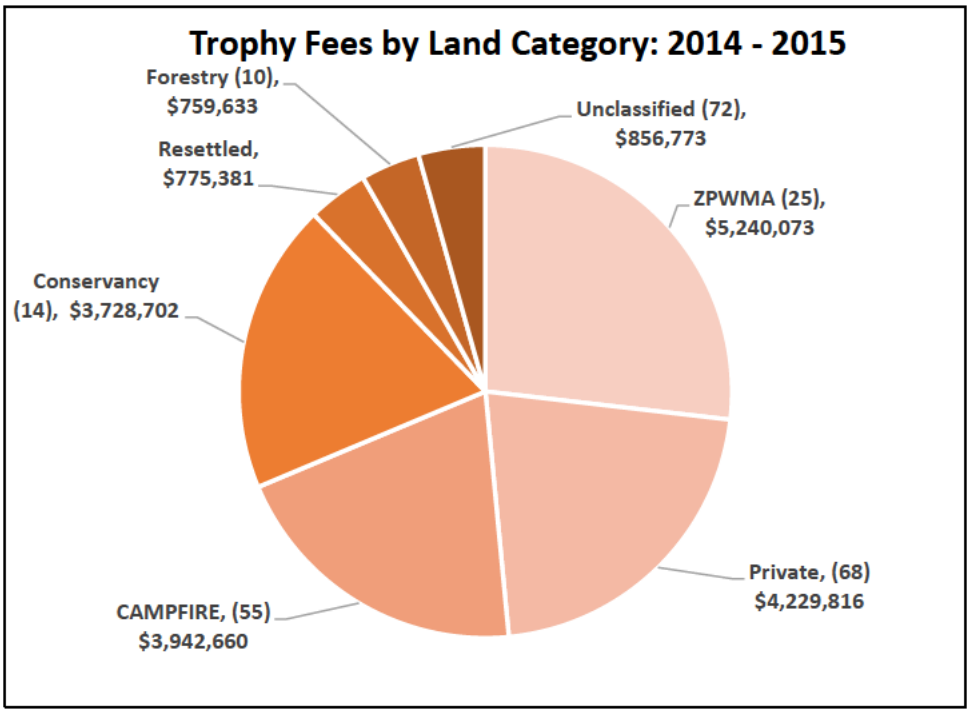


Figure 8: Hunting Trophy Fee Earnings by Land Categories (2014 - 2015). Note that from the description provided in the database, it was not possible to allocate some individual properties to a specific category. These have been recorded as unclassified (adapted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2).

Overall, approximately US$10.7 million was generated in 2014 and US$8.7 million in 2015 from the 62 species on offer. The ZPWMA represented by 25 properties that it either offers on tender to the private sector or operates as hunting areas itself generated the largest income from trophy fee sales

(US$5.2 million). The 14 Conservancies accounted for US$3.7 million while the 68 private properties are recorded as generating US$4.2 million. The CAMPFIRE areas (N=55) generated US$3.9 million.

Together with the income from daily rates (US$13,190,372 in 2014 and US$9,684,396 in 2015 (gross US$22,874,768), extracted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2), these funds are used to pay for several operational expenses including employment, law enforcement, administration and management.

7.5 Quota Setting Process

The process for quota setting follows procedures agreed to by all stakeholders (ZPWMA, 2014).

- Step 1: Allocate existing quota to each block/hunting area

The starting point for implementation of age-restrictions and adaptive quota management was to allocate existing lion quotas. This quota would then be managed adaptively in line with the age of lions hunted. In future, it is envisaged that fixed quotas for lions would fall away as quotas would be based on the age of lions hunted in the previous year.

- Step 2: Hunters complete and submit return forms and photos after each lion hunt

The data would be compiled into a database by a ZPWMA representative (currently Ms Roseline Mandisodza-Chikerema, Senior Ecologist, ZPWMA). Export permits for trophies will not be issued unless completed hunt return forms (all the required photographs and the first upper premolar) is provided to ZPWMA for aging and monitoring purposes. Furthermore, because the following year's quotas will be based on the ages of the lions hunted in the current year, operators must submit their lion hunt returns and photographs soon after the hunt. At the end of the season, all the teeth would be taken to a dentist to have x-rays conducted to allow for measurement of the size of the pulp cavity.

- Step 3: ZPWMA and Panel of experts assign an age value to each lion trophy

Lion trophies will be aged by ZPWMA, with input from lion scientists and representatives from the hunting industry at a trophy aging session. This is conducted at the end of each hunting season.

- Step 4: Calculate the next years' quotas based on a points system for the ages of lions hunted

A quota setting meeting is held where lion quotas are established for each area based on the age of lions hunted in those areas the year before. This programme commenced in 2014, and so the ages of lions hunted in 2014 will affect the lion quotas in 2015. Table 19 summaries the trend in lion quota allocations since 2002 while Table 12 provides a detailed overview of the lion trophies taken in 2015.

Table 19: Summary of lion quota allocations and offtake since 2002 (Data provided by ZPWMA)

Year	Lion Allocated Quotas	Female Offtake	Male Offtake	% Utilisation
2002	126	22	49	56%
2003	138	5	11	6%
2004	155	4	9	8%
2005	108	3	20	21%
2006	124	1	17	14%

Year	Lion Allocated Quotas	Female Offtake	Male Offtake	% Utilisation
2007	117	0	9	7%
2008	90	0	17	18%
2009	111	0	9	8%
2010	98	12	30	43%
2011	121	20	38	48%
2012	101	18	27	44%
2013	101	1	34	34%
2014	101	0	37	26%
2015	82	0	49	60%
2016	81	0	33	41%

Table 20: Analysis of lion trophies taken on various properties in 2015

Hunting Area Name	Sex	Killed Wounded	Grid Ref	Date Shot	Trophy Size
Sapi Area	M	KILLED	35l0783	03/06/2015	
Matetsi Safari Area - Unit 3	M	KILLED	307551	05/04/2015	61.31
Antoinette & Antoinette Extension	M	KILLED	187159	02/07/2015	26 7/16"
Tsholotsho District Area 2-South	M	KILLED	S1926181 E02652250	27/10/2015	25 6/8 inches
Hurungwe Safari Area - Rifa	M	KILLED	35K178113	10/05/2015	24.5
Deka Tail	M	KILLED	651 480	10/04/2015	60.38 cm
Hurungwe Safari Area - Nyakasanga	M	KILLED	s15.56.457 e029.15.584	07/06/2015	26
Msaise	M	KILLED	VN204700	14/05/2015	23
Mapari	M	KILLED	VN798124	09/06/2015	23SCI
Ngamo/Sikumi	M	KILLED	456923	09/05/2015	
Deka Safari Area	M	KILLED	278493	26/06/2015	61.5
Mbire (Guruve) South Area 2	M	KILLED	919056	09/08/2015	25.3
Bubye Valley Conservancy	M	KILLED	0194090 7625410	21/02/2015	25"
Bubye Valley Conservancy	M	KILLED	9337	29/03/2015	26"
Bubye Valley Conservancy	M	KILLED	31129	07/04/2015	25
Woodlands Farm	M	KILLED	644972	22/05/2015	25"
Bubye Valley Conservancy	M	KILLED	35K 453 159	10/05/2015	23.625
Bubye Valley Conservancy	M	KILLED	36K 908 852	25/04/2015	25"
Chewore Safari Area - North	M	KILLED	TT015643	05/06/2015	25
Bubye Valley Conservancy	M	KILLED	36K 227 593	12/05/2015	26"
Matetsi Safari Area - Unit 4	M	KILLED	4.05E+12	09/06/2015	24
Matetsi Safari Area - Unit 5	M	KILLED	865505	09/06/2015	25.25
Gunundwe	M	KILLED	822094	11/06/2015	
Bubye Valley Conservancy	M	KILLED	36K 004 971	24/06/2015	25.5625

Hunting Area Name	Sex	Killed Wounded	Grid Ref	Date Shot	Trophy Size
Bubye Valley Conservancy	M	KILLED	942 151	25/06/2015	12
Kusile District Area 1	M	KILLED	S185604.9 E0271547.4	02/07/2015	
Mokore Ranch	M	KILLED	VN110030	15/07/2015	15"
Bubye Valley Conservancy	M	KILLED	36K 229 607	29/07/2015	26"
Bubye Valley Conservancy	M	KILLED	191 623	25/07/2015	27.0625
Nyaminyami District Area 2 (Omay)	M	KILLED	657019PM	18/07/2015	24 1/8"
Matetsi Safari Area - Unit 5	M	KILLED	862 451	15/07/2015	25 8/16 inches
Matendere	M	KILLED	781021	26/07/2015	23.875
Matetsi Safari Area - Unit 1	M	KILLED	740726	13/08/2015	25
Bubye Valley Conservancy	M	KILLED	213 602	15/08/2015	15
Sango	M	KILLED	62691	23/08/2015	23.125
Sango	M	KILLED	320548	27/08/2015	
Dande Safari Area	M	KILLED	945352	13/10/2015	24in
Hurungwe Safari Area - Rifa	M	KILLED	35k062038	30/09/2015	25.25
Bedford	M	KILLED	190429	06/09/2015	
Ngamo/Sikumi	M	KILLED	456919	07/09/2015	
Bubye Valley Conservancy	M	KILLED	206 622	23/09/2015	26"
Hammond	M	KILLED	35k880103	17/10/2015	23.375
Kazuma/Panda Masuei	M	KILLED	s18.44144 & E025.64434	09/10/2015	
Nyaminyami District Area 1 (Omay)	M	KILLED	PM453354	13/11/2015	26"
Chewore Safari Area - South	M	KILLED	ST967260	25/10/2015	
Riverside Ranch	M	KILLED	35k227702	31/10/2015	24.78
Matetsi Safari Area - Unit 6	M	KILLED	18.06.55.68.25.22	03/12/2015	
Chewore Safari Area - South	M	KILLED	QN975310	06/12/2015	
Sapi Area	M	KILLED	Mtawatawa	11/06/2015	24"

7.6 POINTS SYSTEM FOR ADAPTIVELY MANAGING LION QUOTAS IN ZIMBABWE

The points system used to adaptively manage lion quotas has been developed following similar systems that have been implemented in Tanzania and northern Mozambique. The systems that are in place in Tanzania and Niassa differ slightly, but both lion quotas are set per the age of the lions harvested during the previous hunting season (Begg and Begg, 2008; Tanzania Wildlife Division 2013). The Tanzanian system is more punitive with significant quota reductions, trophy confiscation and fines for non-compliance, whereas the Niassa system is more accommodating but nevertheless can result in quota reductions if five-year-old lions are hunted. The latter was aimed at a means of accommodating the difficulty of telling five-year-old lions apart from four year olds.

After reviewing the Tanzanian and Mozambican age restriction systems and debating possible models for application in Zimbabwe, an adaptive quota management system for lion hunting based on the ages of lions hunted was agreed on in July 2013 in Harare, Zimbabwe, during a meeting hosted

by the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) and an independent non-governmental conservation organisation. The approach adopted by Zimbabwe recognises four as opposed to three key age categories (Table 21).

Table 21. Proposed points system for lion age restrictions and quota setting in Zimbabwe

	≥6 years	**No trophy**	**5 years' old**	**4 years' old**	**<4 years**	**Failure to submit hunt return/incomplete hunt returns**
For quotas of 3/more	4	3	3	2	-3	0
For quotas of 2	4	3	3	2	0	0
For quotas of 1	6	3	3	2	0	0
Quota setting process	These points are added up and divided by 3 to yield the quota for next year					

During 2013, operators were requested to submit hunt returns and photos as a trial run to get the system up and running. In 2014 operators were requested to do the same but were informed that the age of the lions hunted in 2014 would determine their lion quotas in 2015. The 2015 lion hunt results would thus also determine the 2016 quota. The key distinction of the Zimbabwean system is that the quota will not be affected if they hunt animals that are five years old. This position was adopted after considering various the population models that suggested that the hunting animals of five years of age or older is predicted to be comparatively safe from a population perspective (Whitman et al. 2007). Moreover, after reviewing aging techniques, the consensus was that professional hunters could be distinguish between lions that are five or above. The system therefore rewards operators with increased quotas if they hunt animals of six years and older, but it does not penalize them if they hunt animals of five years. Neither are they penalised if they do not shoot a lion that they have on quota, however, the quotas will be reduced if they hunt animals younger than five years or if they failed to complete hunt returns.

Lions are aged by triangulating multiple different aging characteristics, including:

- The degree of facial scarring;
- The teeth colour and degree of wear;
- The mane development (particularly regarding the shape around the ear and the mohawk);
- Through post mortem analysis of the width of the pulp cavity of the second premolar (which becomes narrower with age).

7.6.1 Results of the Adaptive Lion Quota Management System: 2013 to 2016

In 2013, only 28% of the lions hunted were 5 years or older, in 2014 that figure had risen to 49% and in 2015 to 77.3% (Figure 5). The proportion of lions hunted that were less than 5 years of age dropped overall between 2013 and 2015 (Figure 9).

In 2015 the Zimbabwe national lion hunting quota was set at 82 lions. Of this 82, only 49 were hunted in 2015, and based on the resultant score from aging the trophies, and the fact that operators chose not to hunt lions of inadequate age (see Figures 9, 10 and 11), the recommended quota for 2016 was set at 81. In 2015 there was a marked increase in the age of lions hunted. Notably, only one lion of <4 years of age was hunted and the large majority of lions were 5 years or older (Figure 9).

As was agreed upon at the 2013 lion management meeting in Harare, the CAMPFIRE areas in which lions occur are currently exempted from the age restrictions. This approach was adopted as a means of ensuring that impoverished communities obtain the opportunity to benefit from the presence of lions, recognising the potential negative impacts the species has on the livelihoods of livestock farmers.

Using these figures and estimating the average value of a lion safari at approximately US$ 80,000 then a 50% offtake would generate approximately US$ 2,800,000 annually. If management costs are approximately $150 km^2, then the lion safaris alone can support 18,600 km^2 of wildlife habitat in Zimbabwe.

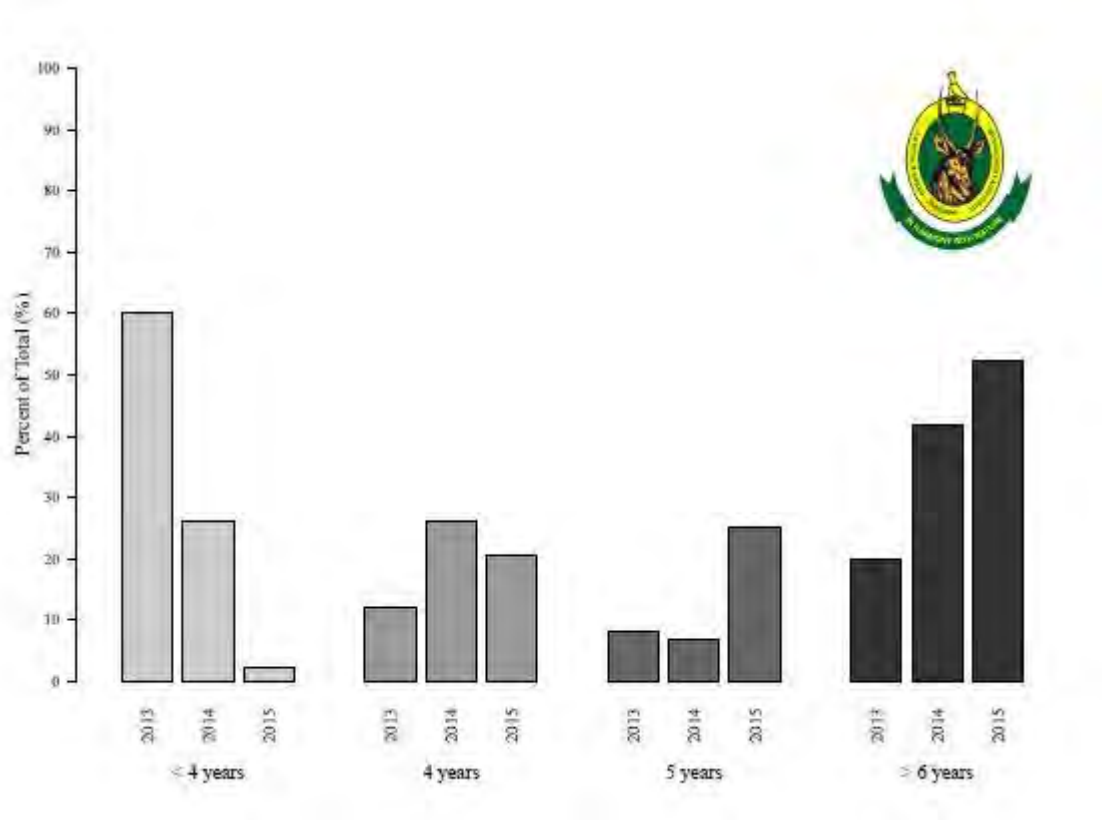


Figure 9: The percentage of lions hunted in each age class in 2013, 2014 and 2015 in Zimbabwe.

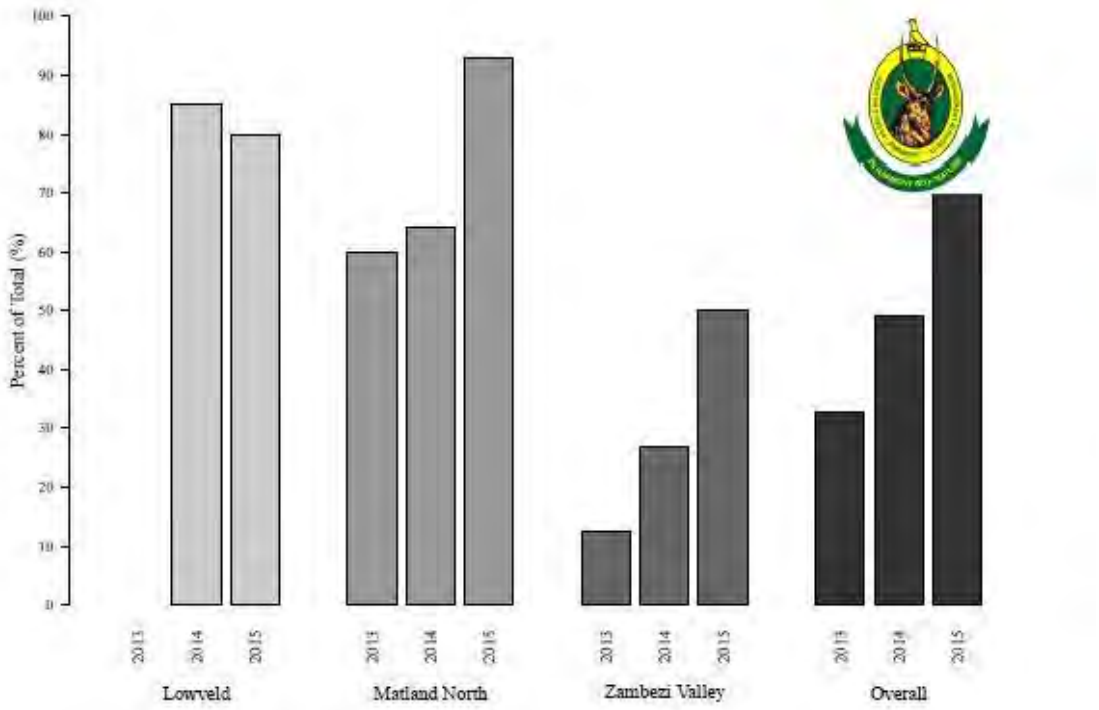


Figure 10: The proportion of lions hunted that were 5 years or older in the three main lion-hunting areas of Zimbabwe.

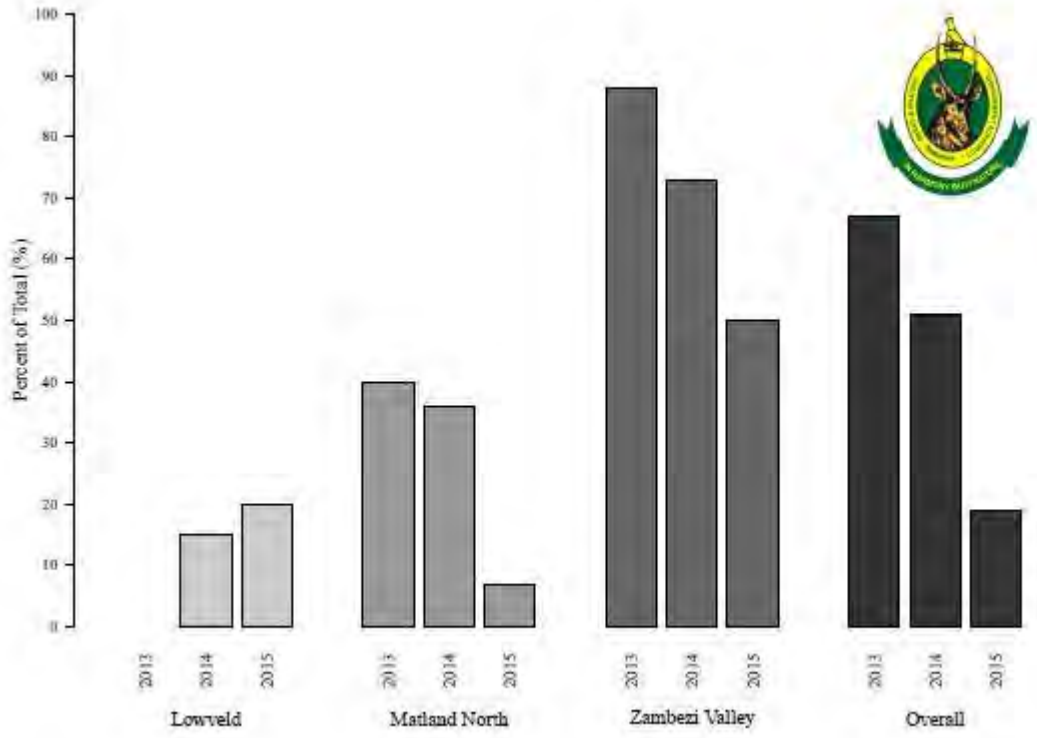


Figure 11: The proportion of lions hunted that were less than 5 years of age in the three main lion-hunting areas of Zimbabwe.

7.6.2 Case study: Safari Hunting surrounding Hwange National Park

The Hwange National Park is surrounded by hunting areas that fall under the Authority, Forestry Land, Private Land and Communal Land. The ZPWMA is responsible for setting and administrating quotas in conjunction with stakeholders for the safari areas, forestry areas, communal lands and private properties.

The Matetsi Safari Area to the north of Hwange National Park was established in the 1970s when several unsuccessful private sector mixed faming properties were expropriated, compensated and the resultant block of land turned over to safari hunting – a largely untried venture at that time on a large scale. An intensive monitoring system was set in place to gauge the effectiveness of the scheme and this continues to this day (Crossmary et al. 2013, Figure 12). The seven concessions (six given over to safari hunting) are leased on five year terms and concessionaires pay a 5 year "right to lease" fee, an annual rental, a fixed quota fee (payable if animals are shot or not) and a supplementary quota fee which allows additional animals to be bought as per need.

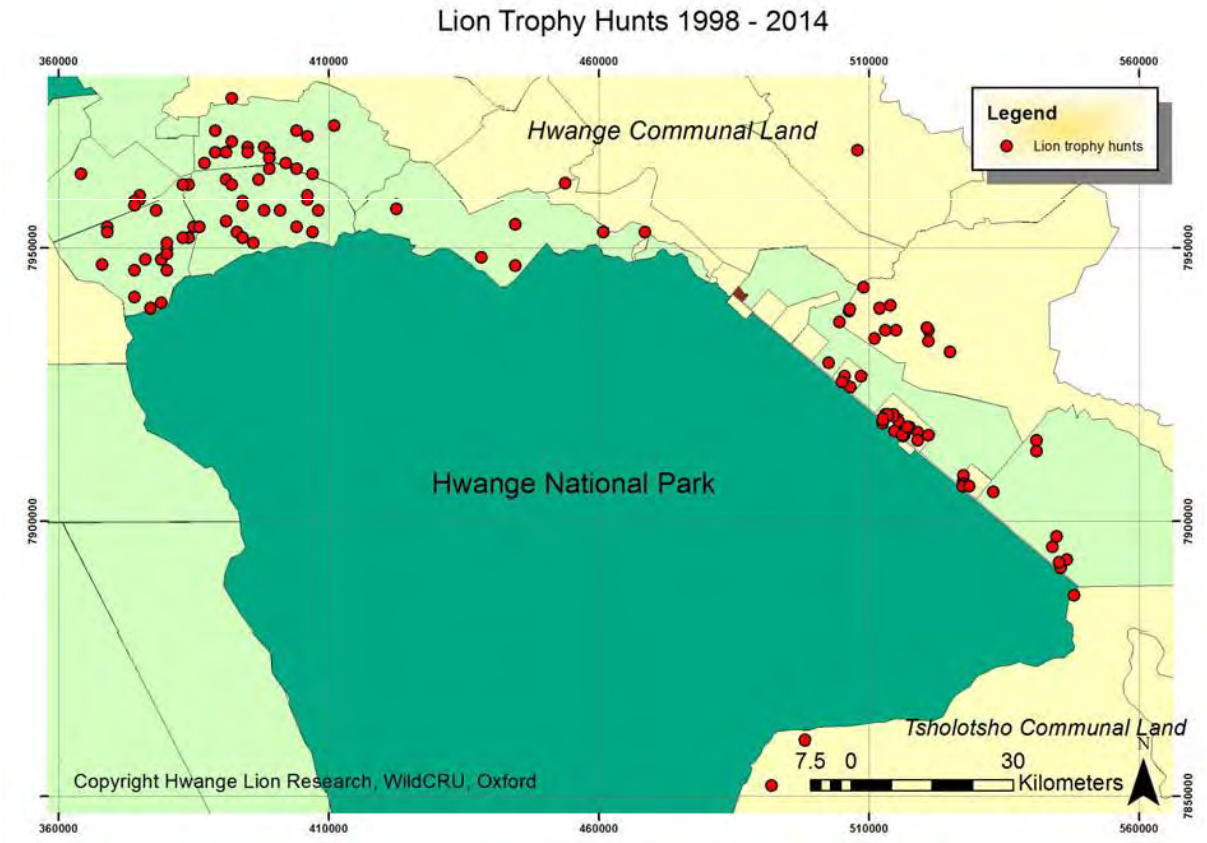


Figure 12: Record of where lion have been hunted on the land surrounding the Hwange National Park since 1998 (data extracted from the Hwange National Park Management Plan).

8 THREATS AND MITIGATION

The consensus of the scientific and animal welfare community is that the populations of lion in Africa has declined by 43% in the last two decades, with the greatest declines having occurred in west Africa. The exception to this are the populations of southern Africa, notably South Africa, Namibia, Botswana and Zimbabwe that are home to 24- 33% of the overall population has increased (Funston et. al. 2016).

Nonetheless, as is the case in other range states, the greatest threats to lion in Zimbabwe are from habitat loss, snaring and retaliatory killings where livestock are involved.

8.1 HUMAN-LION CONFLICT

The main source of illegal killing of lions is a result of Human-Lion conflict. The human population of Zimbabwe has increased since 1960 (estimated at 13 million). There is considerable pressure to convert land to agro-pastoral production, and the pressure is expected to increase. It is not unexpected therefore that the incidence of Human-Lion conflict will increase. ZPWMA records show that 200 attacks occurred on humans and 150+ on livestock (cattle, goats, sheep, dogs etc.) were killed in 2015 (see Table 13 above).

Retaliation for these livestock losses is usually done poisoning or hunting. The exact number of lions killed in this way is difficult to assess, but may number over 50/year. These indiscriminate killings pose the most significant threat to the species, and is of major concern to the management authorities. For example, the Area Manager for Hwange National Parks reported that 6 lions were killed on the Hwange National Parks boundary in 2016, and the Authority responded to several problem animal attacks on livestock.

In accordance with the Parks and Wildlife Act of 2001 when a lion attacks a human or kills livestock, it shall be eliminated. However, despite the numerous incidents reported across the country, less than 10 lions are killed through official "problem animal control" (PAC).

8.2 HABITAT LOSS

Zimbabwe supports substantial populations of lions outside of its protected areas and extensive conservancies. Moreover, despite its expanding human population, many of the protected areas are still intact however, the threat to lions from habitat loss exists in the Sebungwe and the South East Low Veld where the fragmented nature of the protected areas is compounded by an increasing human and livestock populations surrounding these areas. In these areas, habitat loss, reduction in prey populations and killing of problem lions are the major threats to long term lion survival.

Due to the large size of the protected area system in the Zambezi Valley and North West Matabeleland, threats are limited to lion range which extends into adjacent settled areas. The huge natural prey base in these protected areas, reduced killing of problem animals associated with lions preying on livestock in adjacent settled areas.

The potential and real loss of habitat and the fragmentation of range and conflicts with people in the absence of effective incentive mechanisms to maintain such habitat is probably the second greatest threat to lions after retaliatory killings. Increasing livestock numbers is reducing the available habitat in buffer areas adjacent to the protected areas, and increasing the incidents of human-lion conflicts. Lions are being more and more regarded as a liability and economic cost to rural communities. Reversing this trend is difficult under normal circumstances, and this has been made that much more difficult with the cessation of lion hunting. Integrating income from lions into rural economies, and demonstrating that lions contribute to the welfare and development of people is regarded as one strategy to mitigate against this. The involvement and empowerment of rural people in natural resource management through the CAMPFIRE programme that strives to provide economic and financial incentives through sustainable use, is one of the main driving forces behind changes in attitudes towards wildlife in communities where lion-livestock conflicts occur.

8.3 ILLEGAL TRADE IN LION PRODUCTS

Very few lions are poached in Zimbabwe (not to be confused with retaliatory killings). Records, mainly from anti-poaching reports, are for impoundment of body derivatives such as skins, teeth/claws, body

fats and bones. These may be sought after for local traditional medicinal use. Poaching mainly occurs along the boundaries of the protected areas where lions are incidentally snared as non-target prey.

The illegal trade in lions and their products (i.e. bone trade) is very insignificant. There are no records of people found in possession of illegally acquired lion specimens in Zimbabwe, and anyone found in possession of illegally acquired lion specimens is required to pay a fine US$5000 or faces a mandatory jail sentence. On conviction for lion poaching, courts may ask the accused to pay a compensation fee of US$20 000.

8.4 BUSHMEAT POACHING

Poaching for bushmeat is an important livelihood component of rural communities in Zimbabwe and a vast literature exists on this subject (see Lindsey et. al. 2015a and 2015b). Poverty stands as the major driver of illegal hunting, and the livelihoods of illegal hunters have been augmented considerably through revenue generated from bushmeat sales. Illegal hunters use bushmeat both for supplementing household protein and for economic gain.

Poaching for bushmeat does not seem to have impacted directly the overall lion's status in Zimbabwe, but more research is needed to fully understand its impact on lion. However, lions are often inadvertently caught in snares set for animals targeted by bushmeat poachers. Where possible, lions caught in snares are captured and treated (Figure 13).





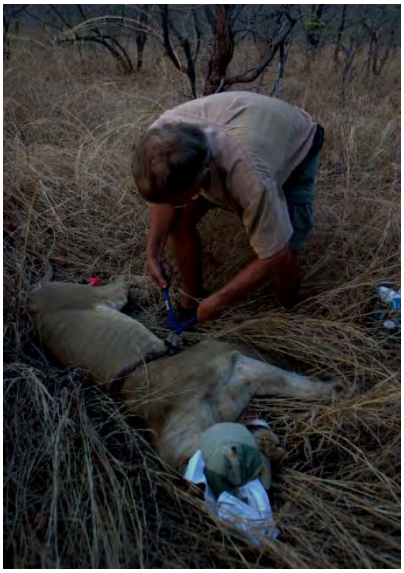




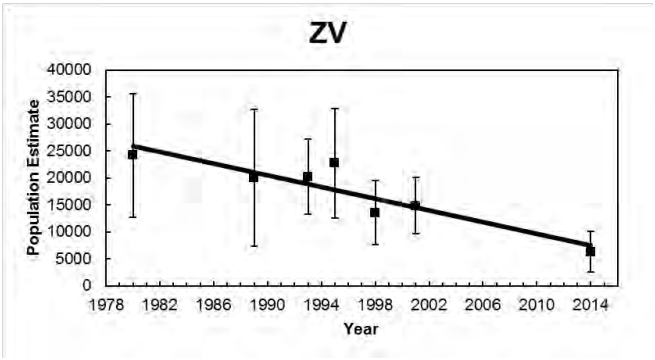
Figure 13: Young lioness being treated by the Victoria Falls Conservation Trust after a snare was removed from around the chest (Source: S. Edwards)

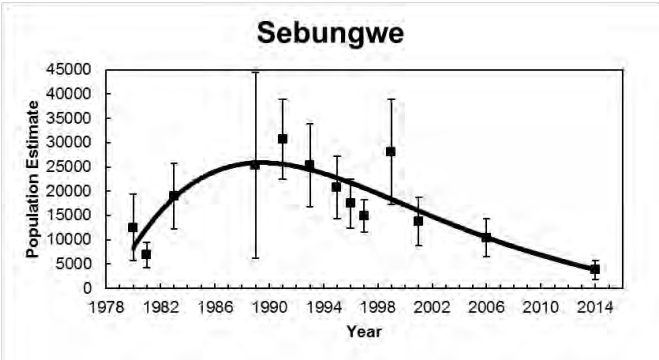
8.5 PREY ABUNDANCE

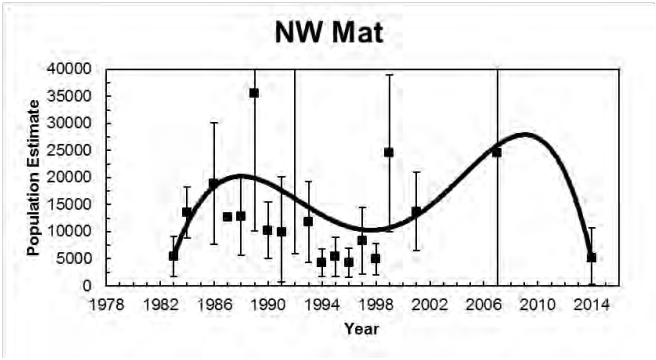
The extent to which bushmeat poaching outside of the Parks Estate is depleting lion's prey is not known. Prey abundance is still high in all protected areas where lions occur, and as abundance of prey species is highly correlated with lion density (Hayward et al 2007), data on the main prey species for lion, extracted from the 2014 aerial surveys of elephants and other large herbivores (Dunham et. al., 2015, 2015a, b, c, d) are shown in below (ZV = Zambezi Valley, NW Mat = North West Matabeleland).

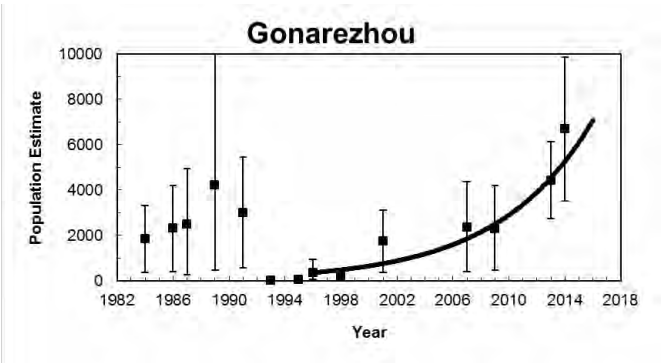
The overall long term trends show that most population status of most prey species has declined in recent years. There are many possible explanations for these declines, but probably the most critical factor has been droughts, especially that experienced in 2005.

Buffalo

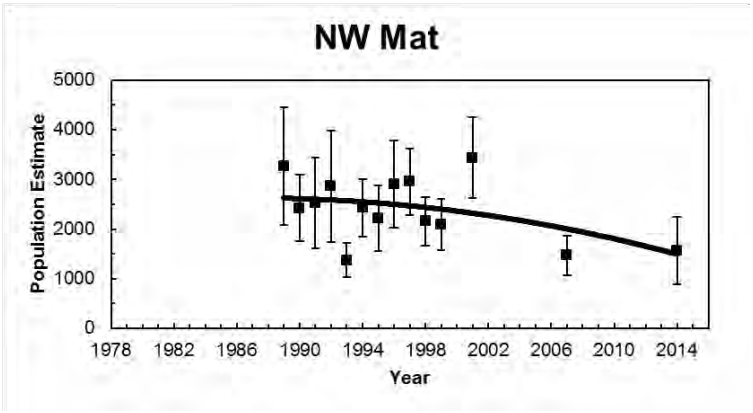

ZV
Population Estimate
40000
35000
30000
25000
20000
15000
10000
5000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

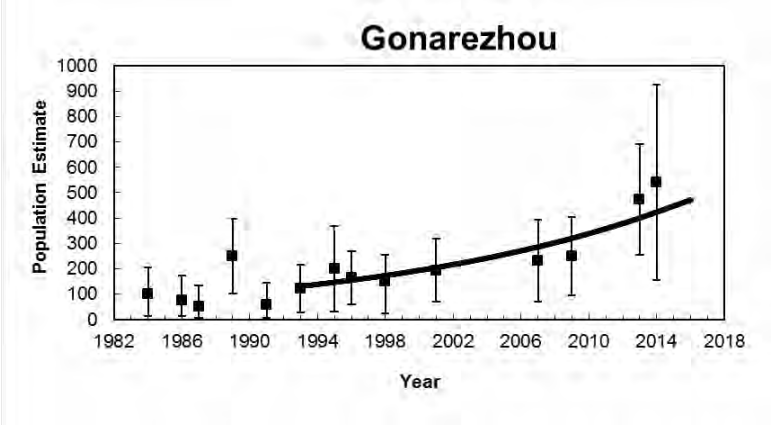

Sebungwe
Population Estimate
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


NW Mat
Population Estimate
40000
35000
30000
25000
20000
15000
10000
5000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

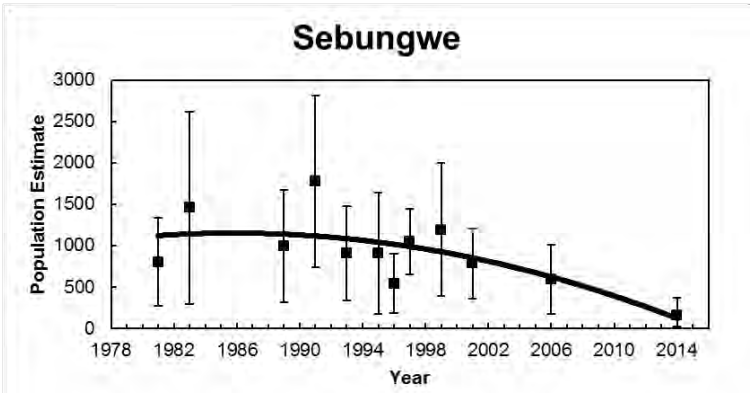

Gonarezhou
Population Estimate
10000
8000
6000
4000
2000
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

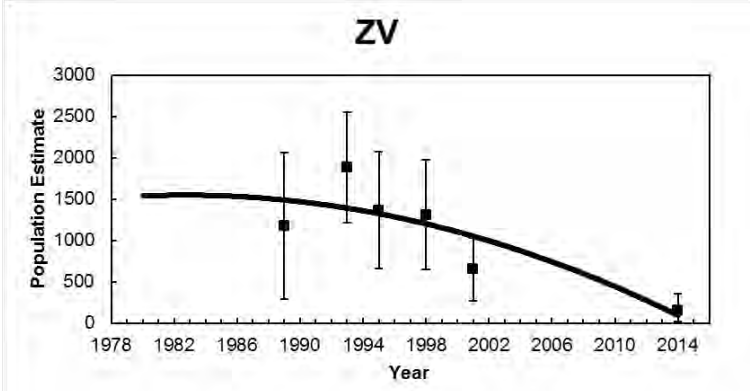
Giraffe

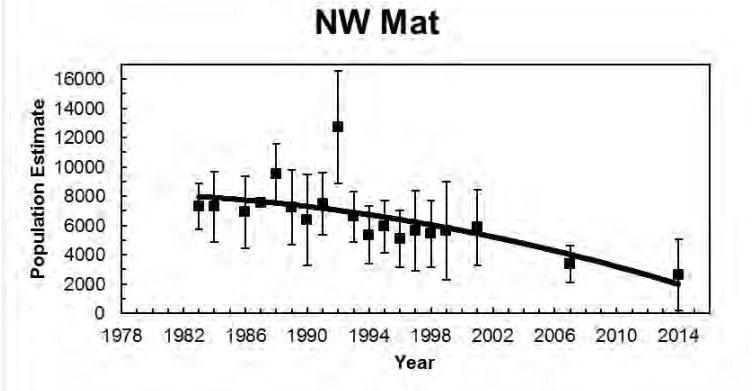

NW Mat
Population Estimate
5000
4000
3000
2000
1000
0
1978
1982
1986
1990
1994
1998
2002
2006
2010
2014
Year

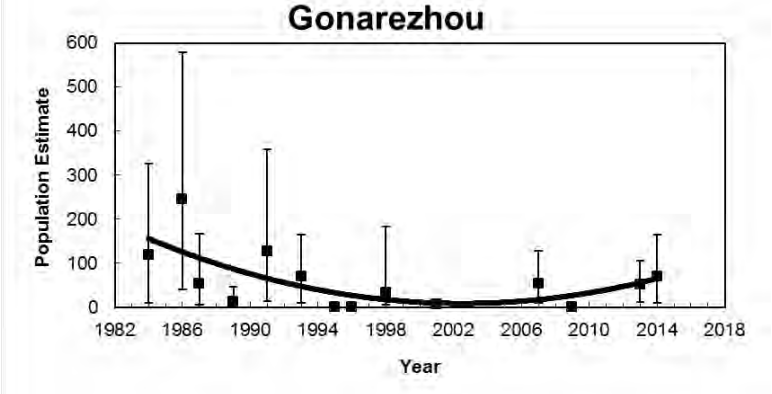

Gonarezhou
Population Estimate
1000
900
800
700
600
500
400
300
200
100
0
1982
1986
1990
1994
1998
2002
2006
2010
2014
2018
Year

Sable

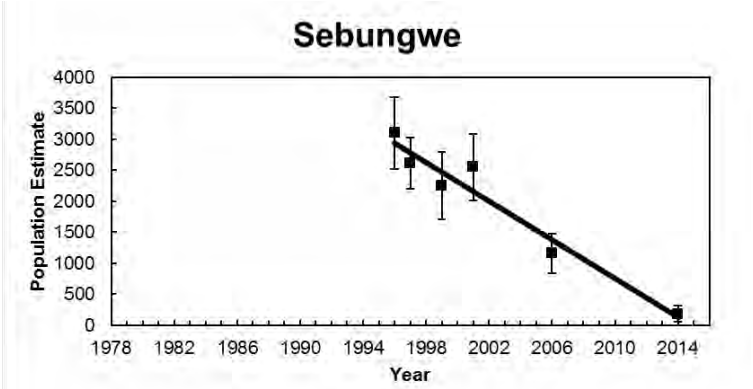

Sebungwe
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

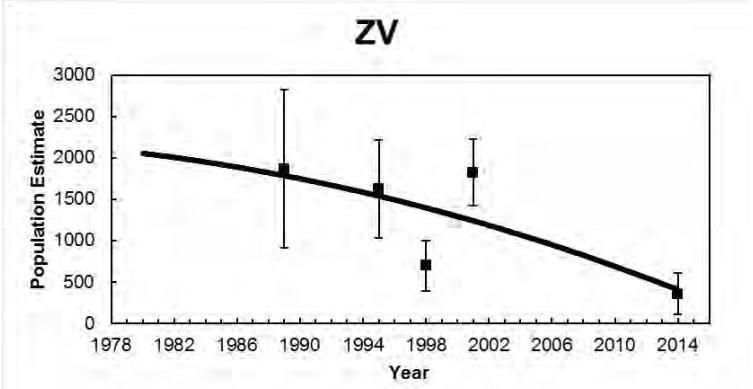

ZV
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

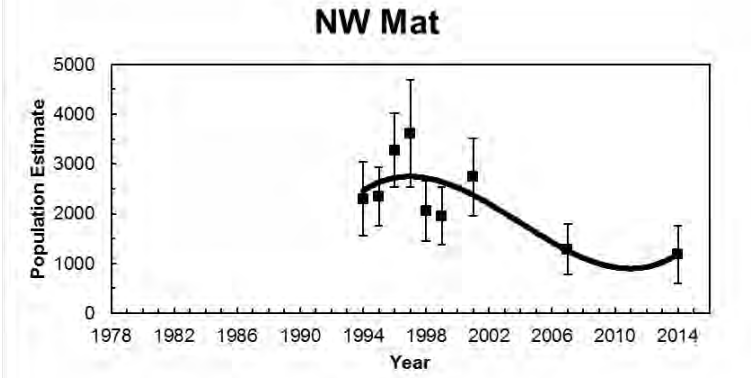

NW Mat
Population Estimate
16000
14000
12000
10000
8000
6000
4000
2000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

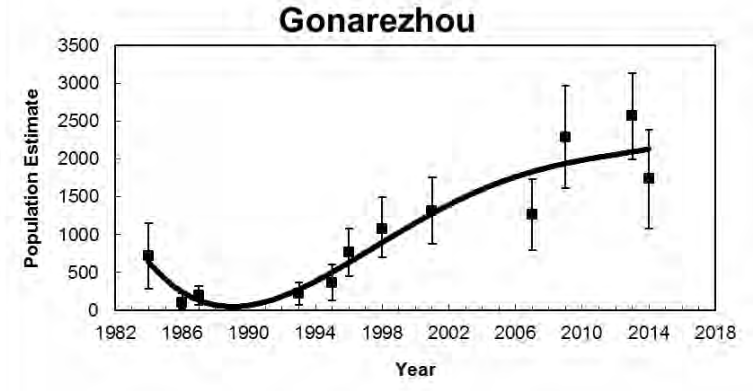

Gonarezhou
Population Estimate
600
500
400
300
200
100
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

Kudu

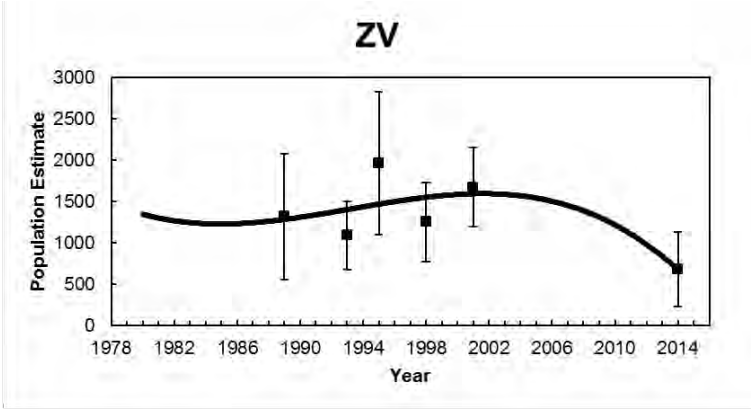

Sebungwe
Population Estimate
4000
3500
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

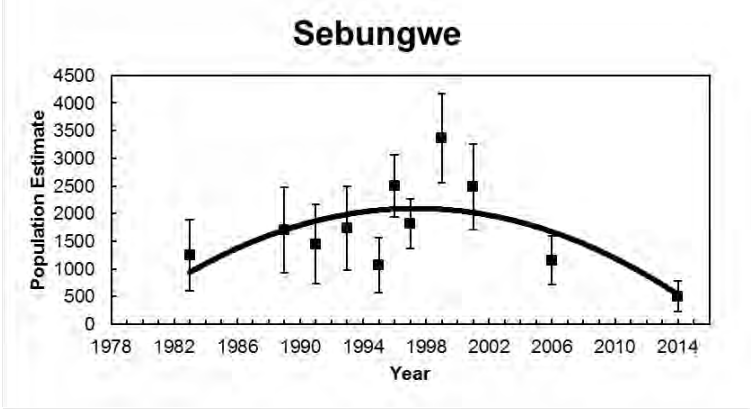

ZV
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

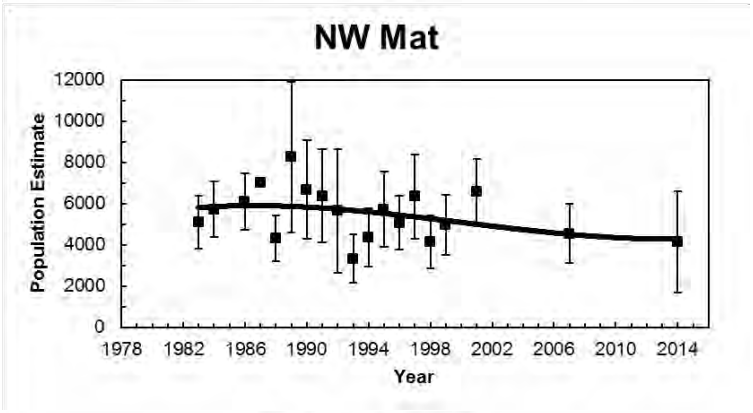

NW Mat
Population Estimate
5000
4000
3000
2000
1000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

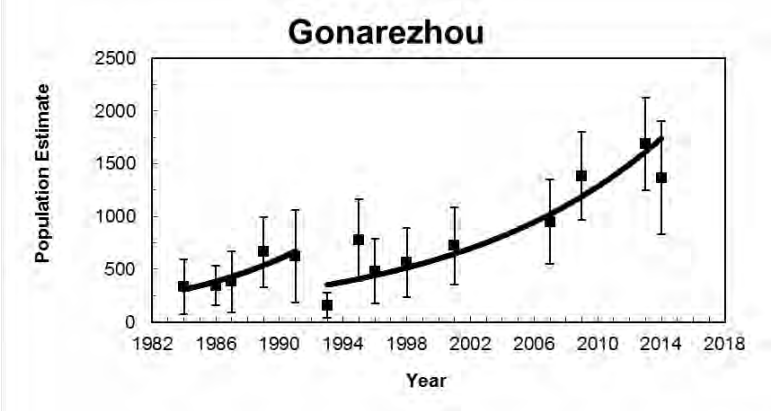

Gonarezhou
Population Estimate
3500
3000
2500
2000
1500
1000
500
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

Zebra

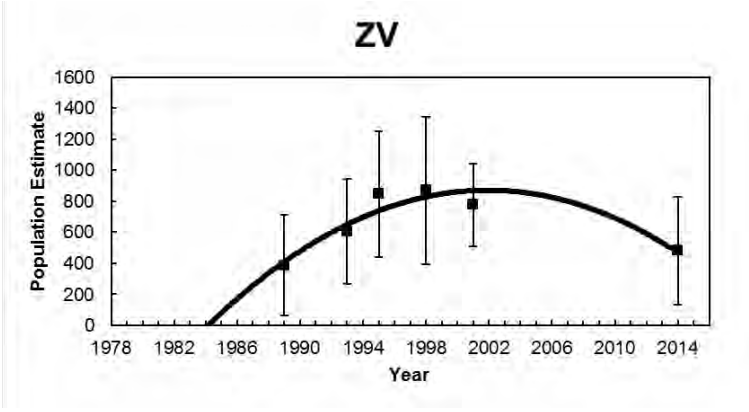

ZV
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

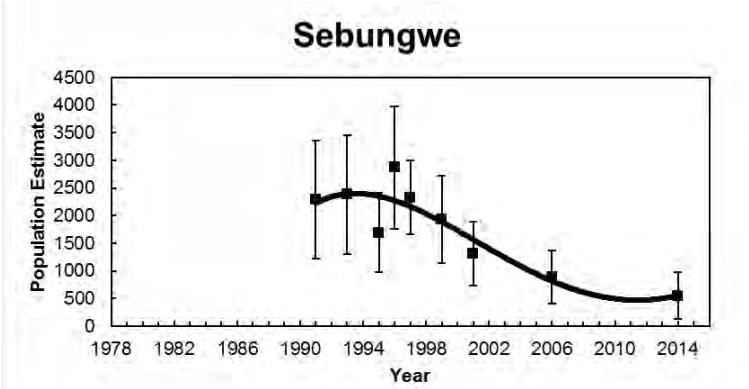

Sebungwe
Population Estimate
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

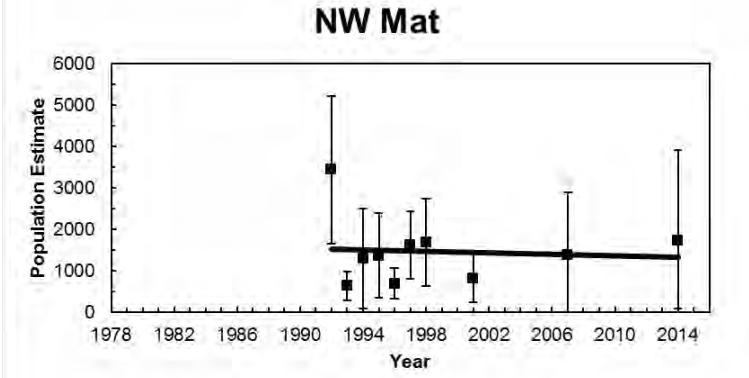

NW Mat
Population Estimate
12000
10000
8000
6000
4000
2000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

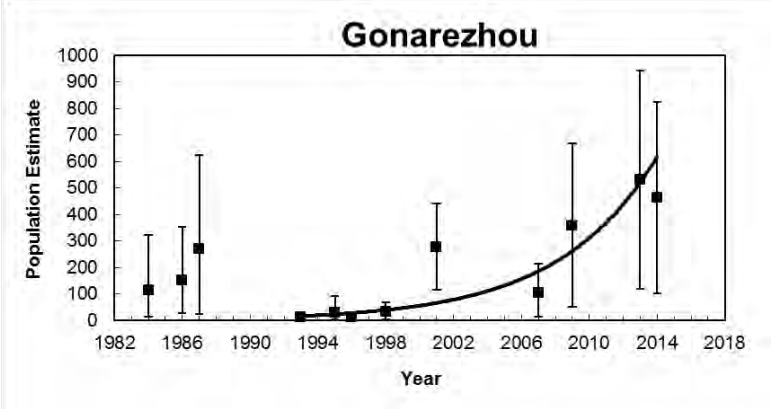

Gonarezhou
Population Estimate
2500
2000
1500
1000
500
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

Waterbuck


ZV
Population Estimate
1600
1400
1200
1000
800
600
400
200
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


Sebungwe
Population Estimate
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


NW Mat
Population Estimate
6000
5000
4000
3000
2000
1000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


Gonarezhou
Population Estimate
1000
900
800
700
600
500
400
300
200
100
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

9 ASSESSMENT OF THE ENHANCEMENT AND NON-DETRIMENT FINDINGS

The assessment of the enhancement and non-detrimental findings for lion in Zimbabwe is presented here using the "IUCN SSC GUIDING PRINCIPLES ON TROPHY HUNTING AS A TOOL FOR CREATING CONSERVATION INCENTIVES. VER. 1.0. IUCN SSC (2012)" as a guide. Zimbabwe recognises the importance of these principles to guide and manage trophy hunting as a legal, regulated conservation activity which provides a critical tool to secure a sound social, economic and ecological conservation scenario.

Biological Sustainability: Trophy hunting can serve as a conservation tool when it:

	Principle	**Remarks**
1	***Does not contribute to long-term population declines of the hunted species or of other species sharing its habitat, noting that a sustainably harvested population may be smaller than an unharvested one***	Considering the latest available estimate of lion population size in Zimbabwe (1,800 – 2,000), trophy hunting harvests a yearly mean of 2.7% of adult male lions. This figure has decreased since the establishment of age restriction rules on lion hunting. This low offtake is sustainable and generates significant financial and other benefits to ZPWMA, Communities and Private Sector.
2	***Does not substantially alter processes of natural selection and ecosystem function; that is, it maintains "wild populations of indigenous species with adaptive gene pools." This generally requires that hunting offtake produces only minor alterations to naturally occurring demographic structure. It also requires avoidance of breeding or culling to deliberately enhance population-genetic characteristics of species subject to hunting that are inconsistent with natural selection***	Safari hunting in does not substantially alter natural selection or ecosystem processes. The limited quota, as further limited by age restrictions, ensures that hunting offtakes do not negatively affect natural processes. This age-based policy was adopted in part to mitigate any social or population impacts from limited safari hunting. (Whitman et al. 2004).
3	***Does not inadvertently facilitate poaching or illegal trade of wildlife***	Safari hunting in Zimbabwe does not facilitate poaching or illegal trade. Poaching and illegal trade in lion products is currently very low suggesting that the existence of licensed, regulated hunting is helping control poaching and not facilitating it. Hunting operators are in the frontlines against poaching, and are obligated through their concession lease agreements to assistance with anti-poaching. Operators spend significant resources on this, and work in close cooperation with the ZPWMA to combat all forms of illegal wildlife trade. Even where anti-poaching is not a legal prerequisite, operators fund their own anti-poaching teams and support government rangers and community scouts e.g. in Sengwa and Dande Safari Area

	Principle	Remarks
4	***Does not artificially and/or substantially manipulate ecosystems or their component elements in ways that are incompatible with the objective of supporting the full range of native biodiversity***	Hunting in Zimbabwe has created financial incentives for the development and retention of wildlife across Safari Areas, Forestry Areas, Communal CAMPFIRE Areas and private Conservancies thereby supporting biodiversity over 145,000km^2 where hunting is a primary land use. Hunting areas on private and communal land outside of the protected areas also serve as buffer zones for many national parks and safari areas which would be converted to other land uses if these were abandoned.

Net Conservation Benefit: Trophy hunting can serve as a conservation tool when it

	Principle	Remarks
1	***Is linked to identifiable and specific parcels of land where habitat for wildlife is a priority (albeit not necessarily the sole priority or only legitimate use); and on which the "costs of management and conservation of biological diversity [are] internalized within the area of management and reflected in the distribution of the benefits from the use"***	Zimbabwe has identified Safari Areas within the Parks Estates where maintaining habitats and wildlife populations is the priority. These gazetted protected areas cover approximately 17,000km^2 where, without safari hunting, it would be difficult to secure and maintain natural ecosystems and prey bases for lions. In addition to these areas, lion occur on 66% (approximately 11,000km^2) of the land set aside as Conservancies. The operational and law enforcement costs incurred by hunting companies on a yearly basis ranges from US$300,000 to US$500,000 per hunting concession, which includes the expense of camps, salaries, anti-poaching, fuel, community assistance, etc. Many of the government's costs of maintaining Safari Areas are transferred to the private sector through the obligations of their concession agreements. Revenues from hunting in communal CAMPFIRE areas are used to support a range of social services (e.g. schools, clinics, irrigation schemes etc.) while operators cover the costs of anti-poaching, maintenance and development, and contributions to communities living nearby (e.g. through boreholes, grinding mills etc.).

		In private hunting areas and conservancies, the costs and benefits of wildlife in the area are internalized and distributed within the area of management. Critically, most of the Conservancies have elected to manage and conserve endangered species, such as black rhino, and offset the costs of this by conducting sustainable hunting of lion and other key trophy species.
2	***Produces income, employment, and/or other benefits that generate incentives for reduction in pressures on populations of target species, and/or help justify retention, enhancement, or rehabilitation of habitats in which native biodiversity is prioritized. Benefits may create incentives for residents to co-exist with such problematic species as large carnivores, herbivores competing for grazing, or animals considered to be dangerous or a threat to the welfare of humans and their personal property***	Hunting produces direct and indirect income, employment, and other benefits that generate incentives that reduce the threats to wildlife populations. Approximately US$44 million accrued to the country from the revenues of trophy hunting over the last two years. This could have been 5% higher if it were not for restrictions on the export of elephant and lion trophies. This revenue pays for the daily wildlife conservation work in all sectors of the wildlife industry, including research projects, surveys, anti-poaching, and other services. Of this amount, approximately 20% is paid directly to the ZPWMA which is then used to support its management activities, including anti-poaching budgets. Local communities benefit from hunting income through leasing the right to hunt and the sale of trophy fees in CAMPFIRE areas as well as from voluntary contributions and meat. Over the last 6 years, payments from hunting operations generated approximately US$16 million. The nature of the hunting industry does not require large numbers of people to be employed. Nonetheless, the average hunting company employs approximately 80 people on a permanent basis and 20 on a seasonal basis. This equates to approximately 3,000 people who would not otherwise secure any form of employment because of the lack of opportunities in the remote areas where hunting takes place.
3	***Is part of a legally recognized governance system that supports conservation adequately and of a system of implementation and enforcement capable of achieving these governance objectives***	All wildlife species in Zimbabwe, including the African lion, are protected under the Parks and Wildlife Act of 1996 (Chapter 20:14) as amended by Act Number 19 of 2001 which came into operation on the 1st of June 2002 through a Statutory Instrument 144C of 2002. The Act that was originally passed by Parliament in 1975 was a unique move in Africa, if not globally, that promoted the rapid development of the country's wild life industry and lead to the partial

		extension of the principle to the Communal Lands through the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in the 1980s. The Act provided a legal basis for the devolution of Authority through granting Appropriate Authority Status to the communal areas to manage the wildlife resources for their own benefit. The Act was subsequently revised in 1996 and 2001 with the latest revision paving the way for the establishment of the current Parks and Wildlife Management Authority to replace the former Department of National Parks and Wild Life Management. Following the introduction of the Parks and Wild Life (General) (Amendment) Regulations, 1998 (No.2), i.e. Statutory Instrument 26 of 1998, the administration of the wildlife industry experienced increasing centralisation of controls on wildlife management and utilisation on alienated and communal land. The Parks and Wildlife Management Authority is mandated by the Parks and Wildlife Act [Chapter 20:14], with the responsibility of conserving Zimbabwe's wildlife heritage through effective, efficient and sustainable protection and utilisation of natural resources for the benefit of present and future generations. The Authority was established to allow it to retain the revenue that it generates to fund its operations and thereby reducing its dependence on Treasury. This entailed introducing a commercial dispensation and putting in place effective revenue generation and financial management systems. The ZPWMA has the mandate to manage the entire wildlife population of Zimbabwe, whether on state, private and communal land.

Socio-Economic-Cultural Benefit

	Principle	**Remarks**
1	***Is premised on appropriate resource assessments and/or monitoring of hunting indices, upon which specific quotas and hunting plans can be established through a collaborative process. Optimally, such a process should (where relevant) include local communities and draw on local/indigenous knowledge. Such resource assessments (examples might include counts or indices of population performance***	Zimbabwe implements an adaptive quota setting quota system that uses inputs from monitoring data and input from a variety of stakeholders including ZPWMA field and research staff, local communities, hunting operators, and independent biologists. Quotas are set based on population estimates or trend analyses, monitoring data, hunt return data, research work and indices as may be reflected in various reports by field personnel.

	such as sighting frequencies, spoor counts) or hunting indices (examples might include trophy size, animal age, hunting success rates and catch per hunting effort) are objective, well documented, and use the best science and technology feasible and appropriate given the circumstances and available resources	For lions, specifically, the ZPWMA together with the Safari Operators Association (SOAZ), the Zimbabwe Professional Hunters Association (ZPHGA) and invited independent scientists (such as Panthera) review the returns from the current hunting season and assign points as per the lion aging criteria. The overall quotas allocated and actual offtake have been reduced in recent years as a precautionary measure, including implementing moratoriums in some regions where lion densities have declined. These measures, i.e., age, population trends, maximum overall numbers and levels of utilisation has resulted in lower quotas thus underlining Zimbabwe's commitment to sustainable hunting.
2	***Involves adaptive management of hunting quotas and plans in line with results of resource assessments and/or monitoring of indices, ensuring quotas are adjusted in line with changes in the resource base (caused by ecological changes, weather patterns, or anthropogenic impacts, including hunting offtake)***	Quotas are set adaptively in line with the results of monitoring trends and on regulatory compliance. If an underage lion is harvested, the quota for that area is removed in the next season to allow the population to age and to penalize the non-compliance. In this way, Zimbabwe ensures responsible and sustainable offtakes that have limited impact on the lion population.
3	***Is based on laws, regulations, and quotas (preferably established with local input) that are transparent and clear, and are periodically reviewed and updated***	Safari hunting in Zimbabwe is regulated through the National Parks and Wildlife Act and supporting Regulations that specify when, where and how animals are hunted. Both the professional hunters and the hunting client are licensed in terms of these regulations, and all returns are lodged electronically and tracked through the Reserve Bank TRAS-2 system. As described above, quotas are established in a transparent and participatory way.
4	***Monitors hunting activities to verify that quotas and sex/age restrictions of harvested animals are being met***	The monitoring of the lion hunting is carried out through the implementation of a specific database and a specific safari return form. All hunting permits issued by (and compulsorily returned to) the ZPWMA are registered on a specific database that has been developed under the auspices of the Exchange Control Division of the Reserve Bank that records all parameters related to hunting safaris, including records of lion hunting. The database is accessible to the ZPWMA who can extract reports on all lion hunting activities for all areas in the country. Since 2013, all professional hunters conducting lion hunting safaris are required to fill in the return form for both successful and unsuccessful safaris that

		captures a broad range of general information on the safari (client name, duration, date, payments etc. For the successful lion hunting safaris, additional information related to hunting effort and success, trophy skull measures (total length and width) and specified photographs are taken of the physical features (mane etc.) and upper and lower jaws. These return forms and trophy photographs are compulsory. No CITES export permit can be issued without compliance. All data forms are reviewed by the ZPWMA together with a committee appointed by the SOAZ and ZPHGA to ensure the offtakes and subsequent exports are not detrimental to the survival of the species. Zimbabwe also requires that a ZPWMA ranger accompany all lion safaris both on state land and private land.
5	***Produces reliable and periodic documentation of its biological sustainability and conservation benefits (if this is not already produced by existing reporting mechanisms).***	The Exchange Control Division of the Reserve Bank publishes a detailed report that summarises all data related to sport hunting. This includes country of origin of clients, gross income from daily rates and trophy fees (by company), average trophy and safari values, and the contribution of key species to the overall income generated through hunting. The ZPWMA also produces annual reports that highlight the performance of the hunting industry, listing the challenges that it faces. It also submits periodic reports to CITES.

Accountable and Effective Governance

	Principle	**Remarks**
1	***Is subject to a governance structure that clearly allocates management responsibilities***	The governance structure is described in the Parks and Wildlife Act and its subsidiary regulations that clearly provides for institutional arrangements and administration defining the management responsibilities within the relevant Government Authority.
2	***Accounts for revenues in a transparent manner and distributes net revenues to conservation and community beneficiaries according to properly agreed decisions;***	The equitable distribution of costs and benefits take into consideration the role of stakeholders in relation to the land category. Benefit sharing to communities under the CAMPFIRE programme is determined through an approved ratio that channels 55% of all income from hunting to the Ward level. This institution is monitored at the local level by the Rural District Councils that guide Ward

		Wildlife Committees with respect to community projects and services. At national level this is monitored by Ministry of Rural Development, Preservation and Promotion of Culture and Heritage Safari operators contribute substantially and voluntarily, over and above the prescribed fixed contribution, especially where this involves anti-poaching efforts and community developments. They provide funding, equipment and the technical expertise for repairs, transportation, and other social services (schools, boreholes). In addition, hunting companies collaborate with both ZPWMA and District anti-poaching teams to remove snares, participate in serious wildlife crime investigations and arrest poachers.
3	***Takes all necessary steps to eliminate corruption;***	Anti-corruption efforts in Zimbabwe are governed by the following legislation: • The Prevention of Corruption Act (1983); • Public Service Act (1995); • The Ombudsperson Amendment Act (1997); • Anti-Corruption Commission Bill (2004); • The Criminal law (Codification and Reform) Act (2004); • Bank Use Promotion and Suppression of Money Laundering Act (2004); • Criminal Procedure and Evidence Amendment Act (2004); and • Criminal Law (Codification and Reform) Act of 2006 The Zimbabwean Anti-Corruption Commission (ACC) was established after the passing of the Anti-Corruption Commission Bill in June 2004. The Commission is a signatory to the Southern Africa Development Community (SADC) Protocol as well as the African Union (AU) and United Nations Convention on Anti-Corruption.
4	***Ensures compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.***	The CITES Management Authority of Zimbabwe, the ZPWMA, ensures compliance of safari hunting to CITES guidelines and provisions.

10 REFERENCES

Bauer, H. Chardonnet, P. and Kristin Nowel, l. 2005. Status and distribution of the lion (*Panthera leo*) in East and Southern Africa. Background paper for the East and Southern African Lion Workshop, Johannesburg, 2006. IUCN, Pretoria.

Bauer, H. and Van der Merwe, S. 2004. Inventory of free-ranging lions *Panthera leo* in Africa. 26–31 pp. Available at: WOS:000220283600007.

Bauer, H., Chapron, G., Nowell, K., Henscheld, P., Funston,P.,Hunter, L.T.B., Macdonald, D.W. and Packer, C. 2015. Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas. www.pnas.org/cgi/doi/10.1073/pnas.1500664112

Begg, C. and Begg, K. 2008. Trophy monitoring of lion and leopard trophies in Niassa National Reserve, Mozambique: 2007 hunting season. Ratel Trust and SRN, Mozambique.

Chitauro. 2016. Status of the hunting sector in Zimbabwe. Internal report prepared by the Director of Exchange Control om behalf of the Reserve Bank of Zimbabwe. Unpublished.

Creel, S. and Creel, N.M. 1997. Lion density and population structure in the Selous Game Reserve: evaluation of hunting quotas and offtake. Afr. J. Ecol. Volume 35, pages 83 - 93

Crosmary, W.G., Loveridge, A.J., Ndaimani, H., Lebel, S., Booth, V., Côté, D. and Fritz, H. 2013. Trophy hunting in Africa: long-term trends in antelope horn size. Animal Conservation •• (2013) ••–•• © 2013 The Zoological Society of London.

Davidson, Z. and Loveridge, A. 2005. Population Estimation by Spoor Counts with Calibration Using Known Lion Density. Status report of the Gwaai ICA; Wildlife Conservation Research Unit, Oxford University.

Davidson, Z. and Romanach, S. 2007. Estimations of lion and hyena density in the Savé Valley Conservancy using two different census techniques: spoor transects and call-up stations. Report for SVC, WildCRU and University of Zimbabwe, TREP.

du Preez, B., Groom, R., Mufute, O., Mandisodza-Chikerema, R. and Booth, V. 2016. Sport-Hunting and Lion *Panthera leo* Conservation in Zimbabwe. Report prepared by the Bubiana Valley Conservation Research.

Dunham, K.M. Mackie, C.S. and Nyaguse, G. 2015a. Aerial Survey of Elephants and other Large Herbivores in the Zambezi Valley (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 118 pp.

Dunham, K.M., Mackie, C.S., Nyaguse, G. and Zhuwau, C. 2015b. Aerial Survey of Elephants and other Large Herbivores in north-west Matabeleland (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 126 pp.

Dunham, K.M., Mackie, C.S., Nyaguse, G. and Zhuwau, C. 2015c. Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 111 pp.

Dunham, K.M. & van der Westhuizen, H.F. 2015d Aerial Survey of Elephants and other Large Herbivores in Gonarezhou National Park and Save Valley Conservancy (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 115 pp.

Funston, P.J., Herrmann, E., Babupi, P., Kruiper, A., Jaggers, H., Masule, K. and Kruiper, K. 2001. Spoor frequency estimates as a method of determining lion and other large mammal densities in the Kgalagadi Transfrontier Park. (Book chapter).

Funston, P., Henschel, P., Hunter, L., Lindsey, P., Nowak, K., Vallianos, C. and Wood, K. 2016. Beyond Cecil: Africa's Lions in Crisis. Panthera and WildAid, New York and San Francisco.

Groom, R. 2008. Carnivore densities in the Savé Valley Conservancy; Results of the 2008 spoor survey. Report for Savé Valley Conservancy Technical Advisory Committee.

Groom, R. J. 2009. Carnivore Densities in Gonarezhou National Park: Results of the May/June 2009 Spoor Survey. Lowveld Wild Dog Project.

Groom, R.J. 2010. The abundance and conservation status of lions (*Panthera leo*) and spotted hyenas (*Crocuta crocuta*) in Gonarezhou National Park, Zimbabwe. Results of the 2010 call-up survey. African Wildlife Conservation Fund, unpublished report.

Groom, R.J., Funston, P.J. and Mandisodza, R. 2014. Surveys of lions *Panthera leo* in protected areas in Zimbabwe yield disturbing results: what is driving the population collapse? Oryx http://journals.cambridge.org.

Groom, R. J. and Watermeyer, J. 2015. Carnivore Densities in Gonarezhou National Park. Results of the 2015 Spoor Survey. Gonarezhou Predator Project

Groom, R. J. and Watermeyer, J. 2015a. Carnivore Densities in the Savé Valley Conservancy. Results of the 2015 Spoor Survey & Wild Dog Monitoring Project. African Wildlife Conservation Fund

Hayward, M. W., O'Brien, J., and Kerley, G.I.H., 2007. Carrying capacity of large African predators: predictions and tests. Biological Conservation, 139(1), 219-229.

IUCN/SSC. 2012. IUCN/SSC Guiding principles on trophy hunting as a tool for creating conservation incentives. Ver. 1.0. IUCN, Gland. http://cmsdata.iucn.org/downloads/iucn_ssc_guiding_principles_on_trophy_hunting_ver1_09aug2012.pdf

Loveridge, A.J. Searle, A.W., Murindagomo, F., Macdonald, F.W. 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation 134: 548 – 558

Lindsey, P. A., Balme, G., Becker, M., Begg, C., Bento, C., Bocchino, C., Dickman, A., Diggle, R. W., Eves, H., Henschel, P., Lewis, D., Marnewick, K., Mattheus, J., McNutt, J. W., McRobb, R., Midlane, N., Milanzi, J., Morley, R., Murphree, M., Opyene, V., Phadima, J., Purchase, G., Rentsch, D., Roche, C., Shaw, J., van der Westhuizen, H., van Vliet, N. and Zisadza-Gandiwa, P. 2015a. The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. FAO/Panthera/Zoological Society of London/WCS Report, Harare. 79 pages.

Lindsey, P., Taylor, W.A., Nyirenda, V., Barnes, L., 2015b. Bushmeat, wildlife-based economies, food security and conservation: Insights into the ecological and social impacts of the bushmeat trade in African savannahs. FAO/Panthera/Zoological Society of London/SULi Report, Harare. 58 pages.

Miller, J.R.B., Balme, G., Lindsey, P.A., Loveridge, A.J., Becker, M.S., Begg, C. Brink, H., Dolrenry, S., Hunt, J.E., Janssoni, I., Macdonald, D.W., Mandisodza-Chikerema, R.L., Cotterill, O.L., Packer, C., Rosengren, D., Stratford, K., Trinkel, M., White, P.A., Winterbach, C., Winterbach, H.E.K. and Funston, P.J. 2016. Aging traits and sustainable trophy hunting of African lions. Biological Conservation 201 (2016) 160–168.

Mills, M.G.L. , Biggs, H.C. and White, I.J. 1995. The relationship between rainfall, lion predation and population trends in African herbivores. Wildl. Res. 22: 75–88

Stander, P.E. (1998) Spoor counts as indices of large carnivore populations: the relationship between spoor frequency, sampling effort and true density. Journal of Applied Ecology, 35, 378-385

Seymour-Smith, J. L. and Loveridge, A. J. 2015. Mana Pools National Park Predator Survey July – October 2015.

Whitman, K.L., Starfield, A.M., Quadling, H. and Packer, C. 2007. Modeling the effects of trophy selection and environmental disturbance on a simulated population of African lions. Conservation biology: The Journal of the Society for Conservation Biology, 21(3): 591–601.

ZPWMA, 2006. Conservation Strategy and Action Plan for the Lion (*Panthera leo*) in Zimbabwe. Zimbabwe Parks and Wildlife Management Authority, Ministry of Environment and Tourism, Harare, Zimbabwe. 19 pages.

ZPWMA, 2014. Age Restrictions on Lion Trophies and the Adaptive Management of Lion Quotas in Zimbabwe.

ZPWMA, 2016. Hwange National Park Management Plan 2016 – 2016. Prepared by African Wildlife Foundation on behalf of the Zimbabwe Parks and Wild Life Management Authority, Harare.

11 APPENDICES

11.1 ANNEX I: SUMMARY OF NATIONAL PARKS ESTATE, FORESTRY, COMMUNAL AND PRIVATE LAND WHERE LION ARE KNOWN TO OCCUR

1. National Parks Estate

Type of Land	Name of Park	District	Area (hectares)	Presence of lion
NP	Chizarira	Binga	191,000	Yes
NP	Gonarezhou	Chiredzi	505,000	Yes
NP	Matusadonha	Nyaminyami	140,700	Yes
NP	Chimanimani	Chimanimani	17,110	No
NP	Mana Pools	Hurungwe	219,600	Yes
NP	Kazuma Pan	Hwange	31,300	Yes
NP	Hwange	Hwange	1,465,100	Yes
NP	Victoria Falls "A"	Hwange	1,904	No
NP	Victoria Falls "B"	Hwange	436	No
NP	Zambezi	Hwange	56,010	Yes
NP	Rhodes Nyanga	Nyanga	47,150	Migratory
NP	Rhodes Matopos	Matobo	42,400	No
Total Area National Parks (ha)			**2,717,710**	
Botanical Gardens	Pioneer Reserve	Beitbridge	38	No
Botanical Gardens	Tolo River Reserve	Beitbridge	44	No
Botanical Gardens	South Camp Reserve	Beitbridge	26	No
Botanical Gardens	Chisekera Hot Springs	Chiredzi	95	No
Botanical Gardens	Mawari Raphia Palm	Mt. Darwin	34	No
Botanical Gardens	Tingwa Raphia Pan	Mt. Darwin	290	No
Botanical Gardens	Haroni Forest	Chimanimani	20	No
Botanical Gardens	Rusitu Forest	Chimanimani	150	No
Botanical Gardens	Sebakwe Acacia Karoo	Kwekwe	60	No
Botanical Gardens	Sebakwe Great Dyke	Kwekwe	165	No
Botanical Gardens	Sebakwe Mountain Acacia	Kwekwe	53	No
Botanical Gardens	Mazowe "A"	Harare	43	No
Botanical Gardens	Mazowe "B"	Harare	3	No
Botanical Gardens	Bunga Forest	Mutare	495	No
Botanical Gardens	National Botanic Garden	Harare	67	No

Type of Land	Name of Park	District	Area (hectares)	Presence of lion
Botanical Gardens	Vumba Botanic Garden	Mutare	200	No
Botanical Gardens	Ewanrigg Botanic Garden	Goromonzi	286	No
Total Area of Botanical Gardens and Botanical Reserves:			**2,069**	
Sanctuary	Maninii Pan	Chiredzi	300	No
Sanctuary	Melsetter Eland	Chimanimani	1,800	No
Sanctuary	Mbaze Pan	Nkayi	40	No
Sanctuary	Nyamanyetsi (Nyamanechi)	Guruve	2,840	No
Sanctuary	Mushandike	Masvingo	12,900	No
Sanctuary	Rhodes - Bulawayo	Matobo	1,100	No
Total Area Sanctuaries			**18,980**	
Safari Area	Tuli	Beitbridge and Gwanda	41,600	Yes
Safari Area	Chete	Binga	108,100	Yes
Safari Area	Chipinga (Chipinge)	Chipinge	26,100	No
Safari Area	Malapati (Malipati)	Chiredzi	15,400	Yes
Safari Area	Chinsa	Gokwe	171,300	Yes
Safari Area	Hartley (Chegutu)	Chegutu	44,500	No
Safari Area	Charara	Kariba and Hurungwe	169,200	Yes
Safari Area	Hurungwe	Hurungwe	289,400	Yes
Safari Area	Doma	Makonde	94,500	Yes
Safari Area	Umfurudzi	Shamva	76,000	No
Safari Area	Dande	Guruve	52,300	Yes
Safari Area	Chelvore (Chewore)	Hurungwe	339,000	Yes
Safari Area	Sapi	Hurungwe	118,000	Yes
Safari Area	Deka	Hwange	51,000	Yes
Safari Area	Matetsi	Hwange	295,500	Yes
Total Area of Safari Areas:			**1,891,900**	
Recreational	Chibwatata	Binga	6	No
Recreational	Kavira	Binga	50	No
Recreational	Lake Kariba	Binga, Nyaminyami and Hwange	287,200	Yes

Type of Land	Name of Park	District	Area (hectares)	Presence of lion
Recreational	Ngezi	Kadoma	5,800	No
Recreational	Umfuli (Mfurudzi	Chegutu	12,700	No
Recreational	Lake Robertson (Manyame Lake)	Chegutu, Makonde and Harare	11,200	No
Recreational	Lake Cunningham	Insiza	4,172	No
Recreational	Chinhoyi Caves	Makonde	120	No
Recreational	Manjirenji	Zaka	3,400	No
Recreational	Bangala	Zaka and Masvingo	2,700	No
Recreational	Sebakwe	Kwekwe	2,600	No
Recreational	Robert McIlwaine (Chivero)	Harare	6,180	No
Recreational	Umzingwane	Umzingwane	1,233	No
Recreational	Kyle (Mutirikwi)	Masvingo	16,900	No
Recreational	Lake Matopos	Matobo	2,900	No
Total Area of Recreational Parks, Lakes and Dams			**357,161**	

Total Area National Parks (ha)	2,717,710
Total Area of Botanical Gardens and Botanical Reserves:	2,069
Total Area Sanctuaries	18,980
Total Area of Safari Areas:	1,891,900
Total Area of Recreational Parks, Lakes and Dams	357,161
Total Ha	**4,987,820**

2. Forestry Land

Land	Name	District	Area (ha)	Presence of lion
Forestry Areas	Fuller	Hwange	23,300	Yes
Forestry Areas	Panda Masuie	Hwange	33,500	Yes
Forestry Areas	Kazuma	Hwange	24,000	Yes
Forestry Areas	Mvutu	Hwange	2,100	No
Forestry Areas	Sikumi	Hwange	54,400	Yes
Forestry Areas	Gwayi	Lupane	144,265	Yes
Forestry Areas	Lake Alice	Lupane	39,000	No
Forestry Areas	Ngamo	Lupane	102,900	Yes

Land	Name	District	Area (ha)	Presence of lion
Forestry Areas	Chisengu	Lupane	4,006	No
Forestry Areas	Glencoe	Lupane	2,050	No
Forestry Areas	Lionhills	Lupane	2,747	No
Forestry Areas	Martin (i)		400	No
Forestry Areas	Martin (ii)		4,400	No
Forestry Areas	Mudima		6,355	No
Forestry Areas	Nyambewa		5,484	No
Forestry Areas	Tandai		5,450	No
Forestry Areas	Tarka		4,343	No
Forestry Areas	Gwampa	Nkayi	47,000	No
Forestry Areas	Chesa	Nkayi	14,250	No
Forestry Areas	Inseze	Nkayi	35,200	No
Forestry Areas	Inseze Extension	Nkayi	8,400	No
Forestry Areas	Umgusa	Nkayi	32,200	No
Forestry Areas	Umzibani	Nkayi	2,471	No
Forestry Areas	Kavira	Binga	28,200	Yes
Forestry Areas	Mzolo	Binga	67,200	No
Forestry Areas	Sijarira	Binga	25,600	Yes
Forestry Areas	Bembesi	Binga	55,100	No
Forestry Areas	Molo	Binga	2,900	No
Forestry Areas	Mtao	Chirumanzu	8,170	No
Forestry Areas	Chirindu	Chirumanzu	950	No
Forestry Areas	Gungunyana	Chirumanzu	1,650	No
Forestry Areas	Mafungabusi	Chirumanzu	82,100	No
Forestry Areas	Mudzongwe	Chirumanzu	1,420	No
Forestry Areas	Ungwe	Chirumanzu	567	No
Forestry Areas	Nyangu	Chirumanzu	16,600	No
Forestry Areas	York	Chirumanzu	1,455	No
Forestry Areas	Banti	Mutare	2,219	No
Forestry Areas	Stapleford	Mutare	24,600	No
Rhodes Estate	Erin	Nyanga	10,700	No
Rhodes Estate	Sauerdale North	Nyanga	214	No

Land	Name	District	Area (ha)	Presence of lion
Total Forest Areas (ha)			**927,866**	

3. CAMPFIRE Districts

District	Natural Region	Total Area (km^2)	Area of CF Wards (km^2)	Number of Wards	CF Wards	District Pop (persons)	Presence of lion
Beitbridge	5	12,935	4,595	21	6	80,946	Migratory
Binga	3,4&5	12,308	7,930	27	21	87,802	Migratory
Bubi	4	5,547	88	12	2	36,614	Migratory
Bulilimamangwe	4&5	12,574	1,530	33	10	156,641	Migratory
Chaminuka	2a,2b,3,4&5	2,752	380	26	2	94,047	No
Chimanimani	1,2a,3,4&5	3,419		28		110,836	No
Chipinge(Gazaland)	1,2a,3,4&5	5,223	408	33	2	336,893	Migratory
Chiredzi(Gaza Khomanani)	5	17,748	3,633	32	9	183,228	Yes
Chiweshe(Mazowe)	2a	4,482	375	29	5	198,319	No
Gokwe North	3,4&5	7,359	2,523	25	4	164,558	Migratory
Gokwe South	3&4	11,138	1,308	28	6	238,581	Migratory
Goromonzi	2a	2,504		26		147,126	**No**
Mbire (Guruve)	2a,3&4	7,810	4,215	28	14	135,637	Yes
Gwanda	4&5	10,792	2,283	23	6	112,984	No
Hurungwe	2a,3,4&5	19,895	2,793	40	9	246,902	Yes
Hwange	4&5	29,934	4,021	27	15	71,707	Yes
Hwedza	2b&3	998				69,981	No
Kusile(Lupane)	3&4	7,780	2,885	24	11	94,469	Migratory
Marondera	2a&2b	3,554		24		104,601	No
Matobo	4&5	7,278	1,233	26	4	89,281	No
Mudzi	4	4,222	1,009	18	2	109423	No
Mutoko	2b,3&4	4,052		29		122,941	No
Muzarabani	2a,3&4	4,322	2,540	17	9	69,851	Migratory
Mwenezi	4&5	12,933		31		101,354	Migratory
Nkayi	4	5,333	2,628	23	6	113,302	Migratory
Nyaminyami(Kariba)	4&5	6,327	3,532	16	11	27,717	Yes
Nyanga	1,2b,3&4	5,738	253	37	1	128,439	Migratory
Pfura(Mt. Darwin)	2a,2b,3&4	1,771				164,362	No
Rushinga	3&4	2,408		17		75,332	No
Tsholotsho	4	7,823	5,354	20	8	111,828	Yes
UMP Zvataida	2b,3&4	2,682	619	15	2	86,302	No
Umzingwane	4	1,074				62,954	No

District	Natural Region	Total Area (km²)	Area of CF Wards (km²)	Number of Wards	CF Wards	District Pop (persons)	Presence of lion
Zivagwe	4	2,363				65,752	No
TOTAL/AVERAGE		247,078	56,135	735	165	4,000,710	

4. Conservancies

	Name of Conservancy	District	Area (hectares)	Presence of lion
Conservancies	Malilangwe	Chiredzi	40,000	Yes
Conservancies	Save	Chiredzi	344,200	Yes
Conservancies	Chiredzi River	Chiredzi	28,500	No
Conservancies	Bubye Valley	Matabeland South	374,000	Yes
Conservancies	Bubiana	Matabeland South	130,000	No
Conservancies	Gwayi	Hwange	150,897	Migratory
Conservancies	Midlands Black Rhino	Midlands	85,000	No
Other	Matetsi Farms	Hwange	155,627	Migratory
Total Area of Conservancies			**1,308,224**	

11.2 ANNEX II: SUMMARY OF PRIMARY LEGISLATION AND REGULATIONS

11.2.1 The Policy for Wild Life of 1992

This policy provides for Government to maintain a protected area network known as the Parks and Wild Life Estate for the conservation of the nation's wild resources and biological diversity. According to the policy, government will use the Estate to promote a rurally based wild life industry and will harmonise the management of the Estate with the efforts of neighbouring communities that are developing wild life as a sustainable form of land use. The policy vests executive responsibility for the Parks and Wildlife Estate in the Department of National Parks and Wild Life Management (DNPWLM). It provides for the following categories of protected area: National Park; Safari Area; Sanctuary; Recreational Park, Botanic Reserve and Botanic Garden.

- The objectives of the Parks and Wild Life estate will be to:
- Preserve representative samples of Zimbabwe's aquatic and terrestrial flora and fauna and their physical environments;
- Protect areas of scenic beauty and special interest;
- Preserve rare, endangered and endemic species;
- Conserve water catchments;
- Provide opportunities for public education and the advancement of scientific knowledge;

and, without prejudice to any of the above:

- Encourage public use related to the enjoyment and appreciation of these areas; and
- Generate economic activity within the Estate and surrounding areas to enhance rural development.

The policy commits the DNPWLM to an adaptive management strategy in which research and monitoring are incorporated as integral components of management. It states that where sport

hunting is an objective in a protected area, quotas will be set to the maximum sustainable level at which trophy quality can be maintained and the hunting can be marketed. In terms of the policy the emphasis of tourism in parks should be low density and high quality tourism. An EIA must be carried out for major developments such as construction of roads, powerlines, buildings or dams.

With respect to Wildlife Conservation, the Policy states that the Government of Zimbabwe aims to encourage the conservation of wild animals and their habitats outside the Parks and Wild Life Estate recognising that this is only likely to be successful if wild life can be used profitably and the primary benefits accrue to people with wild life on their land. "*Recognising that much of Zimbabwe does not consist of good arable land, Government regards wild life management in all its diverse forms as a legitimate land use which may be the most appropriate or highest-valued form of development in many areas*". The policy also states that Government will take the necessary legal and enforcement measures to prevent the illegal use of wildlife.

Addressing community rights to natural resources the Policy states that government intends to "*transform land use in remote communal areas through its Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), under which rural peoples have the authority to manage their wild life and other natural resources and benefit directly from so doing*". Further government will "*ensure that wildlife is not undervalued to the people living with it by permitting them to use it sustainably for their own gain as they are able to do with other natural resources and agricultural products*".

The policy states that the mechanism for communities to gain rights over wild life will be through the granting of Appropriate Authority to Rural District Councils (under the Parks and Wildlife Management Act of 1975). For this authority to be granted, the Minister will require:

1. An acceptable management plan from councils in which objectives for wild life are stated and preliminary intentions for achieving these objectives are outlined;
2. An acceptable institutional plan which outlines clearly the methods by which councils intend a) to involve wild life producer communities in district level management and b) to devolve the decision-taking process in local wild life management and the distribution of wild life benefits to producer communities;
3. The department to assist councils in managing their wild life and to coordinate the activities of NGOs who are assisting councils;
4. The approval by the department of all annual quotas of wild life killed or sold in communal lands during the interim period while councils develop their management capacity;
5. The presentation of annual reports from Councils to the Director and to their constituents detailing the year's performance in wild life management in their district.

The policy provides for the Minister to withdraw Appropriate Authority from a council not conforming to conditions and objectives under which it was granted.

11.2.2 Wildlife Based Land Reform Policy

In 2004 there was a move to revise the Policy for Wildlife to cater for the Land Reform programme. The revised policy, known as the Wildlife-Based Land Reform Policy, has not however been formally accepted by Government. Nonetheless, it is important to summarise what was envisioned at that time since this has influenced the way the management of wildlife outside of the Parks Estate has unfolded.

The vision of this reformed policy is to ensure profitable, equitable and sustainable use of wildlife resources, particularly in areas where agricultural potential is limited. It states that "*the policy has*

been developed in the context of Zimbabwe's Land Reform Programme and is underpinned by recognition that wildlife is a viable land-use option, that it can facilitate attainment of equity objectives and that it is feasible. This policy is complemented by existing natural resources legislation and the state protected area system."

The policy also states that the key issues that were taken into consideration were:

- The State will continue to make provision for wildlife management outside the protected area system, including setting aside certain core zones for wildlife production. Wildlife should be the only permitted primary land use option in these areas.
- Outside core zones, wildlife production, amongst other land use options, will be encouraged. The most profitable and ecologically sustainable land use option must be allowed to evolve in response to changing economic influences, notwithstanding the need to ensure food security in these areas.
- The scale of wildlife operations must be allowed to vary from intensive to extensive, depending on agro-ecological settings.
- All beneficiaries of wildlife operations, whether individually or jointly, must equitably share the costs of production.
- Wildlife management responsibility and authority must be devolved to the most appropriate level for efficient resource management and production incentives must be maximized for landholders.
- Security of tenure over resources is key to successful wildlife-based land reform. These core areas should be identified.

The aims of the Wildlife-Based Land Reform Policy are listed as:

1. To facilitate the indigenisation of the wildlife sector and to ensure more equitable access by most Zimbabweans to land and wildlife resources and to the business opportunities that stem from these resources.
2. To maintain a proportion of land outside state protected areas under wildlife production.
3. To enhance diversity of land uses through wildlife production.
4. To promote secure and equitable tenure.
5. To develop and implement appropriate institutional arrangements for wildlife-based land reform.

The policy recognized that wildlife production can be at different scales, which are dependent on several factors that include the type of wildlife, management regime and ecological conditions. Three categories are highlighted in the policy:

1. Intensive production systems with captive or semi-captive species such as crocodiles and ostriches (1 – 100 hectares).
2. Semi-intensive to semi-extensive production systems with free-ranging "plains game" populations (1,000 to 10,000 hectares).
3. Extensive production systems incorporating "big game" populations (over 10,000 hectares).

The Wildlife Based Land Reform Policy promotes two land redistribution models:

1. A state leasehold approach which is based on the reallocation of leasehold leases.
    a. This approach entails the acquisition of the entire land-holding with compensation for infrastructure, wildlife, etc.,

   b. The land will be reallocated to lessees under terms and conditions that will ensure sustainable wildlife management, on-going investment and capacity-building in that area.
2. A corporate equity model that involves transfer of shares within a land-owning company.
   a. The transfer of shares will be in accordance with the Indigenisation goals and sound business principles;
   b. Proposals from stakeholders must outline realistic ways in which new entrants can increase their shareholdings well beyond an initial level, over a reasonable time scale.
   c. The proposals must make provision for immediate allocation of shareholdings to new participants.

The Policy document also acknowledges that the two approaches can be applied in combination and shall be considered on a case by case basis, and that the State may from time to time consider other approaches that meet the objectives of the Wildlife Based Land Reform Policy.

11.2.3 Parks and Wild Life Act Chapter 20:14 of 1996 as amended in 2001:

This is the pivotal Act with respect to wildlife management in Zimbabwe. The Act includes the following sections:

1. Parks and Wildlife Board
2. Parks and Wildlife Estate and Parks and Wildlife Land
3. National Parks
4. Botanical Reserves and Botanical Gardens
5. Sanctuaries
6. Safari Areas
7. Recreational Parks
8. Specially Protected Animals
9. Specially Protected Indigenous Plants
10. Indigenous plants
11. Hunting, removal, viewing and sale of animal products
12. Protection of animals and Indigenous plants on alienated land
13. Fish Conservation
14. Evidence, prevention and detection of offences and additional penalties and forfeitures
15. Inspectors, Officers, employees and advisory committees
16. General

The Act also defines the different types of land (Alienated land):

a. “Private Land” means land the ownership of which is vested in any person other than the President.
b. “State Land” means land vested in the President other than Communal Land or trust land vested in the President.
c. “Trust land” means any land, other than Communal land held in trust by the President or a statutory body or by a person, whether solely or jointly with others, by virtue of his being the holder of some office in a statutory body.

The Parks and Wildlife Act of 1975 (as amended) states that the purposes of National Parks are:

1. To preserve and protect the natural landscape and scenery.
2. To preserve and protect wild life and plants and the natural ecological stability of wild life and plant communities for the enjoyment, education and inspiration of the public.

Establishment of Protected Areas: The Act enables the President to declare National Parks on State land or Trust Land if the trustees give their consent (Section 22). The Act enables the Minister acting on the authorisation of the President to acquire land for the Parks and Wild Life Estate either compulsorily or by agreement in terms of the procedures contained in the Communal Land Act and the Land Acquisition Act. The Act gives the Minister the power to manage National Parks, control entry and authorise or restrict certain activities and carry out various conservation measures. The Act provides for the provision of facilities and services for tourists in National Parks or to lease out such facilities or services. The Act allows the Minister to issue a permit for hunting in National Parks.

The Act makes provision for the establishment of Botanical Reserves and Botanical Gardens (Section 26) on State Land or Trust Land for the preservation and protection of rare or endangered indigenous plants or representative plant communities for the enjoyment, education and benefit of the public.

A third category of protected area is a Sanctuary which may be established by the President on State Land or Trust Land (Section 31) to afford special protection to all animals or a particular species of animal in the sanctuary for the enjoyment and benefit of the public. The Minister may provide tourism facilities and services in a Sanctuary or lease facilities or services. The Minister may also issue permits for hunting or the removal of game from a sanctuary for certain purposes.

In terms of the Act the President may establish Safari Areas on State Land or Trust Land as part of the Parks and Wild Life Estate (Section 36) for the preservation and protection of the natural habitat and the wild life in these areas in order that facilities and opportunities may be afforded to the public for camping, hunting, fishing, photography, viewing of animals, bird watching and similar activities. The Minister may lease sites in safari areas for various purposes and may grant hunting or other rights. Hunting or removal of wildlife in a safari area may only take place with a permit.

The fifth category of protected area provided for by the Act is a Recreational Park (Section 41), which may be established by the President for the purpose of preserving and protecting the natural features for the enjoyment, benefit and recreation of the public. The Minister may designate areas within Recreational Parks which can be alienated or leased for the provision of tourism facilities and services.

Prospecting and mining are prohibited in National Parks, Botanical Reserves, Botanical Gardens, Sanctuaries or Recreational Parks without a permit issued by the Minister and with the consent of the Minister of Mines (Section 119). The Environmental Management Act of 2002 also makes provision for land to be acquired by the State for conservation purposes. According to Section 109 the President may acquire land or set land aside for the improvement or proper management of the environment. In the absence of an agreement with the land owner the President may acquire the land in accordance with the procedures under the Land Acquisition Act. The President may set aside any area of Communal Land for the conservation or improvement of natural resources or for the protection of irrigation works or sources of water supplies provided that no such area shall be set aside until the Minister responsible for the administration of the Communal Land Act is satisfied that suitable provision has been made elsewhere for the inhabitants who will be affected by the setting aside of the area (Section 110).

Specially Protected Animals and Plants: The Act makes provision for the Minister to declare certain animals as specially protected (Section 44). In terms of the Act, no-one may hunt, have in their possession, or sell a live specially protected animal or the meat or trophy from such an animal without a permit. The trophy of any specially protected animal must be surrendered to the state if not obtained by a permit. The Act specifies the purposes for which the Minister may issue a permit for use of

specially protected animals (Section 46), but provides the Minister with some flexibility as he/she may issue a permit for any purpose which in the opinion of the Minister is in the interests of the conservation of animals.

The Act also makes provision for the declaration of specially protected indigenous plants (Section 49). No person may pick a specially protected plant without a permit, although the owners or occupiers of land or a person acting under their authority may pick a specially protected plant for cultivation, forestry, building construction or the construction of roads and other infrastructure. No person may sell a specially protected plant without a permit unless the person is a recognised dealer in specially protected indigenous plants or a member of a recognised horticultural society and the purchase is from a member of the same or other recognised society. The Act specifies the purposes for which the Minister may issues permits for the picking or sale of specially protected indigenous plants. The Act also stipulates that no person may pick or sell indigenous plants without a permit (Section 55) provided that the appropriate authority for any land may pick or sell or authorise others to pick or sell indigenous plants (Section 56). If the Minister deems it necessary for the conservation of an indigenous plant, the Minister may prohibit the picking or selling of that plant (Section 57).

Hunting and removal of animals: The Act prohibits hunting, removal of an animal or any part of an animal or the sale of an animal without a permit unless by an appropriate authority for the land (Section 59), which is the owner of freehold land, a Rural District Council on communal land, the Forestry Commission on state forests and the DNPWLM on the parks and Wildlife Estate. The appropriate authority for the land may issue permits to others to use the wild life (except for specially protected species). If the Minister deems it necessary for the conservation of a animal, he/she may prohibit the hunting or removal of such animals in a specific area (Section 60) and may serve a notice to prohibit a specific person from hunting, conducting photographic tourism, or being in the possession of a weapon used for hunting save for self-defence. The Minister does not have to give reasons for such prohibitions. The Act enables the killing of an animal without a permit for self-defence (Section 61).

The Act prohibits anyone from conducting of hunting or photographic safaris within the parks and wild life estate or on forest land without holding a professional hunter's licence or a professional guide's licence (Section 65). No person may manufacture an article from a trophy, process a trophy or sell or otherwise dispose of a trophy or an article manufactured from a trophy from an animal that has been hunted in contravention of the Act (Section 73).

If the Minister believes it in the interests of conservation, he/she may declare any animal that is not a specially protected animal as a protected animal and any indigenous plant that is not a specially protected plant as a protected plant (Section 77) on alienated land within the area of an environment committee established in terms of the Environmental Management Act of 2002 and the Rural District Councils Act of 1988. No person may, without a permit, hunt an animal or pick an indigenous plant that has been declared protected. The Minister may also restrict the extent of hunting animals or picking of indigenous plants on alienated (private freehold) land in the area of an environment committee if the Minister believes that the hunting of animals or picking of plants is unsustainable. The Minister may authorise an environment committee to reduce the numbers of problems animals on any alienated land within its area if the number of such animals is sufficient to cause excessive damage or nuisance. Section 79 gives environment committees the power to restrict hunting on alienated land if it believes that hunting is unsustainable.

The Minister may declare any person to be the appropriate authority for any waters (Section 83) and may declare controlled fishing waters (Section 84) for which the Minister may make regulations for

the control, regulation, restriction of prohibition of fishing. Unless the Minister designates areas of water where a permit is not required, no-one except the appropriate authority for that water may fish in any water without a permit. Section 87 regulates the means of fishing by prohibiting the use of explosives, firearms and poisons. Section 88 controls the introduction into any water of fish and plants that are not native to that water. No-one except the appropriate authority for a water may fish commercially and sell the fish without a permit (Section 90). The minister may ban fishing by specific persons in any area in the interests of conservation (Section 96).

Enforcement: The Act provides for the powers of conservation officials, and police officers in relation to enforcing the Act. It provides for penalties for various offences and for the Minister to make regulations on a wide range of issues and activities. The Act provides for the highest penalties to be awarded for the unlawful killing of a rhinoceros or other specially protected game specified by the Minister in an
official notice and for the unlawful possession or trade in rhino horn, ivory or the trophy of any other specially protected animal specified by the Minister in an official notice (Section 128).

The Environmental Management Act of 2002 provides the Minister responsible for the Environment to regulate the use of wetlands. In terms of Section 113 of the Act the Minister may declare any wetland to be an ecologically sensitive area and may impose limitations on development in or around such area. Further, no person may without authorisation in terms of the Act:

a. reclaim or drain any wetland;
b. disturb any wetland by drilling or tunnelling in a manner that has or is likely to have an adverse impact on any wetland or adversely affect any animal or plant life therein;
c. introduce any exotic animal or plant species into the wetland. Section 114 enables the Minister to serve an order on the owner, occupier or user of land under which they must take measures, construct such works or refrain from specific activities in order to protect the environment.

Biological Diversity: Further the Act enables the Minister to take such measures as may be necessary for the conservation of biological diversity and the implementation of Zimbabwe's obligations under the United Nations Convention on Biological Diversity adopted in 1992 and may, in so doing (Section 116):

a. identify the components of the biological diversity of Zimbabwe;
b. determine the components of biological diversity which are threatened with extinction;
c. prepare and maintain an inventory of the biological diversity of Zimbabwe;
d. determine actual and potential threats to the biological diversity and devise such measures as are necessary for preventing, removing or mitigating the effect of those threats;
e. devise measures for better protection and conservation of rare and endemic species of wild fauna and flora;
f. develop national strategies, plans and programmes for the conservation of the biological diversity of Zimbabwe;
g. promote the integration of conservation and sustainable use of biological diversity into relevant sectoral policies, plans and programmes;
h. require in writing any developer, including the government, to integrate the conservation and sustainable utilisation of the biological diversity in any project the implementation of which has or is likely to have detrimental effects to the biological diversity of Zimbabwe;
i. protect indigenous property rights of local communities in respect of biological diversity with scientific knowledge;

j. support the integration of traditional knowledge on conservation of biological diversity with scientific knowledge;
k. prohibit or restrict access by any person to or the exportation of any component of the biological diversity of Zimbabwe.

The Minister may also take such action or measures as may be necessary for the conservation of the biological diversity of a specific locality and may:

a. promote such land use methods as are compatible with the conservation of the biological diversity of that locality;
b. select and manage environmental protection areas for the conservation of the various terrestrial and aquatic ecological systems;
c. establish and manage buffer zones near environmental protection areas;
d. prohibit or control the importation of and introduction into the wild of exotic animal and plant species;
e. identify, promote and integrate traditional knowledge into the conservation and sustainable utilisation of the biological diversity of that locality; and
f. determine special measures for the protection of species, ecosystems and habitats faced with extinction.

Community rights to natural resources: The Act provides for land holders to acquire rights over wildlife through the granting of "appropriate authority" status. Thus, the owners of private freehold land are deemed to be the appropriate authority over wildlife on their land (Section 2). Communities acquire rights over wildlife through Rural District Councils (RDCs). A 1982 amendment to the Act provides for the Minister to appoint an RDC as the appropriate authority for wild life on the communal land within the jurisdiction of the RDC (Section 108). The Act states that no person may hunt any animal on any land or remove any animal or part of an animal except in term of a permit issued by the appropriate authority for that land [Section 59(2)]. The appropriate authority may hunt any animal on the land, remove any animal or part of an animal from the land and may issue permits to others to hunt or remove animals from the land. RDCs are then expected to apply the guidelines contained in the 1992 Wildlife Policy to devolve the decision-taking process in local wild life management and the distribution of wild life benefits to producer communities (i.e. smaller and more localised groups of people with wildlife on their land). Further policy guidelines state that RDCs
are expected to distribute a percentage of income derived from wildlife use to producer communities and to allow these communities to be responsible for several wildlife management activities. Because of the existing administrative system of local government, producer communities had to be represented by Ward Development Committees (WADCOs) and Village Development Committees (VIDCOs) which are advisory bodies to Councils.

In this way, various legal entities are granted authority over wildlife outside the Parks Estate. These authorities include private land-owners (where the land is held under an agreement of purchase or lease), forest land (such as Forestry Commission estates). For Communal Land, the Rural District Councils (RDC) may be appointed the Appropriate Authority. The Minister of Environment grants this authority, with input from the Zimbabwe Parks and Wildlife Management Authority. If appropriate authority is not granted, the authority remains vested in Central Government. This Appropriate Authority clause in the Act, paved the way for the implementation of the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE)[3].

Statutory Instruments: There are several statutory instruments (SI) that regulate the wildlife sector:

[3] Note that the CAMPFIRE programme is about to undergo a comprehensive review that will impact on future policies.

- SI 362 of 1990: This legislation provides in sections 66-75 for the Regulation of Manufacture, Processing and Dealing in trophies.
- SI 76 of 1998: Parks and Wild Life (Import and Export) (Wild Life) Regulations specifically deals with Import and Export of wildlife products. This legislation was enacted to ensure compliance with CITES requirements for export and import of wild flora and fauna. These provide for the following:
    - Section 3 deals with the Control of Import and Export of wild life and trophies and lays down a general prohibition on the import into or export from Zimbabwe of any "wild life" or trophy of "wild life" except in accordance with either a certificate issued in terms of section 5 by the Director or Director of Customs, or an open general permit:
    - Section 5 deals with Permits and Certificates and is consistent with CITES legislation.
    - Section 15 deals with Offences and Penalties. Any person who contravenes any of the provisions of subsection 1 shall be guilty of an offence, and liable to a fine or imprisonment. To effectively ensure compliance, the Zimbabwe Parks and Wildlife Management Authority deployed a permanent team of officers based at all ports of exit and entry to assist border control officials in monitoring and inspection of all wildlife exports.
- SI 26 of 1998: The regulation provides for the monitoring of all hunting activities in the country to ensure compliance by all Safari Operators and international clients and to ensure that the TR2 Form. (Tourism Hunting Return Form) is duly completed.
- Trapping of Animals (Control) Act Chapter 20:21: The Act provides for the control, restriction and regulation of the construction, possession and use of certain traps for the purpose of trapping animals; to control the sale and disposal of certain animals, to include lions and to provide for matters incidental to or connected with the foregoing.
- SI 92 of 1992: Parks and Wild Life (Payment for Hunting of Animals and Fish) Notice, 2009: This instrument provides for compensation values of various wildlife forms to include animals and fish. It acts as an additional deterrent measure in matters where poaching cases are being dealt with in accordance with the law. The compensation value for illegal hunting of lion is USD 5 000, 00.
- SI 93 of 2009: Parks and Wild Life (Payment for Trapping of Wild Animals) Notice, 2009. This instrument provides for the payment of compensation to the state or game owners in the event that one is convicted for illegally trapping wild animals on various land categories. The compensation value for illegal hunting of lion is USD 5 000, 00.
- SI 40 Of 1994: Parks and Wildlife (Appropriate Authorities for Communal Land) Notice, 1994. This SI facilitates the granting of Appropriate Authority status to various Rural District Councils. This legislation devolved authority to Rural District Councils and gave rights to local communities to sustainable utilize wildlife and other natural resources in their areas of jurisdiction.

11.2.4 The Rural District Councils Act Chapter [29:13] 2002

The Rural District Councils Act is important in the wildlife sector as it provides for a legal entity (in Communal Lands) responsible for wildlife resources. Since the land in Communal areas is not privately owned by the communities and given that most of the communities do not constitute a legal entity, the Appropriate Authority status is conferred to the Rural District Councils (RDCs). Thus the RDCs act as custodians of the wildlife resources on behalf of the communities.

Efforts are now underway in some areas to form Community Development Trusts. There is scope for these Community Development Trusts to be used as vehicles to further devolve authority from the District level to the sub-district level, which will provide more income at a community level and therefore increase conservation support from the community as they will have a true vested interest.

The feasibility of granting Appropriate Authority to these Trusts in Zimbabwe needs to be assessed and piloted. The major challenge with these Trusts is that of financial sustainability as they do not have adequate funds to cater for their activities. Capacity-building of all Trust members is also a key requirement to ensure institutional sustainability.

In the Rural District Councils Act, there are three key terms that will be described further: Ward, Ward Development Committee and Communal Land. According to the Act, a "Ward" (an administrative unit) means a ward into which a council area is divided or re-divided. Several villages make up a ward. In the Act, a "Ward Development Committee" means a village development committee established in terms of Section 58 of the Act. A Ward Committee is made up of members who are elected from the community to represent the community in discussions/meetings with the Rural District Council. The Act further defines three different types of Wards. These are, Commercial Ward, Communal Ward and Resettlement Ward. The Commercial Ward is a large-scale commercial ward or a small-scale commercial ward. A Communal Ward is a ward consisting wholly or mainly of Communal Land. A Resettlement Ward is a ward consisting wholly or mainly of Communal Land (as in the case of the Communal Ward). It is important to establish whether in practice, the RDCs make
this distinction of the wards or whether they are all considered simply just as wards.

The "Communal Land" is defined as any land that is Communal Land in terms of the Communal Land Act [Chapter 20:04]; and any other land that was within the area of a district council on the 19th August 1988.

11.2.5 The Forest Act of 1948

This Act establishes the Forestry Commission and places demarcated forests under its control. The commission is responsible for the control, management and exploitation of state forests including the leasing of timber harvesting rights. The Act also gives the Minister the power to regulate the commercial use of timber from indigenous trees on other land.

As the appropriate authority for the Forest Areas, the Commission is also responsible for the management and conservation

11.3 Annex III: Analysis of Total Revenue by Country of Destination

Destination	2014	2015	Total
United States	$14,485,835	$11,942,785	$26,428,620
Russian Federation	$1,444,729	$861,925	$2,306,654
China	$1,416,196	$441,759	$1,857,955
Germany	$1,100,534	$698,450	$1,798,984
Canada	$620,852	$474,935	$1,095,787
South Africa	$513,070	$576,035	$1,089,105
France	$825,975	$158,291	$984,266
Australia	$671,527	$259,136	$930,663
Spain	$488,616	$321,064	$809,680
Austria	$519,322	$201,073	$720,395
India	$302,653	$241,741	$544,394
United Kingdom	$357,317	$183,888	$541,205
Italy	$181,956	$343,197	$525,153
Hungary	$418,824	$104,262	$523,086
Mexico	$252,263	$266,543	$518,806

Destination	2014	2015	Total
Norway	$300,645	$119,831	$420,476
Denmark	$132,690	$194,435	$327,125
Switzerland	$171,991	$123,828	$295,819
Sweden	$196,575	$80,014	$276,589
Ukraine	$80,432	$163,604	$244,036
Czech Republic	$104,450	$137,456	$241,906
Neatherlands	$89,042	$105,227	$194,269
Nigeria	$171,830	$0	$171,830
Bulgaria	$21,865	$123,469	$145,334
Argentina	$106,529	$24,888	$131,417
Finland	$65,768	$63,223	$128,991
Brazil	$56,785	$59,886	$116,671
Honduras	$104,683	$0	$104,683
Poland	$38,911	$62,015	$100,926
New Zealand	$17,880	$81,127	$99,007
Mauritius	$56,225	$36,945	$93,170
Chile	$91,374	$0	$91,374
Belgium	$9,340	$80,355	$89,695
Portugal	$78,470	$0	$78,470
Columbia	$77,944	$0	$77,944
Slovakia	$69,420	$0	$69,420
Botswana	$59,401	$0	$59,401
Pakistan	$54,208	$0	$54,208
Namibia	$20,298	$18,862	$39,160
Latvia	$37,611	$0	$37,611
Estonia	$12,078	$23,586	$35,664
Slovenia	$20,620	$11,200	$31,820
Kenya	$14,302	$16,957	$31,259
Dominican Republic	$30,463	$0	$30,463
Belarus	$0	$29,430	$29,430
Kazakhstan	$0	$28,460	$28,460
Romania	$0	$20,112	$20,112
United Arab Emirates	$19,629	$0	$19,629
Lao Peoples Democratic Republic	$15,000	$0	$15,000
Bolivia	$0	$11,553	$11,553
Lithuania	$9,164	$0	$9,164
Costa Rica	$5,900	$0	$5,900
Qatar	$4,896	$0	$4,896
Grand Total	**$25,946,088**	**$18,691,547**	**$44,637,635**

11.4 ANNEX IV: ANALYSIS OF TOTAL REVENUE BY SPECIES

Species	$2,014	$2,015	Total	2015 Quota	Utilised	% Utilised
Buffalo	$2,528,559	$1,962,570	$4,491,129	1,635	482	29%
Elephant (Tusks)	$2,042,610	$1,447,090	$3,489,700	246	64	26%
Elephant (Tuskless)	$1,444,040	$229,860	$1,673,900	462	113	24%
Lion	$630,950	$753,000	$1,383,950	82	49	59%
Leopard	$714,100	$668,490	$1,382,590	530	151	28%
Zebra	$594,239	$555,744	$1,149,983	2,480	600	24%
Sable	$456,615	$309,260	$765,875	718	78	11%
Kudu	$341,092	$357,963	$699,055	2,503	289	12%
Waterbuck	$293,903	$256,133	$550,036	988	156	16%
Hippo	$310,321	$217,470	$527,791	303	83	27%
Impala	$277,198	$242,624	$519,822	8,594	1,261	15%
Crocodile	$284,650	$202,705	$487,355	211	70	33%
Eland	$179,470	$187,990	$367,460	1,659	132	8%
Wildebeest	$180,665	$170,350	$351,015	2,189	220	10%
Giraffe	$158,385	$157,410	$315,795	880	135	15%
Nyala	$130,840	$117,175	$248,015	174	38	22%
Bushbuck	$116,011	$94,936	$210,947	1,082	125	12%
Warthog	$98,975	$89,820	$188,795	3,060	208	7%
Hyeana	$75,648	$54,503	$130,151	1,702	118	7%
Klipspringer	$44,130	$40,441	$84,571	823	59	7%
Bush Pig	$18,226	$30,370	$48,596	1,972	69	3%
Tsessebe	$19,800	$19,500	$39,300	186	15	8%
Baboon	$24,909	$13,664	$38,573	8,017	264	3%
Reedbuck	$23,265	$12,731	$35,996	371	20	5%
Steenbok	$13,790	$15,070	$28,860	927	31	3%
Jackal	$9,656	$15,889	$25,545	2,179	105	5%
Civet	$8,850	$11,368	$20,218	1,034	29	3%
Grysbok	$9,435	$8,585	$18,020	632	31	5%
Eland	$16,750	$0	$16,750	1,659	132	8%
Genet	$6,020	$14,183	$20,203	1,136	38	3%
Duiker, Grey	$2,774	$12,523	$15,297	2,005	53	3%
Duiker, Blue	$7,991	$0	$7,991	-	-	-
Honey Badger	$3,681	$3,625	$7,306	622	15	2%
Wild Cat	$3,160	$4,180	$7,340	812	19	2%
Guinea Fowl	$5,496	$968	$6,464	29,174	121	0%
Porcupine	$4,123	$1,473	$5,596	857	9	1%
Serval	$2,670	$2,410	$5,080	536	6	1%
Egyptian Goose	$3,025	$60	$3,085	4	-	0%
Cheetah	$2,560	$0	$2,560	42	-	0%
Ant Bear	$900	$1,651	$2,551	39	6	15%
Francolin	$1,166	$609	$1,775	22,449	109	0.5%

Species	2014	2015	Total	2015 Quota	Utilised	% Utilised
Dove	$1,321	$418	$1,739	34,485	63	0.2%
Monkey, Vervet	$885	$800	$1,685	3,677	15	0.4%
Ostrich	$1,200	$0	$1,200	14	-	0%
Mongoose	$508	$690	$1,198	279	3	1%
Sandgrouse	$456	$688	$1,144	8,088	78	1%
Oribi	$500	$500	$1,000	82	2	2%
Duiker, Red	$950	$0	$950	-	-	-
Caracal	$900	$0	$900	351	-	0%
Bushbaby	$850	$0	$850	-	-	-
Bontebok	$700	$0	$700	-	-	-
Waterfowl	$0	$400	$400	40	2	5%
Springhare	$60	$120	$180	-	-	-
Gemsbok	$105	$0	$105	6	-	0%
Hyrax	$75	$20	$95	371	1	0.3%
Duck	$29	$20	$49	10,779	13	0.1%
Aardwolf	$0	$0	$0	-	-	-
Blesbok	$0	$0	$0	40		0%
Rabbit	$0	$0	$0	252	-	0%
Hare	$0	$0	$0	138	3	2%
Lichtenstein's Hartebeest	$0	$0	$0	5	-	0%
Red Hartebeest	$0	$0	$0	7	-	0%
Grand Total	**$11,099,187**	**$8,288,049**	**$19,387,236**			

Barry, Anna <anna_barry@fws.gov>

Fwd: Conservation Status of African Lion in Zimbabwe

2 messages

Vannorman, Tim <tim_vannorman@fws.gov> Tue, Apr 5, 2016 at 8:43 AM
To: Brenda Tapia <brenda_tapia@fws.gov>, Anna Barry <anna_barry@fws.gov>

info from Zimbabwe on lions

---------- Forwarded message ----------
From: **Olivia Mufute** <omufute@zimparks.co.zw>
Date: Wed, Feb 17, 2016 at 12:15 AM
Subject: RE: Conservation Status of African Lion in Zimbabwe
To: "Vannorman, Tim" <tim_vannorman@fws.gov>

Dear Tim,

Thanks for responding to my email and my apologies for not attaching the document in my previous email. I have now attached the document; ***Conservation Status of African Lion in Zimbabwe***.

The document on the website is the ***Conservation Strategy and Action Plan for Lion (Panthera leo)*** in Zimbabwe and it is a different document from the one I have attached. Yes you can download this document from our website.

Canned hunting is not allowed in Zimbabwe. It is therefore illegal to conduct a canned hunt in Zimbabwe.

Regarding elephant management, the Regional Elephant Management Plans that I sent to you as separate documents are part of the ***National Elephant Management Plan (2015-2020)***. The regional plans are Annexes 9.4 to 9.7 in the National Elephant Management Plan.

Thanks and best regards,

Olivia Mufute

Zimbabwe Parks and Wildlife

Chief Ecologist

Direct line: +263-4-790570

In Harmony With Nature

BOOKINGS / RESERVATIONS
ZIMBABWE PARKS & WILDLIFE MANAGEMENT AUTHORITY
TEL: +263-4-706077/8
SWITCHBOARD : +263-4-707624-9
CELL: +263 783732479
E-MAIL: bookings@zimparks.co.zw
WEBSITE: www.zimparks.org

CNR BORROWDALE RD/SANDRINGHAM DRIVE
BOTANICAL GARDENS
P.O.BOX CY 140 CAUSEWAY, HARARE, ZIMBABWE
www.facebook.com/zimparks
twitter@zimparks



ACCOMMODATION - GAME DRIVES - CAMPSITES - BRAAI PICNICS
Hwange, Victoria Falls, Mana Pools, Matopos, Nyanga, Lake Kyle, Chinhoyi, Lake Chivero, Gonarezhou

Click here to view our website Disclaimer

From: Vannorman, Tim [mailto:tim_vannorman@fws.gov]
Sent: Tuesday, February 16, 2016 6:30 PM
To: Olivia Mufute
Cc: Darcy Vargas
Subject: Re: Conservation Status of African Lion in Zimbabwe

Dear Olivia,

Thank you for the e-mail this morning. There was not a document attached, but I am assuming that it is the same document that is currently on your web page; is that correct? If so, I can download it from the web site, so there is no need to resend the document.

I also see that there is a document on captive-bred lions on the web page. While the document defines "canned hunts", it does not state that canned hunting is illegal. Is it legal to hunt a captive-bred lion and, if so, how are these hunts handled in regards to conservation of wild lions?

On the subject of elephants, when I met with your colleagues in Las Vegas, I learned that Zimbabwe had finalized the national elephant strategy (I have a copy of this document), as well as the four regional plans. I don't have a copy of the regional plans. Would it be possible to send me copies of these documents? I did not see them posted on your web page, but if they are there I could download them.

Thank you again.

Tim

On Tue, Feb 16, 2016 at 10:49 AM, Olivia Mufute <omufute@zimparks.co.zw> wrote:

Dear Tim,

Further to the meeting at the 44th SCI Convention in Las Vegas, please find attached a document: Conservation Status of African Lions in Zimbabwe.

Regards

Olivia Mufute

Zimbabwe Parks and Wildlife

Chief Ecologist

Direct line: +263-4-790570

In Harmony With Nature

BOOKINGS / RESERVATIONS
ZIMBABWE PARKS & WILDLIFE MANAGEMENT AUTHORITY
TEL: +263-4-706077/8
SWITCHBOARD : +263-4-707624-9
CELL: +263 783732479
E-MAIL: bookings@zimparks.co.zw
WEBSITE: www.zimparks.org

CNR BORROWDALE RD/SANDRINGHAM DRIVE
BOTANICAL GARDENS
P.O.BOX CY 140 CAUSEWAY, HARARE, ZIMBABWE
www.facebook.com/zimparks
twitter@zimparks



ACCOMMODATION - GAME DRIVES - CAMPSITES - BRAAI PICNICS
Hwange, Victoria Falls, Mana Pools, Matopos, Nyanga, Lake Kyle, Chinhoyi, Lake Chivero, Gonarezhou

Click here to view our website Disclaimer

–

Timothy J. Van Norman, Chief

Branch of Permits

Division of Management Authority

U.S. Fish and Wildlife Service

(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

–
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

Conservation Status of African Lion in Zimbabwe.pdf
1382K

Vannorman, Tim <tim_vannorman@fws.gov> Tue, Apr 5, 2016 at 8:44 AM
To: Brenda Tapia <brenda_tapia@fws.gov>, Anna Barry <anna_barry@fws.gov>

more zimbabwe lion info

——— Forwarded message ———
From: **Vannorman, Tim** <tim_vannorman@fws.gov>
Date: Tue, Feb 16, 2016 at 11:29 AM
Subject: Re: Conservation Status of African Lion in Zimbabwe
[Quoted text hidden]
[Quoted text hidden]

CONSERVATION STATUS OF THE AFRICAN LION (*Panthera leo*) IN ZIMBABWE



ZIMBABWE PARKS AND WILDLIFE MANAGEMENT AUTHORITY
JULY 2014

TABLE OF CONTENTS

1.0 INTRODUCTION 3

2.0 SPECIES BIOLOGY AND LIFE HISTORY CHARACTERISTICS 4

2.1 Taxonomy 4

3.0 LION DISTRIBUTION AND RANGE 6

3.1 Parks and Wildlife Estate 6

3.2 Gazetted Indigenous Forest Areas 7

3.3 Commercial Ranches 8

3.4 Communal Area Management Programme for Indigenous Resources 8

3.5 Summary Distribution of Lions 9

4.0 SURVEY METHODOLOGY 11

5.0 POPULATION ESTIMATES 13

6.0 POPULATION DENSITIES 14

7.0 POPULATION TRENDS 19

8.0 LEGAL UTILIZATION OF LIONS 20

8.1 Annual Trophy Quotas 20

8.2 Quota Setting 21

8.3 Annual Trophy Quotas 21

9.0 ILLEGAL TRADE IN LIONS AND THEIR PRODUCTS 22

10.0 HUMAN AND LION CONFLICT MANAGEMENT 22

11.0 MANAGEMENT INITIATIVES AND CONTROL MEASURES WITH REGARD TO LION CONSERVATION 23

REFERENCES 25

1.0 INTRODUCTION

The African lion (*Panthera leo*) is an important species that plays a big role in the savannah ecosystem. It is a flagship species with huge social, economic and ecological values. It is a powerful symbol for Africa, and yet living with lions poses hardships for many communities. In some areas, the lion is a major predator on domestic livestock leading to profound conflicts with local communities.

The lion is not only a source of personal and economic damage and danger but is also of economic and personal benefits. The species contributes positively to the livelihoods of local communities through sport hunting. Trophy hunting also contributes to the conservation of lions through financial benefits that are ploughed back into its conservation and that local communities use for rural development programmes. Trophy hunting of the African lion is undertaken through a strict scientific based quota setting process with an objective of ensuring that utilization and any form of harvesting is sustainable.

Zimbabwe is one country that sustainably manages its lion population inside and outside protected areas. The African lion population is increasing in most areas. Research and monitoring of the species is at an advanced stage as there is a lot of baseline information and publications on the conservation status of the species. Zimbabwe has a lion management plan and strategy that are being implemented and reviewed on a regular basis. Rigorous monitoring of lion trophy hunting through adaptive management principles is carried out in Zimbabwe. Non-detrimental findings are conducted for all exports. In conclusion, harvesting and any other forms of off take are not detrimental to the survival of the African lion in Zimbabwe.

2.0 SPECIES BIOLOGY AND LIFE HISTORY CHARACTERISTICS

2.1 Taxonomy

Class	Mammalia
Order	Carnivora
Family	Felidae
Species	*Panthera leo*
English	African lion
Shona	Shumba
Ndebele	Islwane

African lions are the only social felids, with each pride being comprised with an average of 4 to 6 adult lionesses, their dependent offspring, and a temporary coalition of pride males. In lion prides there is no dominance hierarchy amongst lionesses, and female lions are 'free agents' who only contribute to communal care when they have cubs of their own. Although the pride is a stable social unit, it is a fission–fusion social group, in which individuals are typically found in a range of subgroup sizes and compositions. Although earlier studies suggested otherwise, grouping patterns within lion prides are, not associated with foraging efficiency or any other aspect of hunting. However Packer et al. (1990) concluded that group territoriality and group defence of cubs are the main reasons for sociality in lions. Mosser et al. (2009) conclude that female sociality has largely to do with interactions between neighbouring prides – supporting the group territorial hypothesis. Larger prides/subgroups usually 'win' encounters with neighbouring prides (Packer et al. 1990; Grinnell et al. 1995). Larger prides are generally found in higher quality habitats, which typically have numerous buffalo herds and several river confluences (Mosser 2008). The threat posed by neighbours leads to larger group sizes than does the threat of infanticide (Mosser et al. 2009). Cooperative defence against infanticide is another benefit of grouping for female lions (Pusey & Packer 1994). Playback experiments revealed that pride with dependent cubs typically retreat from

foreign males, but that lionesses approach female intruders (McComb et al. 1993, 1994). Leaving cubs unprotected puts them at considerable risk, suggesting that the need to respond to territorial threat may often override the value of protecting cubs. Cooperative defence against infanticide is another benefit of grouping for female lions (Pusey & Packer 1994). However, the threat posed by neighbours leads to larger group sizes than does the threat of infanticide (Mosser et al. 2009).

Although pride males are not always with the pride they fulfil a key function defending the pride and chasing off would be invading or "infanticidal males". In order to do so, males typically form coalitions of two or three males, with solitary males seldom being able to defend a territory. Territories are defended through roaring, patrolling, scent marking and direct aggressive encounters. Importantly male lions impact their reproductive success, mortality and wounding of females. Neighbouring resident males also influence the female grouping patterns within larger prides, and improve the quality of their own pride's territory. Thus male lions are important in group-territorial competition and may use lethal aggression to tip the balance of power in favour of their prides (Mosser et al. 2009). Numerical advantage may additionally benefit large male coalitions by reducing levels of inter-pride competition for their females. The effects of intergroup competition between females are direct and immediate, so much so that male coalitions attempt to modify the dynamics of territorial competition. Group-territorial competition therefore provides strong selection for sociality in both male and females lions. Lions are matrilineal (females stay in their natal pride), with one-third of females dispersing to form new prides (Pusey & Packer 1987). Males leave their natal pride by the age of 4 years and remain solo or form a coalition with other males (Pusey & Packer 1987). Large coalitions of young males (4-5 years of age) are able to easily oust single pride males from their territories, and in areas with no males older than six years of age successfully maintain reproduction in lion prides

Although there is *not yet any empirical evidence* on how the group territorial nature of lions is affected by excessive trophy hunting, the findings from Mosser et al. (2009) suggest that these could be substantive. Without males to co-operate in group territorial defence lionesses might:

- Have to alter their groupings patterns (which may have as yet not described negative consequences)
- Lose more cubs to infanticide, both from foreign males and ***importantly to lionesses from neighbouring prides*** that will kill cubs if the opportunity exists
- Experience higher wounding and mortality rates

3.0 LION DISTRIBUTION AND RANGE

In Zimbabwe, lions are found in three broad land use types, namely gazetted protected areas (parks estate and indigenous forest areas), community-based natural resource management areas and on private land.

3.1 Parks and Wildlife Estate

Parks Estate is under the jurisdiction of the Zimbabwe Parks and Wildlife Management Authority and covers about 13% of the area of the country (390 580 km^2). The Parks Estate comprises six categories of protected areas that are gazetted under the Parks and Wildlife Act, Chapter 20:14. The six categories of protected areas are national parks, recreational parks, sanctuaries, safari areas, botanical reserves and botanic gardens. In these areas, wildlife is the primary and only land use permitted except in botanic gardens. The African lions occur in most of Zimbabwe parks and wildlife estates with the exception of a few areas located in the high and central parts of the country i.e. Matopos National Park, Sebakwe, Ngezi, Chivero, Kyle and Chegutu Safari Area. There are no free ranging lions found in the country's recreational parks, which are located in areas of high human densities where conventional agricultural practices in the surrounding areas preclude the establishment of viable population sizes. Recreational Parks are not suitable for lions due to the small size of the areas, existing prey base and are therefore subject to high human-wildlife conflict. Most of the National Parks and Safari Areas located on the borders of the country support lion populations. Connectivity of lion range has been enhanced by the creation of Transfrontier Conservation Areas such as Greater Limpopo Transfrontier Park (GLTP) and Greater Mapungubwe Transfrontier Conservation Area. Trophy hunting of wildlife is legally permitted in safari areas. There are sixteen safari

3.3 Commercial Ranches

In 1960's there was a shift in wildlife policy from State control to individual proprietorship for white commercial farmers who could now benefit financially from the wildlife on their farms. In 1975, the Parks and Wildlife Act 14/1975 gave commercial farmers the right to exploit wildlife, including lions on their land. The Act legally formalized the policy shift towards sustainable utilization by aiming to confer privileges on owners or occupiers of alienated land as custodians of wildlife. The Act designated these owners or occupiers of alienated land as Appropriate Authorities over wildlife. On commercial private land, lions are found on single ranches and on conservancies. Conservancy are defined as a contractually legitimated entity which involves two or more recognized land and resource authorities. Most of the private farms that have lions are adjacent to major gazetted protected areas.

3.4 Communal Area Management Programme for Indigenous Resources

It was until 1982 that the right to exploit wildlife was extended to communal through granting the Appropriate Authority Status over their wildlife resources to rural district councils. Such Authority allows Rural District Councils to manage and benefit from wildlife resources occurring in them. The intention was to return rights of access to natural resources through legislative change, devolve responsibility and economic empowerment. The Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) is the process through which Government is devolving the management of wildlife resource to communal farmers. Currently (July 2014), 58 Rural Districts have been granted the Appropriate Authority status to manage wildlife resources in their areas. Lions are found in communal areas that are adjacent to major protected areas (Figure2). Lion hunting is allowed in CAMPFIRE districts. Outside of protected areas, lions largely exist on areas peripheral to National Parks.

areas found in the country and lions are found in Matetsi in the north-western area, Chete, Chirisa (in the Sebungwe region), Charara, Hurungwe, Sapi, Doma (in the Zambezi Region), Malipati (South-eastern part of the country) and Tuli safari areas (Figure 1).

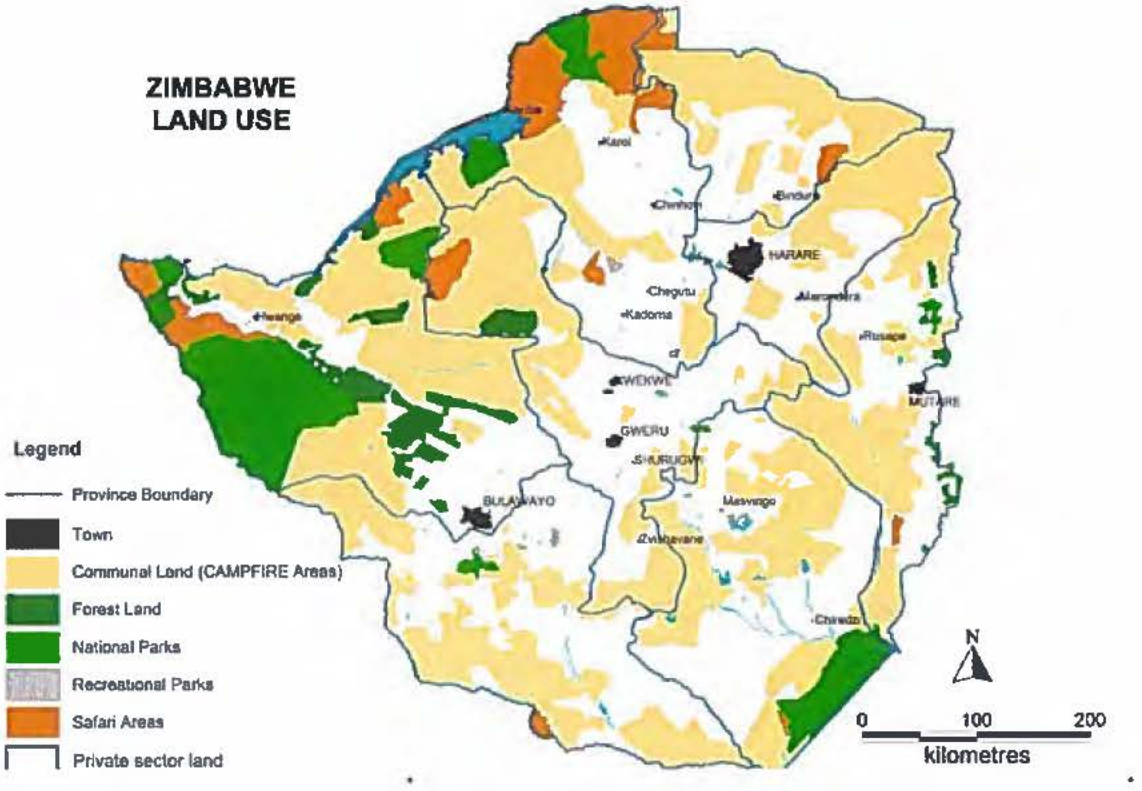


Figure 1: Map of Zimbabwe showing safari areas where trophy hunting is legally permitted.

3.2 Gazetted Indigenous Forest Areas

According to the Forest Act, Chapter 19:05, twenty-four gazetted indigenous forest areas are under the jurisdiction of a State parastatal, Forestry Commission and cover about 880 000 ha (2%) of the area of the country. In gazetted indigenous forest areas, lions are found and hunted in Fuller, Kazuma, Pandamasuwe, Ngamo, Sikumi, Gwayi, Sijarira and Gwampa Forests. The above mentioned State gazetted areas are found on Kalahari sands in the north-western part of the country Zimbabwe.

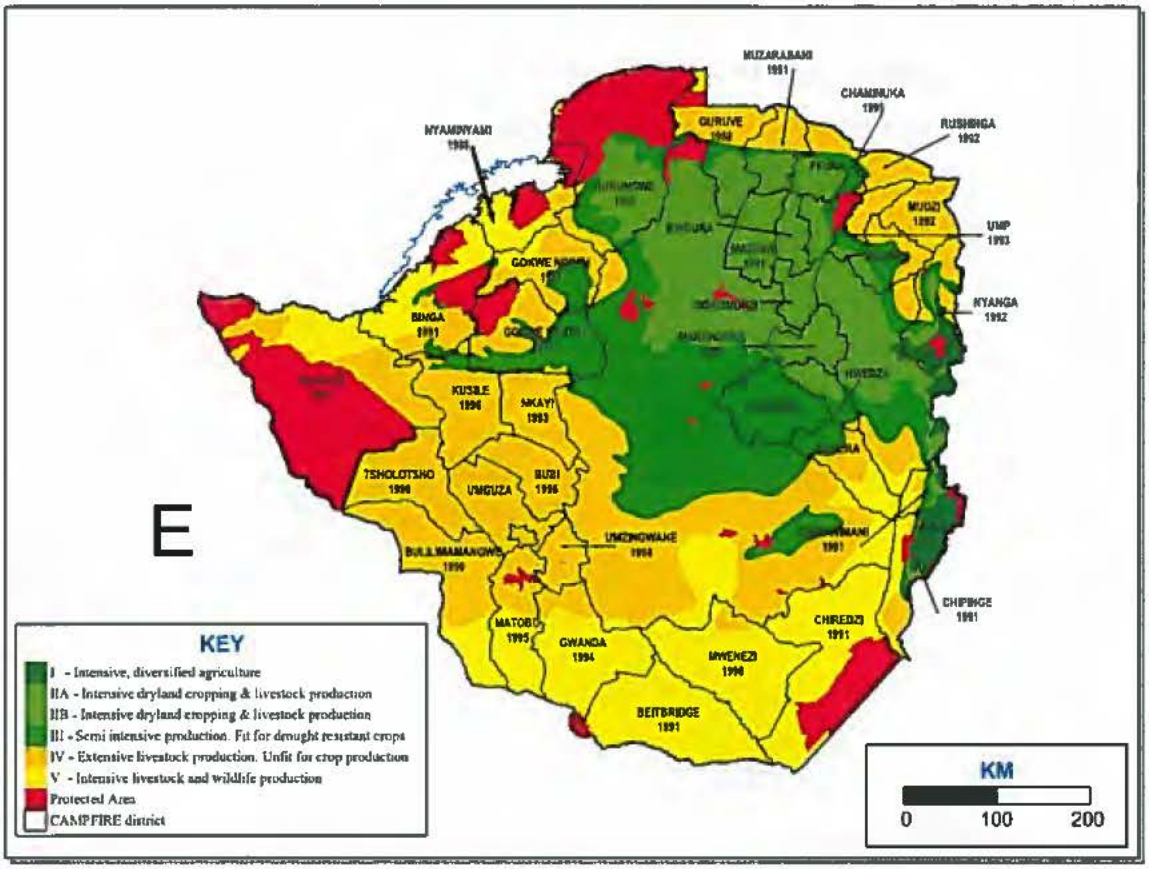


Figure 2: Map of Zimbabwe showing CAMPFIRE districts

3.5 Summary Distribution of Lions

Figure 3 shows a summary of the distribution of lions in Zimbabwe. The distribution of the African lion in Zimbabwe coincides with the major wildlife areas in the country; which are as follows, the North West Matabeleland Region, Sebungwe Region, the Mid-Lower Zambezi valley and South-Eastern part of the country (Gonarezhou National Park, Save Valley Conservancy, Chiredzi River Conservancy, Malilangwe Conservancy, Beitbridge-Tuli complex). Zimbabwe's main lion range includes the Hwange-Matetsi Ecosystem which is about 25000 km^2, the Mid Zambezi Valley (17127 km^2), Sebungwe (15622 km^2) and the South East Lowveld (11000 km^2) (Table 3). The Hwange Ecosystem covers Hwange National Park, Matetsi Safari Area, Gwayi Intensive Conservation Area and Forestry Commission forests such as Sikumi, Gwampa and Fuller. In addition to the main geographic ranges listed above, lions are found on privately owned game farms,

conservancies, and isolated state protected areas throughout the country. Occasional African lion sightings have been recorded in other areas from time to time such as Nyanga National Park in Zimbabwe's Eastern Highlands and Nyatana Wilderness in the North Eastern border with Mozambique.

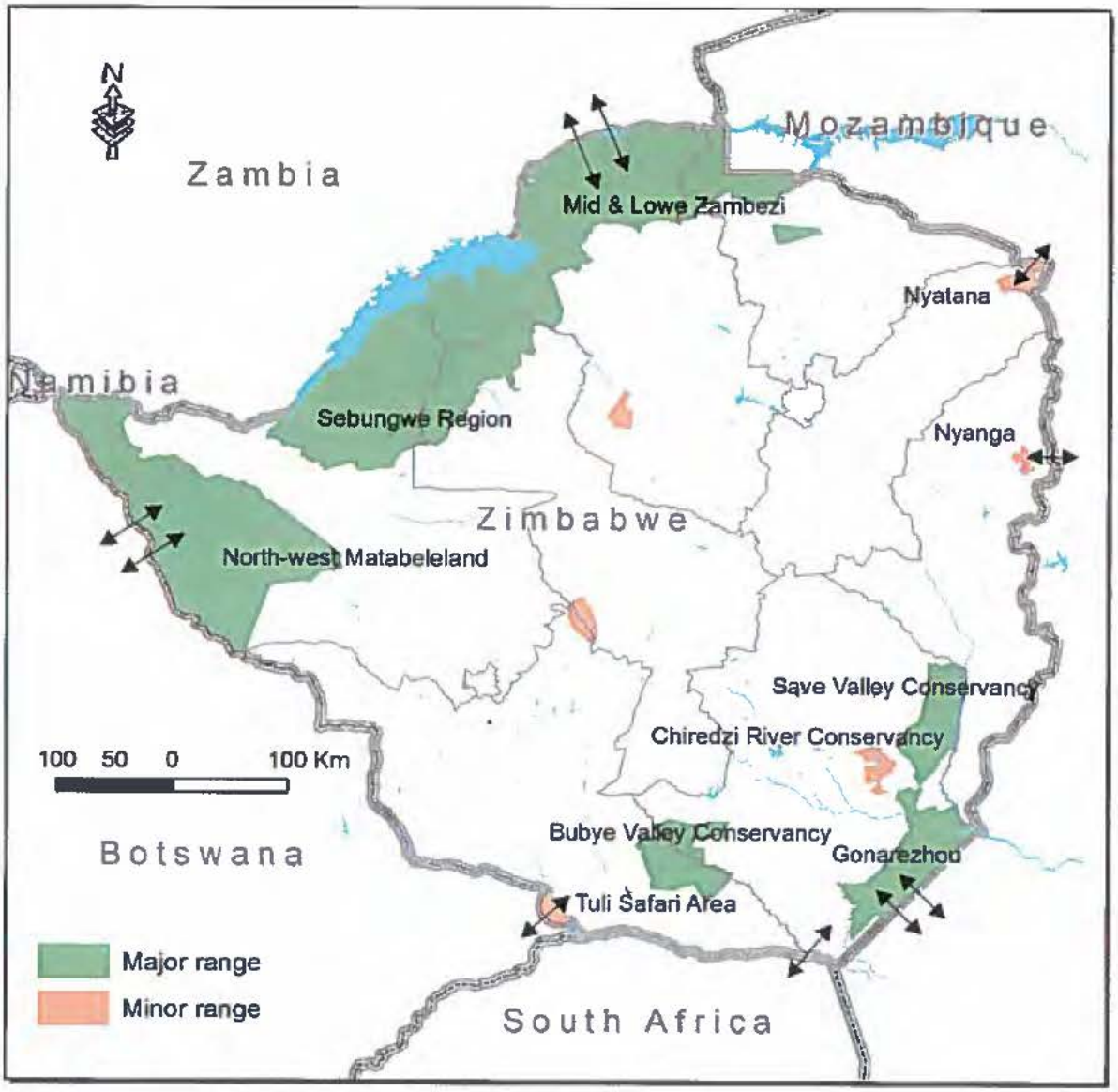


Figure 3: African Lion (*Panthera leo*) Range in Zimbabwe (Zimbabwe Parks and Wildlife Management Authority, 2014)

4.0 SURVEY METHODOLOGY

The population estimates of African lions in Zimbabwe are determined through carnivore spoor surveys, systematic lion collaring and call-up surveys. With the strategy to maintain the wilderness values of most protected areas, there is low road penetration in the parks estates, however all suitable roads are used as transects, and in areas of suitable substrate, spoor surveys have shown to be an effective and efficient means to assess wildlife densities (Stander 1998: Fuston et al. 2001; Davidson and Romanach 2007). Patrol reports, field observations by Zimbabwe Parks and Wildlife Management Authority rangers and other sightings by tour operators and tourists also contribute to knowledge of the status of lions in Zimbabwe's protected areas. Between 2006 and 2012 leopard and lion spoor surveys were conducted in the major wildlife areas. The surveyed areas are shown in the map in Figure 4. A total of 28 sites were surveyed between 2006 and 2012. The survey covered the major areas within the lion range in the country. The survey sites covered 48123km^2 **(12% of the country)** and 14 400km of transects.

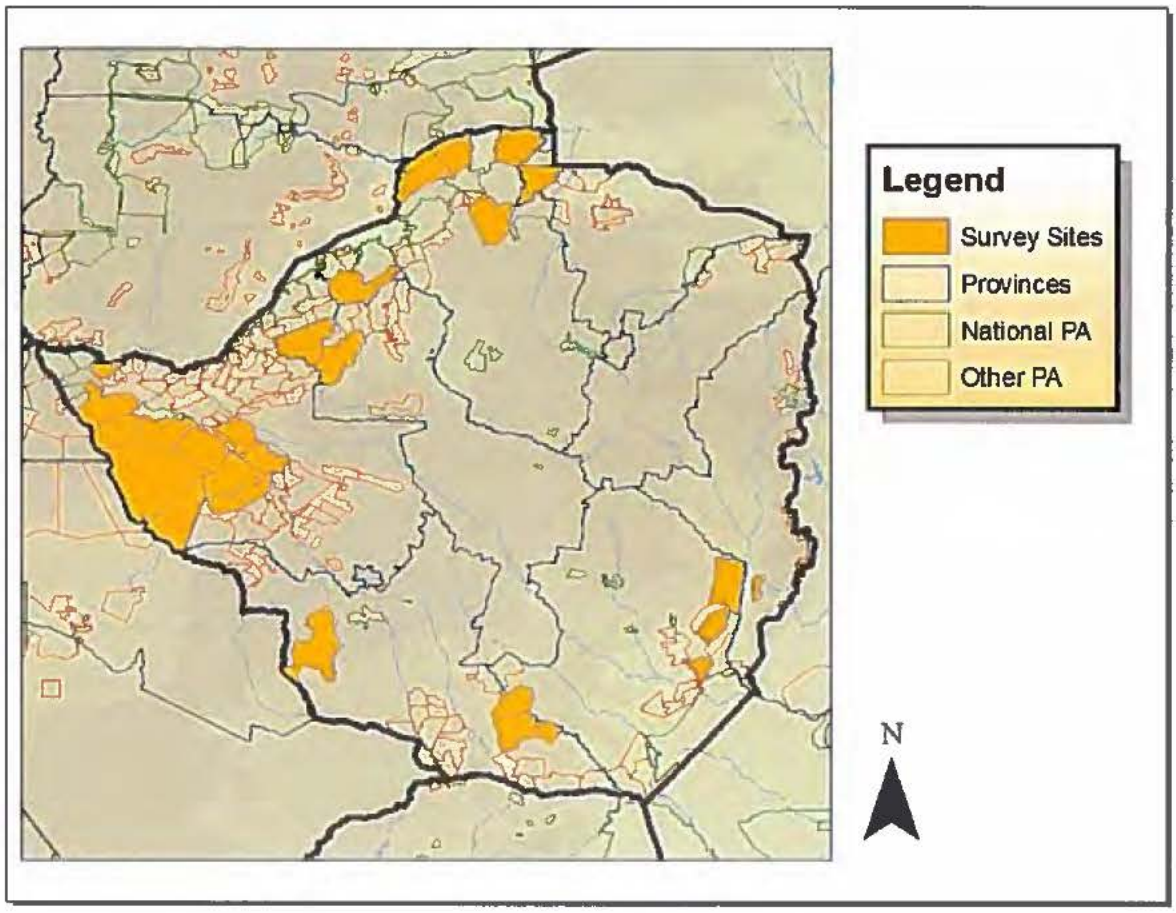


Figure 4: African Lion Survey Sites in Zimbabwe (2012)

Lion population surveys provide useful indices of abundance that can be used to determine spatial distribution, as well as temporal trends in population numbers. Different survey methods are conducted in most of the wildlife estates and areas of minor distribution for purposes of generating information for setting sustainable lion trophy hunting quotas and for population management. In most protected areas, lions compete for food with other carnivores such as spotted hyenas, leopard and wild dog. Carnivore density information can offer early warnings about conservation needs, and provide information for successful future management as well as offer input for decisions regarding hunting quotas or any management requirement. Moreover, carnivore density trends are a reflection of prey densities and therefore save as useful indicator (Conservation Strategy and Action plan for the Lion (*Panthera leo*) In Zimbabwe, 2006).

5.0 POPULATION ESTIMATES

The lion population estimate at national level ranges from 1700 to 2043 animals (Chardonnet 2002, Bauer and Van Der Merwe 2004) (Table 1). The current lion population estimate for the Hwange Matetsi complex is 750, South Eastern Lowveld 350, between 150-175 in the Save Valley Conservancy, 59 in Gonarezhou National Park, 37 in Malilangwe and 400 animals in Bubye Valley Conservancy. The Mid Zambezi Valley comprising of Matusadonha and Mana Pools National Parks, Charara, Chewore and Sapi Safari Areas has a current population estimate of 600 lions (Zimbabwe Parks and Wildlife Management Authority Reports 2011). The current lion population estimates in the minor range areas are also significant.

Table 1: Lion Population Estimates (Bauer & Van Der Merwe, 2004, Chardonnet, 2002).

Area	Sq km's	Estimated population	Estimated minimum	Estimated maximum	Estimated population	Estimated minimum	Estimated maximum
Charara Safari Area	2207	40	24	56			
Chete/Sijarira	1530	40	24	56			
Chewore Safari Area	2704	100	60	140			
Chirisa Safari Area	1788	60	24	56			
Chizarira National Park	1878	60	36	84			
Dande Safari Area	988	50	30	70			
Doma Safari Area	1933	35	21	49			
Gonarezhou/Save Chiredzi/Malilangwe/ Beitbridge/Tuli	5200	130	91	169	188	130	245
Hurungwe Safari Area	2606	80	48	112			
Hwange Ecosystem	25000	120	72	168	543	434	652
Matetsi Safari Area	10349	60	36	84	150	120	180
Mana Pools National Park	14400	97	83	112	495	396	594
Matusadona National Park	1392	120	90	150	310	248	372
Sapi Safari Area.		40	24	56	.		
Zambezi National Park	865	25	15	35			
Totals	72 840	1057	678	1397	1686	1328	2043

6.0 POPULATION DENSITIES

Table 2 shows the current lion population estimates and densities in the Hwange-Matetsi ecosystem. The 12 year average density in the Hwange National Park is 2.8 lions per 100km^2 (2000-2011) with the population fluctuating over this time. This estimate is based on spoor transects and detailed population estimates and on individual recognition of animals in an intensively studied population.

Table 2: Results of lion population surveys of lions in the North West Matabeleland (Hwange Lion Research, 2014)

	Density	Area (km2)	Estimated number of lions	Year of survey
Hwange NP	3.75	14900	559	2013
Matetsi Units 1-5	3.04	1934	59	2008
Matetsi Units 6-7 and Zambezi NP	2.98	1585	47	2013
Ngamo & Sikumi Forest	0.45	1386	6	2008
Gwaai Conservancy	2.40	927	22	2007
Hwange Communal Land (Mvutu & Shana area)	0.61	392	2	2012
Tsholotsho buffer adjacent HNP	0.54	1275	7	2010-11
Chizarira NP	0.83	1948	16	2012
Chirisa SA	0.00	1713	0	2012
Matusadonha NP	2.17	1427	31	2013
TOTAL Lion Estimate			**750**	

The South Eastern Lowveld has a lion population density of about 6 lions per 100km^2 in the Save Valley Conservancy, 9 lions per 100 km^2 in Malilangwe and 0.8 lions per 100 km^2 in the Gonarezhou National Park (Zimbabwe Parks and Wildlife Management Authority Annual Report, 2013) (Figure 5).

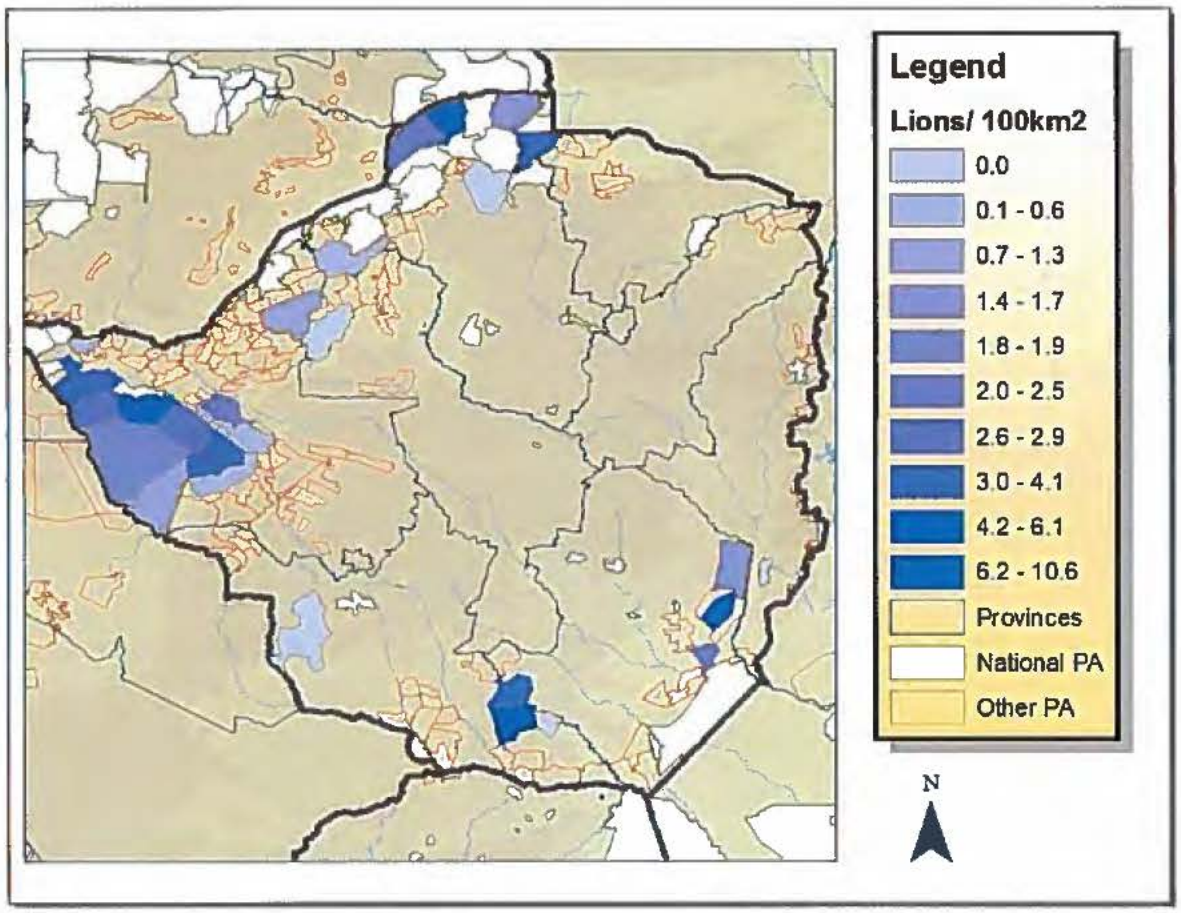


Figure 5: Lion densities in Zimbabwe (Leopard and Lion Spoor Survey Report, 2012).

The Matetsi-Kazuma-Zambezi complex to the North West of Hwange (4935km^2; composed of Deka and Matetsi Safari Areas, Kazuma and Zambezi National Parks and Kazuma and Pandamasuie Forests) is estimated to have a population of 222 lions based on a density of 4.5 lions per 100km^2. This estimate is extrapolated from a spoor survey of 1600km^2 area of the Matetsi-Kazuma-Zambezi complex in 2007. Table 3 shows lion population estimates and densities in selected survey sites in the Zambezi Valley and

surrounding areas from the spoor survey done between 2011 and 2012. Table 4 shows the population estimates for Gonarezhou National Park in 2013.

Table 3: Population estimates and lion densities in selected survey sites in the Zambezi Valley (Hwange Lion Research, 2014)

Survey Site	Density/ 100km^2	Area (km^2)	Estimated number	Year of Survey
Omay	0.28	1865	5	2012
Chewore North	1.92	1648	32	2012
Dande	1.83	1155	21	2012
Hurungwe (Nyakasanga & Rifa)	1.89	1709	32	2011
Mana Pools	4.52	1287	58	2011
Hurungwe Mukwichi CAMPFIRE Area	0	1853	0	2011

Table 4: Population estimates from call up survey for Gonarezhou National Park (Lion Call Up Survey, 2013)

Parameter	Northern GNP	Southern GNP	Total
Area (km^2)	1665	2121	3786
Combined transect length (km)	229.8	301.8	531.6
Penetration ratio	1:7.25	1:7.03	1:7.12
Results			
Number of individual lion spoor seen	22	5	27
Lion spoor frequency (km/spoor)	10.45	60.36	19.69
Spoor density (spoor/100km)	9.57	1.66	5.08
Density of lions per $100km^2$ (Y=0.3049X)	2.9	0.5	1.5
Estimated number of lions	48	11	59

7.0 POPULATION TRENDS

In Zimbabwe, trends in the population estimates of African lions show a growing population trend. The average lion densities in most protected areas are also showing an increasing trend. For example in Gonarezhou National Park as shown in Table 5, an estimate of 24 lions was established in 2009 and by 2013 the population had grown by 150% to an estimated 60 individuals within a period of 4 years. Other areas within other protected areas with similar management regimes are also reflecting similar trends in population estimates.

Table 5: African Lion population estimates for Gonarezhou National Park (2009 to 2013) (Annual Report, 2013)

Species	2009	2010	2011	2012	2013
Lion	24	34	55	49	59

Bubye Valley Conservancy is a closed protected are system with a large resident lion population. Figure 6 shows the trend in lion population growth for the Conservancy from the time of introduction of lions into the property in 1999 to present. Bubye valley conservancy has the highest lion density of 14 lions per $100km^2$.

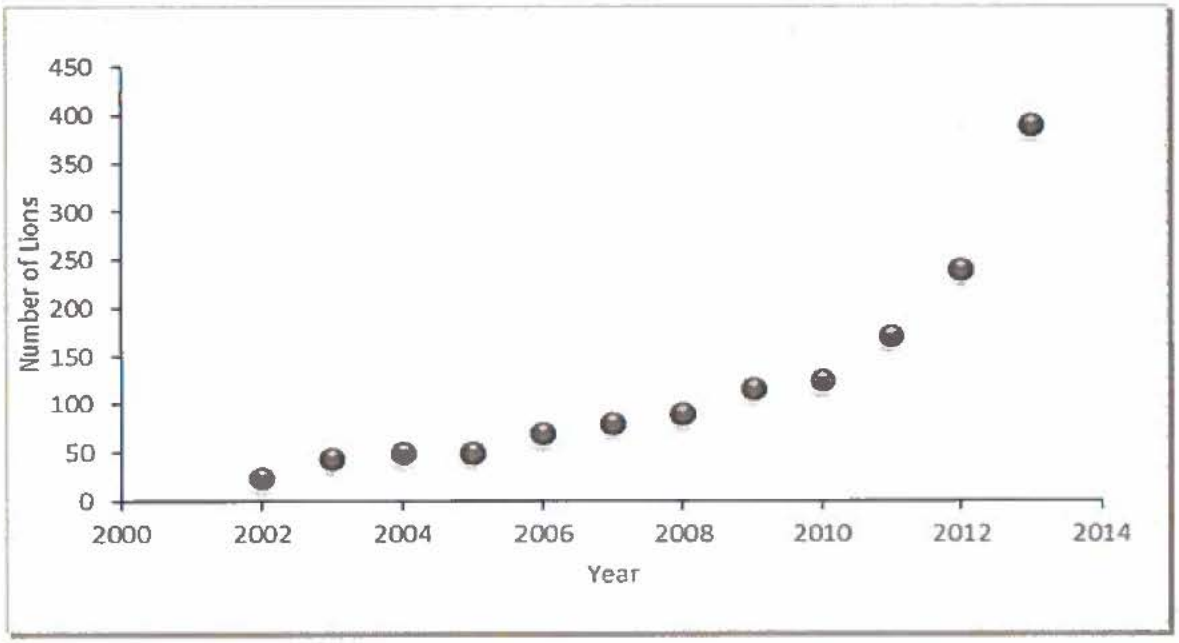


Figure 6: Trends in lion population for Bubye Valley Conservancy (Lion Report, 2014)

8.0 LEGAL UTILIZATION OF LIONS

8.1 Annual Trophy Quotas

Lions are used for consumptive and non-consumptive purposes. The main uses are trophy sport hunting, photographic safaris and educational purposes in captive breeding operations. Table 8 shows national annual lion trophy quotas for different broad land use types. The quotas set for trophy hunting are declining from 114 in 2004 to 89 in 2014 as part of adaptive management of the lions.

Table 8: National Annual Lion Trophy Quotas (ZPWMA Utilisation Unit, 2014)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Parks	36	30	34	30	29	25	26	29	31	36	38
Communal	58	45	43	34	35	38	34	33	31	24	26
Forestry	9	8	3	3	3	3	3	4	4	4	4
Private	11	15	22	26	25	24	19	20	17	21	21
Totals	**114**	**98**	**102**	**93**	**92**	**90**	**82**	**86**	**83**	**85**	**89**

8.2 Quota Setting

Zimbabwe uses scientific information in the setting of adaptive lion quotas. Information from spoor surveys, camera traps, ranger based sighting is used during the quota setting process. Other sources of indirect information include the actual offtake, duration of hunt, trophy size and historical data are also considered. In Campfire areas incidences of Human lion conflict is also taken into consideration where surveys have not been possible.

The Quota setting process involves all stakeholders namely the ZPWMA, Landowners, Safari Operators, Campfire managers and their representatives. During the workshops presentations are made by the proponents who are rigorously questioned by the stakeholders. The Quota setting process is a participatory process where proponents present their proposals which are scrutinised according to set criteria. The Lion quota is therefore adaptively issued depending on the biological factors that are presented at the workshop. Where it is felt that not enough information has been presented a precautionary quota is issued. The Authority reserves the right to carry out verification of the presented information in the form of site visits.

8.3 Annual Trophy Quotas

In Zimbabwe the lion is not listed on the CITES appendix and as such the country is able to set quotas which are sustainable with the numbers not limited by CITES.

9.0 ILLEGAL TRADE IN LIONS AND THEIR PRODUCTS

Illegal trade in lions and their products is very insignificant. There are no records of people found in possession of illegally acquired lion specimens in Zimbabwe. Anyone found in possession of illegally acquired lion specimens pays a fine of USD5000 or faces a mandatory jail sentence. In On conviction for lion poaching, courts may ask the convict to pay compensation fee of US$**20 000.** Some illegal off takes occur when lions are accidentally killed through snares or chemical poisoning meant for herbivores. Other cases involve retaliatory killing of lions as a result of livestock predation outside protected areas. Figure 5 show that poaching of lions is increasing since 2009.

10.0 HUMAN AND LION CONFLICT MANAGEMENT

The lion is a flagship species and powerful symbol of Africa, and yet living with lions poses hardships for many communities. In some areas, the lion is a major predator on domestic livestock, leading to profound conflicts with local herders.

Table Human and Lion Conflict (2009 to 2011) (CAMPFIRE Association, 2012)

District	**Total incidents**	**People Injured**	**People Killed**	**Livestock killed**
Hurungwe	5	2	2	1
Chiredzi	25	0	0	136
Mbire	5	0	5	7
Binga	9	0	0	39
Total	**44**	**2**	**7**	**183**

11.0 MANAGEMENT INITIATIVES AND CONTROL MEASURES WITH REGARD TO LION CONSERVATION

Outside of protected areas, lion's prey base is much reduced. The conservation of habitat outside protected areas is important. Co-existence of lions and people is promoted through giving value to lions, through tourism and hunting Communal Area Management Programme for Indigenous Resources (CAMPFIRE) is promoted in a number of communal lands. Government policy initiatives and control measures regarding lion conservation include the following:

- Appropriate Authority Status where land holders are given the rights to utilize and benefit from wildlife on the areas under their jurisdiction this is through CAMPFIRE, a community based natural resource management programme.
- Wildlife Based Land Reform Policy (2002)
- Conservation strategy and action plan for the lion (*Panthera leo*) in Zimbabwe (2006). Prepared following a Workshop. 30-31 October 2006. Harare

There are a number of collaborative research and monitoring programmes in the major range areas covering land within and around Hwange National Park, Matusadona National Park as well as Bubye and Save Valley Conservancies. These research programmes cover population dynamics, behaviour and prey dynamics as well as impact of trophy hunting, economic value of lions to consumptive and non-consumptive tourism and conflict between lions and local people with a view to mitigating of conflicts and improved conservation of lions in these areas. Other management initiatives and control measures include the following:

- Undertaking non-detriment findings for all lion exports quotas
- Research and monitoring in major parks estates like Hwange NP and Gonarezhou National Park
- Implementing a rigorous Quota setting Methodology across all hunting areas.
- Training of Rural District Councils in alternative Problem Animal Control methods.

- Participatory land use planning to minimize human-lion conflict.
- Development of updated park development plans for all protected areas and surrounding land uses.
- Lion Workshops for various targeted stakeholders.
- Training modules on lion management and lion aging at the Mushandike Wildlife College and National Universities.
- Holding Judiciary Stakeholder workshops to ensure appropriate deterrent sentences to offenders.
- Education and Awareness
- Captive Breeding of lions for tourism and educational programmes.

Starting from 2015 lion spoor surveys will be done at 2 year interval in all wildlife areas and lion call up survey will be done in the third year in all major lion range areas.

REFERENCES

Bauer, H and Van Der Merwe, S 2004. Inventory of free ranging lion *Panthera leo* in Africa. *Oryx* 38(1), 26-31

Chardonnet, Ph (ed) 2002. Conservation of the African lion. Contribution to a status survey. International Foundation for the Care of Wildlife, France, conservation force, USA, 177pp

Conservation Strategy and Action plan for the Lion (*Panthera leo*) In Zimbabwe – Prepared following a workshop 30-31 October 2006, Harare.

Davidson, Z. & Romanach, S. (2007) Estimations of lion and hyena density in the Save Valley Conservancy using two different census techniques: spoor transects and call-up stations. *Report for SVC, WildCRU and University of Zimbabwe, TREP.*

Funston, P.J., Herrmann, E., Babupi, P., Kruiper, A., Jaggers, H., Masule, K. & Kruiper, K. (2001) Spoor frequency estimates as a method of determining lion and other large mammal densities in the Kgalagadi Transfrontier Park. (*Book chapter*).

Grinnell, J., Packer, C. & Pusey, A. E. 1995. Cooperation in male lions: kinship, reciprocity or mutualism? Animal Behaviour, 49, 95–105.

Groom R. J, Funston P.J, & Mandisodza R (2014) Surveys f Lions (*Panthera leo*) in Zimbabwe yielding disturbing results: What is driving the population collapse? Fauna And Flora International, Oryx, 1 of 9

McComb, K., Packer, C.&Pusey, A. (1994). Roaring and numerical assessment in contests between groups of female lions. Anim. Behav. 47: 379–387.

Packer, C., Scheel, D. & Pusey, A. E. 1990. Why lions form groups: food is not enough. American Naturalist, 121, 716–728.

Pusey, A. E. & Packer, C. (1987). The evolution of sex-biased dispersal in lions. Behavior 101: 275–310.

Pusey, A. E. & Packer, C. (1987). The evolution of sex-biased dispersal in lions. Behavior 101: 275–310.

Stander, P.E. (1998). Spoor counts as indices of large carnivore populations: the relationship between spoor frequency, sampling effort and true density. J. Appl. Ecol. 35, 378–385.

Whitman K & Packer C (1997). The effect of sport hunting on social organisation of the African lion (*Panthera leo*). Proceedings of a symposium on lions and leopards as game ranch animals. Onderstepoort, October 1997.

Barry, Anna <anna_barry@fws.gov>

Fwd: Zimbabwe Lion

1 message

Vannorman, Tim <tim_vannorman@fws.gov> Tue, Apr 5, 2016 at 8:41 AM
To: Anna Barry <anna_barry@fws.gov>

Zimbabwe lion information
——— Forwarded message ———
From: **Eckert, Matthew** <MEckert@safariclub.org>
Date: Tue, Mar 29, 2016 at 4:32 PM
Subject: Zimbabwe Lion
To: Tim Van Norman <Tim_Vannorman@fws.gov>

Hi Tim,

Zimbabwe is asking for our support on some lion work. Before we help them, we wanted to ask whether you see anything that is missing from this scope of work that would be important to include for making an enhancement finding. I'm in the office tomorrow through Friday if you wouldn't mind calling me on this issue. They want to start work next week.

Thanks,

Matt
202-543-8733

–
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

***Sign up** for our e-newsletter to learn how we're working around the globe to protect species and their habitats!*

2 attachments



ZPWMA SCI Support Letter.jpg
388K

Lion NDF Proposal.pdf

211K

ZIMBABWE PARKS AND WILDLIFE MANAGEMENT AUTHORITY

Telephone : 263-4-792786-9
: 707624-9

Fax : 263-4-708180
: 793867, 250658

Email : info@zimparks.co.zw

All correspondence to be directed to Director General

Head Office

Botanical Gardens
Cnr Borrowdale Rd/Sandringham Dr
P.O.Box CY 140
Causeway
Harare

www.zimparks.org

Ref:

22 March 2016

SCI Africa Chapter

ATTENTION: Mr George Pangeti

RE: LION (*Panthera leo*) NON DETRIMENT FINDING FOR ZIMBABWE

The Zimbabwe Parks and Wildlife Management Authority (ZPWMA) in conjunction with Zimbabwe Professional Hunters and Guides Association (ZPHGA) are requesting financial support to prepare the Zimbabwe lion non detrimental finding in order to comply with the USFWS general ruling under section 4d of the ESA. The ZPWMA would be working with the ZPHGA on the document under the following terms of reference and guidelines (see attached document).

1. Establish population status
2. Establish population trends
3. Distribution of lions in Zimbabwe
4. Harvest/ utilization of lions
5. trade information and legal status
6. local community involvement
7. use of hunting fees for conservation
8. other biological and ecological factors

The ZPWMA has assigned Mrs Rose Mandisodza-Chikerema to work on the project with Mr Vernon Booth from ZPHGA.

Our budget to undertake this work is outlined in the documents attached.

A. Musakwa (Mr)
For DIRECTOR GENERAL

Study of the contribution of sustainable trophy hunting to the management and conservation of lion in Zimbabwe

Background

On the 23rd December 2015, the U.S. Fish and Wildlife Service (USFWLS), determined that the status of the lion subspecies from West Africa (*Panthera leo leo*) is endangered while the southern and eastern African subspecies (*P. l. melanochaita*) is threatened in terms of the Endangered Species Act of 1973, as amended (ESA)[1]. Consequently, the USFWLS published a rule under section 4(d) of the ESA that provides for conservation measures for *P. l. melanochaita*. This rule is effective from January 22, 2016 and is available on the Internet at http://www.regulations.gov.

In 2011, the USFWLS received a petition from several international animal welfare organisations requesting that the African lion subspecies be listed as endangered under the ESA. In 2012 the USFWLS published a "positive" 90-day finding confirming that it would initiate a status review of the African lion. In October 2014, the results of this review were published in the Federal Register concluding that the listing of the subspecies *Panthera leo leo* as a threatened species was warranted. Moreover, USFWLS proposed a rule under section 4(d) of the ESA to provide conservation measures for the African lion.

Following this announcement, USFWLS received additional comments from the public and peer reviewers that were taken into consideration to determine the final listing status of lion. This final rule incorporates changes based on the comments that were received as well as newly available scientific and commercial information that became available after the close of the comment period. In particular, USFWLS took into consideration additional information on the practices of trophy hunting that experts identified as undermining the sustainability of trophy hunting of lion populations. This prompted USFWLS to expand its assessment of the level of threat that trophy hunting presents to the species that resulted in further factors been take into consideration when making an enhancement finding for importation of sport-hunted trophies of *P. l. melanochaita.*

Information required to support Non-Detrimental Findings (NDF) under the 4(d) Rule for *Panthera leo melanochaita*

The purpose of the ESA is to provide a means whereby the ecosystems upon which endangered and/or threatened species depend may be conserved, to provide a programme for the conservation of such endangered and/or threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in the ESA. As a result, an import permit is now required under 50 CFR 17.32 for the

[1] The Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*), is a law that was passed in the USA to prevent extinction of species by providing measures to help alleviate the loss of species and their habitats. Before a plant or animal species can receive the protection provided by the Act, it must first be added to the Federal List of Endangered and Threatened Wildlife or the Federal List of Endangered and Threatened Plants in part 17 of title 50 of the Code of Federal Regulations (CFR). Section 4 of the Act and its implementing regulations at 50 CFR part 424 set forth the procedures for adding species to these lists.

importation of all *P. l. melanochaita* specimens. Therefore, through the promulgation of the 4(d) rule, all otherwise prohibited activities, including all imports of *P. l. melanochaita* specimens, require prior authorization or permits in terms of the ESA.

The regulations are covered under 50 CFR 17.32 which authorises the permit holder to carry out an otherwise prohibited activity for: scientific purposes, the enhancement of propagation or survival of the species, economic hardship, zoological exhibitions, educational purposes, or special purposes consistent with the purposes of the ESA. Applications for these activities are available from either *http://www.fws.gov/forms/3-200-20.pdf* or *http://www.fws.gov/forms/3-200-37.pdf.*

After extensively reviewing the available data regarding the biology and ecology of lion in Africa, and taking into consideration the benefits from sustainable hunting as well as the threats to continued survival of lion population in southern Africa, the USFWLS has identified the following factors that need to be provided in terms of the permitting regulations at 50 CFR 17.32. Specifically, the issuance criteria for threatened species permits are provided under 50 CFR 17.32(a)(2)), but do not specify what would constitute the enhancement of propagation or survival with regard to authorizing the import of parts or products of *P. l. melanochaita,* including sport-hunted trophies.

Therefore, when making a determination USFWLS will examine:

- The overall conservation and management of the subspecies in the country where the specimen originated;
- Whether that management of the subspecies addresses the threats to the subspecies (i.e., that it is based on sound scientific principles and that the management programme is actively addressing the current and longer term threats to the subspecies).
- Evaluate whether the import contributes to the overall conservation of the species by considering whether the biological, social, and economic aspects of a programme from which the specimen was obtained provide a net benefit to the subspecies and its ecosystem.

The Service will evaluate any application received that involves *P. l. melanochaita* in the context of enhancement of propagation or survival in accordance with its threatened species permitting regulations at 50 CFR 17.32, and issuance criteria for threatened species permits (50 CFR 17.32(a)(2)). These include, in addition to the general permitting criteria in 50 CFR 13.21(b):

(i) Whether the purpose for which the permit is required is adequate to justify removing from the wild or otherwise changing the status of the wildlife sought to be covered by the permit;
(ii) The probable direct and indirect effect that issuing the permit would have on the wild populations of the wildlife sought to be covered by the permit;
(iii) Whether the permit, if issued, would in any way, directly or indirectly, conflict with any known programme intended to enhance the survival probabilities of the population from which the wildlife sought to be covered by the permit was or would be removed;
(iv) Whether the purpose for which the permit is required would be likely to reduce the threat of extinction facing the species of wildlife sought to be covered by the permit;

(v) The opinions or views of scientists or other persons or organizations having expertise concerning the wildlife or other matters germane to the application; and
(vi) Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application.

In addition to these factors, particularly in relation to sport hunting, USFWLS will take into consideration the *IUCN Species Survival Commission (SSC) Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0* (IUCN SSC 2012), to assist them when making an enhancement finding for importation of sport-hunted trophies of *P. l. melanochaita*. This document sets out guidance on the use of trophy hunting as a tool for "*creating incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources*" (IUCN SSC 2012, p. 2) and recognizes that recreational hunting, particularly trophy hunting, can contribute to biodiversity conservation and more specifically, the conservation of the hunted species.

The SSC document lays out five guiding principles that, considered in conjunction with the USFWLS threatened species issuance criteria, will aid the Service when making an enhancement finding for importation of sport-hunted trophies of *P. l. melanochaita*. These are:

(a) *Biological sustainability:* The hunting programme cannot contribute to the long-term decline of the hunted species. It should not alter natural selection and ecological function of the hunted species or any other species that share the habitat. The programme should not inadvertently facilitate poaching or illegal trade in wildlife by acting as a cover for such illegal activities. The hunting programme should also not manipulate the ecosystem or its component elements in a way that alters the native biodiversity.

(b) *Net Conservation Benefit:* The biologically sustainable hunting programme should be based on laws, regulations, and scientifically based quotas, established with local input, that are transparent and periodically reviewed. The programme should produce income, employment, and other benefits to create incentives for reducing the pressure on the target species. The programme should create benefits for local residents to co-exist with the target species and other species. It is also imperative that the programme is part of a legally recognized governance system that supports conservation.

(c) *Socio-Economic-Cultural Benefit:* A well-managed hunting programme can serve as a conservation tool when it respects the local cultural values and practices. It should be accepted by most members of the community, involving and benefiting local residents in an equitable manner. The programme should also adopt business practices that promote long-term economic sustainability.

(d) *Adaptive Management: Planning, Monitoring, and Reporting:* Hunting can enhance the species when it is based on appropriate resource assessments and monitoring (*e.g.*, population counts, trend data), upon which specific science-based quotas and hunting programmes can be established. Resource assessments should be objective, well documented, and use the best science available. Adaptive management of quotas and programmes based on the results of resource assessments and monitoring is essential. The programme should monitor hunting activities to ensure that quotas and sex/age restrictions of harvested animals are met. The

3

programme should also generate reliable documentation of its biological sustainability and conservation benefits.

(e) *Accountable and Effective Governance:* A biologically sustainable trophy-hunting programme should be subject to a governance structure that clearly allocates management responsibilities. The programme should account for revenues in a transparent manner and distribute net revenues to conservation and community beneficiaries according to properly agreed decisions. All necessary steps to eliminate corruption should be taken and to ensure compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.

The Service's approach to enhancement findings for the importation of sport-hunted trophies of *P. l. melanochaita* is consistent with the purpose and intent of the Endangered Species Act. Before it will authorize the importation of a sport-hunted trophy, it must determine that the trophy hunting programme is managed to ensure the long-term survival of the species. In particular, the hunting programme should demonstrate that communities who share the same habitat and compete with humans living in these areas for space and resources benefit from the presence of wildlife.

Thus, when evaluating whether the importation of a trophy of *P. l melanochaita* would be authorized pursuant to 50 CFR 17.32, in accordance with the threatened species issuance criteria, USFWLS will examine how a country's management programme for lions addresses the following three main threats: Habitat loss, loss of prey base, and human-lion conflict.

Some of the factors taken into consideration include:

- Whether the programme is based on sound scientific information and identifies mechanisms that would arrest the loss of habitat or increase available habitat (i.e., by establishing protected areas and ensuring adequate protection from human encroachment).
- Whether the management programme actively address the loss of the lion's prey base by addressing poaching or unsustainable offtake within the country.
- A component of a management plan from which trophy imports would meet the issuance criteria would be whether there are government incentives in place that encourage habitat protection by private landowners and communities and incentives to local communities to reduce the incursion of livestock into protected areas or to actively manage livestock to reduce conflicts with lions.
- Examine if the hunting component of the management programme supports all of these efforts by looking at whether hunting concessions/tracts are managed to ensure the long-term survival of the lion, its prey base, and habitat.
- Examine if the trophy hunting provides financial assistance to the wildlife department to carry out elements of the management programme and if there is a compensation scheme or other incentives to benefit local communities that may be impacted by lion predation.
- Consider how a U.S. hunter's participation in the hunting programme contributes to the overall management of lions within a country.
- Management programmes for *P. l. melanochaita* would be expected to address, but are not limited to,
    - evaluating population levels and trends;
    - the biological needs of the species;

- quotas; management practices;
- legal protection;
- local community involvement; and
- use of hunting fees for conservation.

In evaluating these factors, USFWLS will work closely with the range country and interested parties to obtain the information. By allowing entry into the United States of *P. l. melanochaita* trophies from range countries that have science-based management programmes, it is anticipated that other range countries would be encouraged to adopt and financially support the sustainable management of lions that benefits both the species and local communities. In addition to addressing the biological needs of the subspecies, a scientifically based management programme would provide economic incentives for local communities to protect and expand *P. l. melanochaita* habitat.

Under this 4(d) rule any person wishing to conduct an otherwise prohibited activity, including all imports of *P. l. melanochaita* specimens, must first obtain a permit under 50 CFR 17.32. The onus is on individual requesting the import permit to provide all the information in their application showing that the activity meets the requirements for issuance criteria under 50 CFR 17.32.

Where it is not possible for the applicant to provide all of the necessary information needed by the USFWLS to make a positive determination under the ESA to authorize the activity, the Service will typically consult with the range country to the extent practicable and other interested parties to obtain necessary information.

The Service has the discretion to make the required findings on sport-hunted trophy imports of *P. l. melanochaita* on a country-wide basis, although individual import permits will be evaluated and issued or denied for each applicant. While the Service may make enhancement findings for sport-hunted trophy imports of *P. l. melanochaita* on a country-wide basis, the Service encourages the submission of information from individual applicants.

Steps taken to address the requirements of the 4(d) Rule for *Panthera leo melanochaita*

In 2006, the Zimbabwe Parks and Wildlife Management Authority (ZPWMA), with the help of IUCN, prepared the **"Conservation Strategy and Action Plan for the Lion (*Panthera leo*) in Zimbabwe".** Since then a number of detailed research programmes have been conducted in the Hwange National Park and surrounding protected areas as well as on private conservancies (Malilangwe, Bubye and Save). It has also introduced criteria to monitor the age of trophy hunted lions which in turn is used to assist with quota allocations using a points system.

More recently (2015) the ZPWMA prepared an initial report on the **"Conservation Status of the African Lion (*Panthera leo*) in Zimbabwe".** This report was submitted to the European Union and later to the USFWLS.

Scope of work

In conjunction with the Zimbabwe Parks and Wildlife Authority, Safari Operators Association (SOAZ), Zimbabwe Professional Hunters and Guides Association (ZPHGA) and the

CAMPFIRE Association, the consultant is expected to assess the requirements to fulfil the criteria called for under the 4(d) Ruling issued by the United Stated Fish and Wildlife Services. This will include, but is not limited to the following:

- Assess the overall legal and regulatory framework of the sport hunting sector, and indicate where these might be improved or better enforced.
- Assess the opportunities for improving the governance and transparency in the management of the lion hunting industry.
- Assess the opportunities in the non-government sector that could contribute to improving governance and management of wildlife and protected areas, with a special focus on community participation.
- Assess the reliability of data from the conservation and wildlife sector and indicate activities that may improve data collection for monitoring purposes.
- Assess the suitability of some of the policies and management practices developed in other countries in the region, and indicate opportunities for adapting these for the Zimbabwe setting.
- Identify the knowledge gaps required to complete the Zimbabwe NDF for lion in terms of the 50 CFR 17.32 Permit requirements
- Assist the ZPWMA to prepare the national NDF for lion in accordance with the requirements listed above.

Methodology

The assignment will be a combination of literature studies and limited field work. The consultant will work closely with the ZPWMA and ZPHGA to gather and analyse data related to the administration and management of lion conservation in the country. The consultant will liaise with relevant institutions on the government and non-government side, with selected researchers in national and international research entities with special expertise on the wildlife and conservation sector in Zimbabwe. Special attention is to be given to extracting key economic data from the safari hunting industry that clearly demonstrates its contribution to the conservation of lion in Zimbabwe. If necessary, the consultant will conduct a short field visit to at least one safari area, one CAMPFIRE Area and to a conservancy.

Time frame and reporting

The assignment will take place from 4th April till 27th May, 2016. The consultant will develop a draft report in conjunction with the ZPWMA and conduct a half-day workshop for the relevant stakeholders. The report will be in English, and will be of a maximum of 50 pages plus relevant annexes. The draft report should be submitted by 30th April, and a final report should be submitted one week after receiving written comments from the ZPHGA and ZPWMA.

NDF N

AGE RESTRICTIONS ON LION TROPHIES AND THE ADAPTIVE MANAGEMENT OF LION QUOTAS IN ZIMBABWE



PANTHERA
LEADERS IN WILD CAT CONSERVATION



Photos: P. Funston

Introduction

African lions are one of the most sought after species by international hunting clients and are key for the viability of the trophy hunting industry. However, during recent years there has been increasing awareness of the negative impacts associated with lion hunting on lion populations in some areas, including in Zimbabwe. However, research has also demonstrated that lion hunting can be sustainable if quotas are established in a scientific manner, and that lion populations are able to recover quickly from over-harvest if the pressure on them is removed.

There has been increasing international pressure on lion hunting during recent years, manifested in a proposal to list lions on CITES Appendix I in 2004, and more recently in a petition of the United States Fish and Wildlife Service by a consortium of animal welfare groups to list lions as endangered pursuant to the US endangered species act. The European Union is also under pressure to ban imports of lion trophies. Any of those measures, if adopted would restrict lion hunting by preventing the import of lion trophies into the key markets for trophy hunting in Africa.

The best way to avoid pressure for bans on the trade in lion trophies is to ensure that the management of lion hunting is as sustainable as possible. To that end, ZPWMA hosted a meeting in July 2013 (supported by Panthera), attended by ZPWMA ecologists and regional managers and head office staff (including the Board Chairman), key scientists, hunting industry, CAMPFIRE, conservancy and forestry representatives, among others. At that meeting, consensus was gained on steps needed to make lion hunting more sustainable in Zimbabwe.

Age restrictions

Consensus at the meeting was that Zimbabwe should introduce age restrictions on lions that may be shot as trophies. Such age restrictions would be in line with developments in other major hunting countries, and in line with recognition within the hunting community of the need to restrict off-takes of lions to old males (as per the definition of a 'huntable male lion' created by a panel of experts and adopted by Dallas Safari Club) and others (http://www.accuratereloading.com/2012/dhl.pdf). Age restrictions are currently in place in Tanzania and in Niassa National Reserve in northern Mozambique and have been agreed on in principle by Benin (Lindsey et al. 2013). The latest scientific evidence suggests that if harvest of lions is restricted to animals of 5-6 years of age or older, the population impacts of trophy hunting are likely to be minimal (Whitman et al. 2007). The reason for this is that by the age of 5 or 6, lions have usually had chance to sure at least one litter. Furthermore restricting offtakes to older lions increases the net number of lions that can be harvested over

time, which allows lion hunting to generate more revenue for operators and parks authorities (Whitman et al. 2007).

Points system for adaptively managing lion quotas in Zimbabwe

The points system that will be used to adaptively manage lion quotas has been developed following similar systems that have been implemented in Tanzania and northern Mozambique. The systems that are in place in Tanzania and Niassa differ slightly, but both lion quotas are set according to the age of the lions harvested during the previous hunting season (Begg 2008; Tanzania Wildlife Division 2013). The Tanzanian system is more punitive with significant quota reductions, trophy confiscation and fines for non-compliance, whereas the Niassa system is more accommodating but nevertheless can result in quota reductions if five year old lions are hunted. The latter was aimed at a means of accommodating the difficulty of telling five year old lions apart from four year olds. After reviewing the Tanzanian and Mozambican age restriction systems and debating possible models for application in Zimbabwe, the representatives present at the Zimbabwe lion management meeting agreed on an approach for Zimbabwe with four as opposed to three key age categories (Table 1).

Table 1. Proposed points system for lion age restrictions and quota setting in Zimbabwe

	≥6 years	No trophy	5 years old	4 years old	<4 years	Failure to submit hunt return/incomplete hunt returns
For quotas of 3/more	4	3	3	2	-3	0
For quotas of 2	4	3	3	2	0	0
For quotas of 1	6	3	3	2	0	0
Quota setting process	These points are added up and divided by 3 to yield the quota for next year					

The key distinction of the Zimbabwean system is that the quota will not be affected if they hunt animals that are 5 years old. The reason for this is that according to the population models, hunting animals of 5 years of age or older is predicted to be comparatively safe from a population perspective (Whitman et al. 2007). Furthermore, after reviewing aging techniques, attendees at the meeting felt confident that hunters could be expected to categorize lions as being 5 or above or below 5 years of age. According to the proposed system, operators would be rewarded with increased quotas if they hunted animals of six years and older, would not be penalized if they hunted animals of 5 years or if they did not shoot a lion that they have on quota, but would have their quotas cut if they hunted animals if younger than 5 years or if they failed to complete hunt returns.

Lions would be aged by triangulating multiple different aging characteristics, including: the degree of facial scarring; the teeth colour and degree of wear; the mane development

(particularly regarding the shape around the ear and the mohawk); and through post mortem analysis of the width of the pulp cavity of the second premolar (which becomes narrower with age). Panthera and ZPWMA are in the process of developing aging guidelines from Zimbabwean lions. However, in the meantime, comprehensive guidelines are available from Tanzania which can be used by operators in the interim to assist with aging of lions.

The process for quota setting

Consensus from the workshop was that the following procedures be followed for quota setting and implementation of age restrictions:

- Step 1: Allocate existing quota to each block

The starting point for implementation of age-restrictions and adaptive quota management was to allocate existing lion quotas. This quota would then be managed adaptively in line with the age of lions hunted. In future, it is envisaged that fixed quotas for lions would fall away as quotas would be based on the age of lions hunted in the previous year.

- Step 2: Hunters complete and submit return forms and photos after each lion hunt

The data would be compiled into a database by a ZPWMA representative (currently Roseline Mandisodza-Chikerema). Export permits for trophies will not be issued unless completed hunt return forms (all of the required photographs and the first upper premolar is provided to ZPWMA for aging and monitoring purposes). Furthermore, because the following year's quotas will be based on the ages of the lions hunted in the current year, operators must submit their lion hunt returns and photographs soon after the hunt. At the end of the season, all of the teeth would be taken to a dentist to have x-rays conducted to allow for measurement of the size of the pulp cavity.

- Step 3: ZPWMA and Panel of experts assign an age value to each lion trophy

Lion trophies will be aged by ZPWMA, with input from lion scientists and representatives from the hunting industry at a trophy aging session.

- Step 4: Calculate the next years quotas based on a points system for the ages of lions hunted

A quota setting meeting would then be held where lion quotas were established for each area based on the age of lions hunted in those areas the year before.

This programme has commenced in 2014, and so the ages of lions hunted in 2014 will affect the lion quotas in 2015.

Sport-Hunting and Lion *Panthera leo* Conservation in Zimbabwe

Dr Byron du Preez[†1], Dr Rosemary Groom[‡2], Olivia Mufute[§3] and Roseline Mandisodza-Chikerema[¶3]

[1]Bubye Valley Conservation Research Initiative
[2]African Wildlife Conservation Fund
[3]Zimbabwe Parks and Wildlife Management Authority

January 31, 2016





BUBYE VALLEY CONSERVATION RESEARCH
ZIMBABWE



African Wildlife Conservation Fund

† byron.d.dupreez@gmail.com
‡ rosemary@africanwildlifeconservationfund.org
§ omufute@zimparks.co.zw
¶ mandisodzar@gmail.com

CONTENTS

Summary of Steps Taken by Zimbabwe to Improve the Management of Lion Sport-Hunting 3

Summary of Lion Sport-Hunting's Contribution to Conservation 3

Introduction 3

Lions – *Panthera leo* 5

Conservation and Sport-Hunting 8

Zimbabwe's Adaptive Lion Quota Management System 8
- Results of the Adaptive Lion Quota Management System 9
- Human-Lion Conflict 11

The Bubye Valley Conservancy 12
- History of the Bubye Valley Conservancy 12
- Bubye Valley Conservancy Community Support 12
- Bubye Valley Conservancy Lion Monitoring and Management 13
- Bubye Valley Conservancy Lion Hunting 13

The Savé Valley Conservancy 16
- History of the Savé Valley Conservancy 16
- Savé Valley Conservancy Community Support and Anti-Poaching 17
- Savé Valley Conservancy Lion Monitoring and Management 17
- Savé Valley Conservancy Lion Hunting 18

The Pros and Cons of Conserving Lions 20

Where the Money Goes: The Finances of Lion Sport-Hunting and Reinvestment in their Conservation 22

Discussion 23

Conclusion 25

References 26

SUMMARY OF STEPS TAKEN BY ZIMBABWE TO IMPROVE THE MANAGEMENT OF LION SPORT-HUNTING

i – Banning of all lioness hunting in Zimbabwe

ii – Hunting moratoria around the Gonarezhou and Hwange National Parks

iii – Removal of fixed hunting quotas

iv – Age restrictions on sport-hunted lions

v – Scientifically-based adaptive quota management system

SUMMARY OF LION SPORT-HUNTING'S CONTRIBUTION TO CONSERVATION

i – Lion sport-hunting contributes 33.9% to 42.4% of total revenue on private land

ii – Lion sport-hunting generates up to US$ 557 km^{-2}

iii – Anti-poaching (in particular that of rhinoceroses) costs ~US$ 216 km^{-2}

INTRODUCTION

THE United States Fish and Wildlife Service (USFWS) have recently evaluated the conservation status of the lion *Panthera leo* with particular regard to sport-hunting (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). The results of this evaluation have led to the formal protection of two subspecies under the Endangered Species Act, classifying *P. l. leo* as endangered and *P. l. melanochaita* as threatened. Together these subspecies apparently represent all of the lions in Africa (Barnett et al. 2014).

Sport-hunting is a legal activity in which the international import/export of trophies is both sanctioned and carefully controlled by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The USFWS found that the sport-hunting of *P. l. melanochaita* "*if well managed, may provide a benefit to the subspecies*" (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). Here we explore this statement further, and present data from three long-term *in situ* lion research projects; the Bubye Valley Conservation Research Initiative, Savé Val-

ley Conservancy Research, and the Hwange Lion Research Project.

The data presented in this report clearly illustrates the positive conservation benefit that well-managed trophy hunting of lions can have for the species, as well as the importance of hunting in maintaining the wildlife in an area; addressing Point 5 on page 3 of the Federal Fish and Wildlife Permit Application Form (Form 3-200-20) [i.e. "*Please be aware that the U.S. Fish and Wildlife Service must make a finding that your activities will enhance or benefit wild populations of the species involved. If you have any information that could support this finding (e.g., population status or trend data; how the funds from license/trophy fees will be spent; what portion of the hunting fee will support conservation), please submit such information on a separate page with your application*"].



Figure 1: The lions pictured here, known as Winston (*standing*) and Geronimo (*lying*), were both collared in March 2012 when they were the dominant males in the Matombosa area and have been continuously monitored ever since as part of the on-going long-term WildCRU Bubye Valley Conservation Research Initiative. In November 2015 Geronimo, who was approximately 9 years old, died after succumbing to injuries sustained from fighting with another male. Winston, also 9 years old, has since lost his dominant status, lost his territory to two 4.5 year old males, become nomadic and avoids contact with other males. As of this report being written, the recent litter of cubs that both Winston and Geronimo sired are still alive.

Most importantly, since July 2013 there has been a continuous self-imposed internal reform of the lion hunting industry in Zimbabwe that is actively participated in and supported by all of the relevant stakeholders, including; the Zimbabwe Parks and Wildlife Management Authority (ZPWMA), non-governmental organisations, professional hunters, safari operators, scientists and researchers.

Here we discuss the results of this process in terms of robust evidence regarding the sustainability and self-regulation of lion hunting in Zimbabwe.



Figure 2: Winston and Geronimo's cubs.

LIONS – *Panthera leo*

The IUCN Red List have recently reclassified lions as Vulnerable (remaining as such since 1996; IUCN 2015), estimating that there are between 20,000 and 30,000 free-ranging lions left (Bauer et al. 2015a) in less than 25% of their historic range (IUCN 2006). However, this generalised classification does not take into account an apparent conservation dichotomy: sample subpopulations of lions in Botswana, Namibia, South Africa and Zimbabwe have in fact increased overall (Bauer et al. 2015a). Lions were historically present throughout Africa, some of Europe, the Middle East and Asia (Bauer and Van Der Merwe 2004), but current conservation strongholds remain only in parts of eastern

and southern Africa (Brassine and Parker 2012; Nowell and Jackson 1996). The current lion population estimate for Zimbabwe's major lion areas is approximately 2,600 individuals [Hwange-Matetsi Complex: 750, South Eastern Lowveld: 350, Gonarezhou National Park: 60, Malilangwe: 37, Savé Valley Conservancy: 284, Bubye Valley Conservancy: 500, Mid-Zambezi Valley Complex: 600], though the actual number would be larger if there were data available for the countries minor lion areas that are yet to be surveyed] (ZPWMA 2015).

The lion is a uniquely social felid, forming coalitions of up to nine males associated with one or more female prides that may consist of more than 20 individuals (Macdonald et al. 2010; Schaller 1972). Lions are infamously infanticidal (Schaller 1972), where males will kill unrelated cubs so as to bring the female into oestrus and present an opportunity to sire their own litter, which is often used as an argument against sport-hunting of the species (e.g. Packer et al. 2010), where it is feared that the removal of dominant males causes cub mortality that eventually results in lowered population recruitment and survival (Packer et al. 2009). Infanticide, however, does not result from sport-hunting when age-appropriate males, past their prime and no longer territorial or with dependent cubs, are harvested (Whitman et al. 2004). Moreover, the fission-fusion nature of lion society (Mosser and Packer 2009; Pusey and Packer 1987) means that infanticide may still occur when the dominant males are simply not present there and then to defend their cubs (B. du Preez, pers. obs.).

In the 1990's, lions were successfully reintroduced into private areas in parts of their former range, where they achieved high reproductive and survival rates (Miller and Funston 2014). However, the resultant population growth inevitably led to the potential problem of overabundance (Funston 2008) and low genetic diversity (Trinkel et al. 2010), with both of these issues requiring active and intensive management (Hunter et al. 2007) and ultimately reducing the conservation value of these lion populations (Miller and Funston 2014). The ability to translocate lions originally facilitated the relief of overpopulation, but as the available areas for relocations were used up, sport-hunting and euthanasia have subsequently become the main methods of lion population control (Miller and Funston 2014).

The lion is the apex predator wherever it occurs (Macdonald et al. 2010), and is an ideal conservation umbrella: being large, charismatic and easily observable (e.g. Williams et al. 2000). Lions are important to commercial wildlife ventures, which risk losing significant market share where they cannot offer them to clients (Lindsey et al. 2007), and are thus prioritised in conservation; exploiting their charisma to attract tourists and raise the funds required in ensuring that wildlife areas remain viable. The lion is also a particularly valuable species in the sport-hunting industry, rivalled only in demand by buffalo *Syncerus caffer* and leopard *Panthera pardus* (Creel and Creel 1997), and are therefore prevalent in private wildlife areas (Packer et al. 2013) where their populations can achieve exponential growth rates given the protection and resources afforded by well-managed operations (Smuts et al. 1978; Loveridge et al. 2007b; Kettles and Slotow 2009; Miller and Funston 2014).

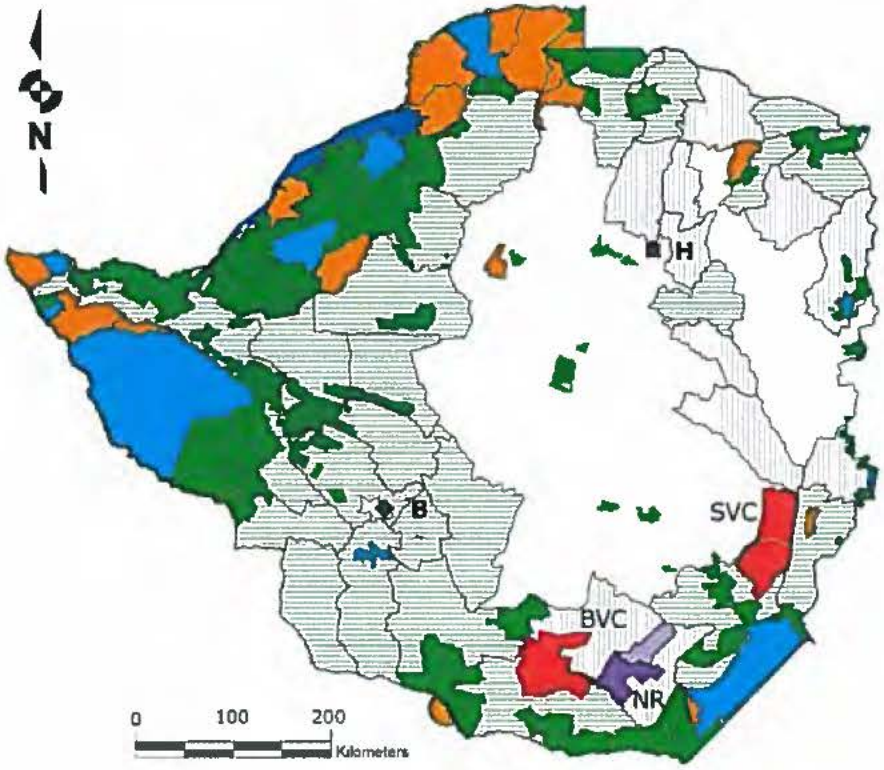


Figure 3: Map of Zimbabwe's main wildlife areas: [*i*] National Parks are represented in light blue; [*ii*] Safari areas are represented in orange; [*iii*] Forestry areas are represented in dark green; [*iv*] Community and Private wildlife areas are represented in light green; [*v*] Communal Land (CAMPFIRE Areas) in which sport-hunting may occur is represented by light green horizontal stripes; [*vi*] Communal Land in which sport-hunting does not occur is represented by grey vertical stripes. [*vii*] The Bubye Valley [BVC] and Savé Valley [SVC] Conservancies are represented in red. [*viii*] The Nuanetsi Ranch [NR] on which sport-hunting takes place is represented in dark purple (light purple represents the Nuanetsi Ranch cattle area); [*ix*] Lake Kariba is represented in dark blue. Harare (the capital city) is represented by a black square and letter '**H**'. Bulawayo is represented by a black diamond and letter '**B**'. Sport-hunting may occur in areas: *ii*, *iii*, *iv*, *v*, *vii* & *viii*

The ability of lions to rapidly increase in abundance is an aspect of their ecology that is often overlooked. Lion populations can achieve exponential growth rates (Miller and Funston 2015; Groom and Watermeyer 2015; du Preez et al. in prep.), and the problems associated with high lion densities fast present themselves and require significant investment in their solution (Hunter et al. 2007; Kettles and Slotow 2009; Loveridge et al. 2007; Packer et al. 2013; Smuts 1978). Whilst unregulated sport-hunting of lions (in particular that of dominant males and pride females) may result in population declines (e.g. Packer et al. 2010; Packer et al. 2009), restricting offtake to only males over

a certain age (i.e. have already bred and/or are no longer dominant) has no impact on lion population persistence, irrespective of quota size (Whitman et al. 2004). Such is the situation currently facing both the Bubye Valley and Savé Valley Conservancies, where the lion populations continue to grow despite sport-hunting and increasing quotas. Whilst sport-hunting may not alleviate over-population in these areas, it does somewhat offset the cost of keeping lions. Culling of lions may be the only realistic option for controlling numbers in larger areas, as the use of contraceptives is likely to be inefficient and expensive. Because of fears about public sentiment associated with sport-hunting, it has now become common practice for managers to cull excess lions in more than 45 wildlife areas in South Africa to which lions have been introduced, and which resulted in the wasteful destruction of about 200 lions in 2012 (Miller and Funston 2014).

CONSERVATION AND SPORT-HUNTING

There is more land area in Africa conserved for hunting than there is in all of Africa's formally protected areas combined: approximately 1.4 million km^2, which exceeds the total area covered by national parks by 22% (Lindsey et al. 2007). For wildlife conservation to be successful outside of national parks, these areas must be self-sufficient and able to generate sufficient revenue to cover the considerable costs of protecting the habitat and wildlife therein (Lindsey et al. 2006). Indeed, conservation would benefit from an incentive to utilise land for wildlife rather than the alternatives of livestock grazing, agriculture, and deforestation.

The international trade of lions, including trophies, is controlled by a strict CITES licensing system on the basis that this trade does not endanger the ultimate survival of the population (https://www.cites.org/eng/disc/how.php [accessed 2015-01-19]). The positive aspects of sport-hunting as a conservation tool include a focus on males and a low percentage off-take; neither of which generally jeopardise populations, and also suggest that hunting could play a role in population recovery (Leader-Williams et al. 2005).

The recommendation of setting uniform harvest limits, e.g. 1 lion 2,000 km^{-2} (Lindsey et al. 2012; Packer et al. 2010), may be overly simplistic, affect the economics of wildlife based landscape use, and disincentivise investment in conservation (Lindsey et al. 2007). A more practical approach to sustainably setting realistic lion sport-hunting quotas could involve using a positive/negative feedback method that calculates a fluid quota per area based on the previous season's performance. Such an adaptive quota management system has already been implemented in Zimbabwe.

ZIMBABWE'S ADAPTIVE LION QUOTA MANAGEMENT SYSTEM

An adaptive quota management system for lion hunting based on the ages of lions hunted was agreed on in July 2013 in Harare, Zimbabwe, during a meeting hosted by the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) and an independent non-governmental conservation organisation. The points system is summarised in Table 1.

Table 1: *Points allocated to hunting blocks arising from the harvest of lions of different ages*

	≥ 6 years	No trophy	5 years old	4 years old	< 4 years	Failure to submit return, or incomplete return
For quotas of ≥3	4	3	3	2	-3	0
For quotas of 2	4	3	3	2	0	0
For quotas of 1	6	3	3	2	0	0
Resultant quota	*These points are added up and divided by 3 to yield the quota for next year*					

During 2013, operators were requested to submit hunt returns and photos as a trial run to get the system up and running. In 2014 operators were requested to do the same but were informed that the age of the lions hunted in 2014 would determine their lion quotas in 2015. The 2015 lion hunt results would thus also determine the 2016 quota.

Results of the Adaptive Lion Quota Management System

In 2015 there was a marked increase in the age of lions hunted in Zimbabwe as a whole. Notably, only one lion of <4 years of age was hunted and the large majority of lions were 5 years or older (Figure 4). In 2013, only 28% of the lions hunted were 5 years or older, in 2014 that figure had risen to 49% and in 2015 to 77.3% (Figure 5). The proportion of lions hunted that were less that 5 years of age dropped overall between 2013 and 2015 (Figure 6). For this achievement, credit is due to the hunting community for showing greater selectivity of harvest. A word of caution however, is that the majority of lions hunted were on the cusp of 5 - 6 years of age and were not older than six years. Restricting hunting to individuals that are at least six (and preferably older) is desirable from a biological perspective due to the reduced risk of the loss of pride males and infanticide of cubs associated with the harvest of such individuals (Whitman et al. 2004).

In 2015 the Zimbabwe national lion hunting quota was set at 85 lions. Of this 85, only 39 were hunted in 2015, and based on the resultant score from aging the trophies, and the fact that operators chose not to hunt lions of inadequate age (see Figures 4, 5 & 6), the recommended quota for 2016 was set at 75 [Harare 2015-11-11]. (The Rural District Council areas in which lions occur are currently exempted from the age restrictions, as was agreed upon at the 2013 lion management meeting in Harare, as a means of ensuring that impoverished communities obtain the opportunity to benefit from the presence of lions, recognising the potential negative impacts the species has on the livelihoods of livestock farmers).

Using these figures and estimating the average value of a lion safari at approximately US$ 80,000 then a 50% offtake (35 lions) would generate US$ 2,800,000 annually. If management costs are approximately $150 km^{-2} (V. Booth, pers. comm.), then the lion safaris alone can support 18,600 km^{-2} of wildlife habitat in Zimbabwe.

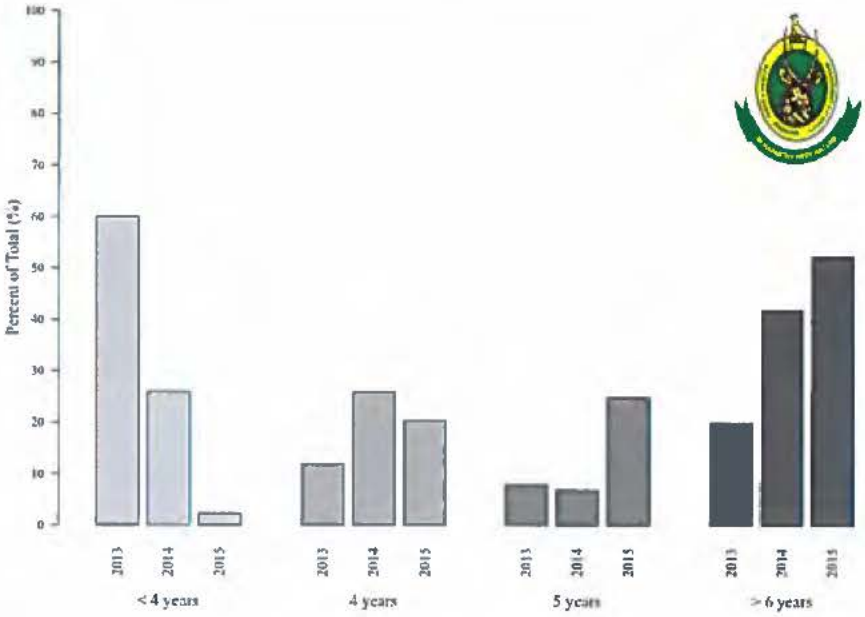


Figure 4: The percentage of lions hunted in each age class in 2013, 2014 and 2015 in Zimbabwe.

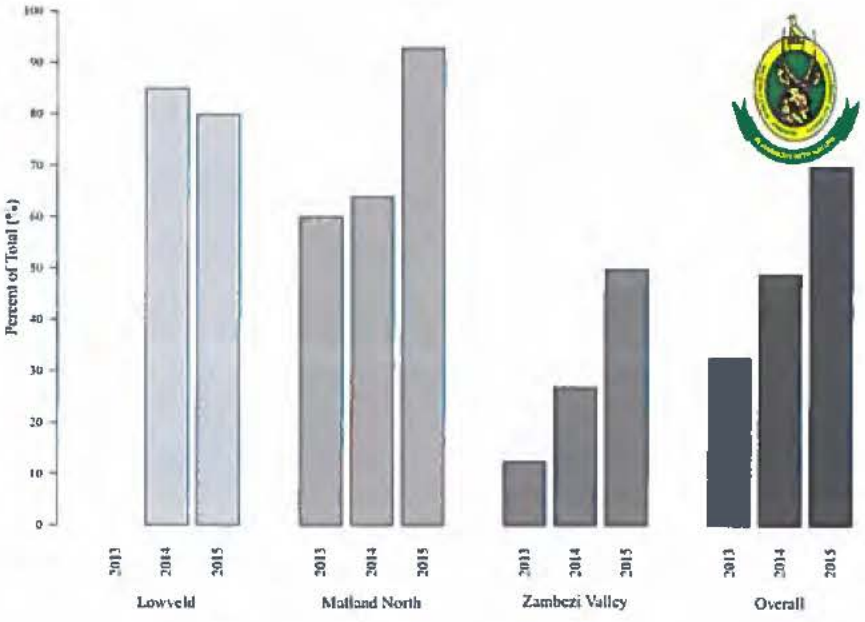


Figure 5: The proportion of lions hunted that were 5 years or older in the three main lion-hunting areas of Zimbabwe.

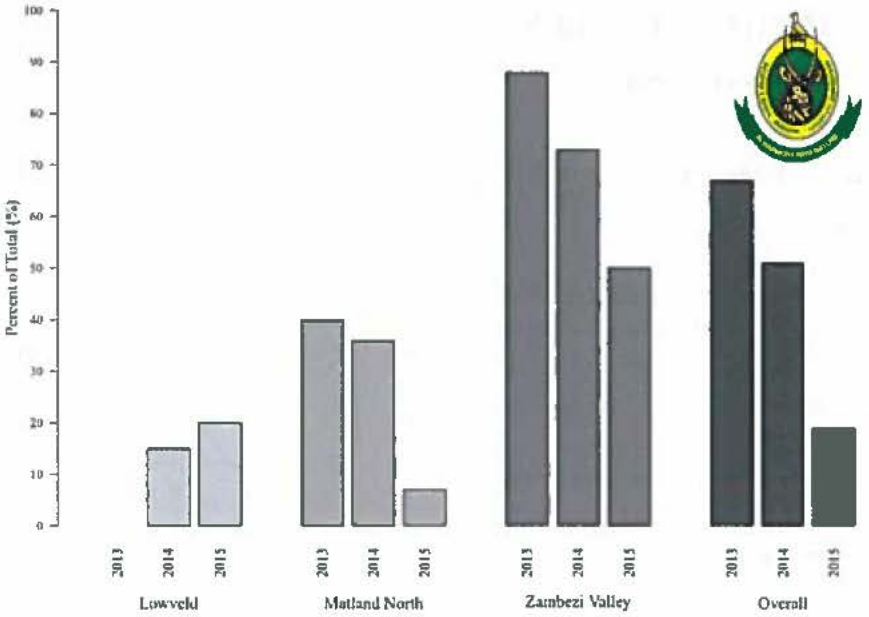


Figure 6: The proportion of lions hunted that were less than 5 years of age in the three main lion-hunting areas of Zimbabwe.

Table 2: *Human and Lion Conflict (2009 - 2011) in Zimbabwe, including human mortality caused by lion (CAMPFIRE Association, 2012)*

District	Total incidents	Livestock killed	*People injured*	*People Killed*
Hurungwe	5	1	*2*	*2*
Chiredzi	25	136	*0*	*0*
Mbire	5	7	*0*	*5*
Binga	9	39	*0*	*0*
Total	44	183	*2*	*7*

Human-Lion Conflict

The lion is a flagship species and powerful symbol of Africa; yet living with lions poses hardships for many communities (e.g. Table 2). In some areas, the lion is a major predator on domestic livestock, inevitably leading to conflicts with local herders. Both sides suffer in this situation.

Outside of protected areas, the lion's prey base is much reduced, which results in relatively greater chance of encountering livestock. Co-existence of lions with people may be enhanced by giving value to lions through tourism and hunting promoted in communal lands under the Communal Area Management Programme for Indigenous Resources (CAMPFIRE). This hunting contributes to the conservation of lions via the financial revenue generated, which is ploughed back into conservation of the resource and empowers local communities to invest in their own rural development programs.

THE BUBYE VALLEY CONSERVANCY

History of the Bubye Valley Conservancy

Towards the end of the nineteenth century, the Liebig's Extract of Meat Company (LEMCO) founded an extensive cattle ranch in the Zimbabwean lowveld, to the detriment of the indigenous wildlife that was initially eliminated because of competition for grazing with the livestock, as well as a risk of disease transmission from buffalo and wildebeest *Connochaetes taurinus*. As their natural prey base became depleted, the predators were subsequently persecuted when they began to prey on the livestock. Some wildlife persisted in small pockets of remote habitat, however lion, elephant *Loxodonta africana*, buffalo and rhinoceros *Diceros bicornis* [black] & *Ceratotherium simum* [white] were all completely eradicated. A monoculture of cattle dominated the landscape and impacted on the environment for the better part of a century.

Then, in 1992, Zimbabwe suffered one of the worst droughts on record, a relatively short time after the devastating one of 1983 that LEMCO was still trying to recover from. The frequency and severity of the droughts effectively reduced confidence in the economic viability of cattle ranching in the area, and the Bubye Valley Conservancy was subsequently founded in 1994 with the realisation that endemic wildlife, which are better adapted than livestock to cope with the local climate, could be successfully commercialised (Child 1988; Bond 1993).

The conversion from cattle ranching back to a wildlife area was neither straightforward nor cheap, requiring a significant initial investment and annual running costs. In just 20 years of operation the Bubye Valley Conservancy now protects the world's third largest black rhinoceros population, one of Zimbabwe's largest lion populations, a large and increasing elephant population, and abundant game.

Sport-hunting is an essential step in converting areas that were previously dedicated to livestock farming into non-consumptive tourism areas (Child 1993), and was fundamental to the formation of Bubye Valley Conservancy and allowing the wildlife populations to recover. The Samanyanga area of the Bubye Valley Conservancy, probably the most scenic section, was originally set aside for non-consumptive photographic tourism, but made an annual loss for several years, before, largely due to Zimbabwe's land reform program and resultant instability in the country, it was reverted back to sport-hunting as the only practical and economically viable option (K. Leathem, pers. comm.). Sustainable sport-hunting provides the sole economic incentive to continue operating the Bubye Valley Conservancy as a wildlife conservation area.

Bubye Valley Conservancy Community Support

The Bubye Valley Conservancy donates over 45 tonnes of meat from sport-hunting to the local communities each year. This meat donation is worth over US$ 100,000 per year, and the communities are free to decide how they use it. In addition to this, the Conservancy also supports several schools, clinics, and community projects in the three surrounding districts of Mwenezi, Maranda and Jopempe. The local community thus

sees a direct benefit from the wildlife on the Bubye Valley Conservancy, but is also empowered by job opportunities created both with these special projects, as well as on the Conservancy. A summary of the Bubye Valley Conservancy community support effort between 2011 and 2015 is provided in Table 4.

Bubye Valley Conservancy Lion Monitoring and Management

After originally being eradicated by cattle ranchers in the area, 13 lions were reintroduced to the Bubye Valley Conservancy in 1999, and four young males broke into the Conservancy that same year. From the original 17 animals present in 1999, the Bubye Valley Conservancy lion population was estimated at approximately 280 individuals in 2009 when robust population surveys were initiated by a research team from the University of Oxford Wildlife Conservation Research Unit (WildCRU), and this population has continued to grow. Today it is estimated that there are over 500 lions on the Bubye Valley Conservancy (du Preez et al. 2015). The exponentially increasing Bubye Valley Conservancy lion population currently exists at one of the highest densities in Africa (~0.187 lions km^{-2}: du Preez et al. 2015; Figure 7), greater than that of the Serengeti, Tanzania (0.100 lions km^{-2}: Pusey and Packer 1987; Spong 2002), Selous, Tanzania (0.080 - 0.130 lions km^{-2}: Creel and Creel 1996, 1997), Kruger National Park, South Africa (0.096 - 0.112 lions km^{-2}: Mills 1995), and Hwange National Park, Zimbabwe (0.027 lions km^{-2}: Loveridge et al. 2007). This equates to one of the largest contiguous lion populations in Zimbabwe.

Bubye Valley Conservancy Lion Hunting

The Bubye Valley Conservancy offsets the cost of lion predation on its wildlife via sport-hunting of the species, and which began in 2002. In 2014, the lion hunting quota allocated to the Bubye Valley Conservancy by ZPWMA was 10 individuals. Based on the fact that the entire quota was harvested and that maximum points were scored for each individual trophy (more than six years in age), the allocated quota was raised to 13 lions for 2015. Only 12 out of 13 lions were hunted in 2015 due to a late cancellation; nevertheless eight lions over six years old and four lions of five years old were harvested and the resultant points justifying a quota of 15 lions for 2016.

Table 3: *The Bubye Valley Conservancy annual lion hunting quota and offtake from 2002 to 2015.*

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Approved quota	1	2	3	2	2	2	3	3	5	8	12	10	10	13
Quota taken	1	2	3	2	2	2	2	3	5	8	12	10	10	12
Percentage success	100	100	100	100	100	100	67	100	100	100	100	100	100	92

Note that while the lion hunting quota for Zimbabwe has been voluntarily reduced by the national steering committee, the Bubye Valley Conservancy lion hunting quota has been successively raised twice based on both hunt success and age of lions hunted and the resultant points scored under the national adaptive quota management system (Table 3).

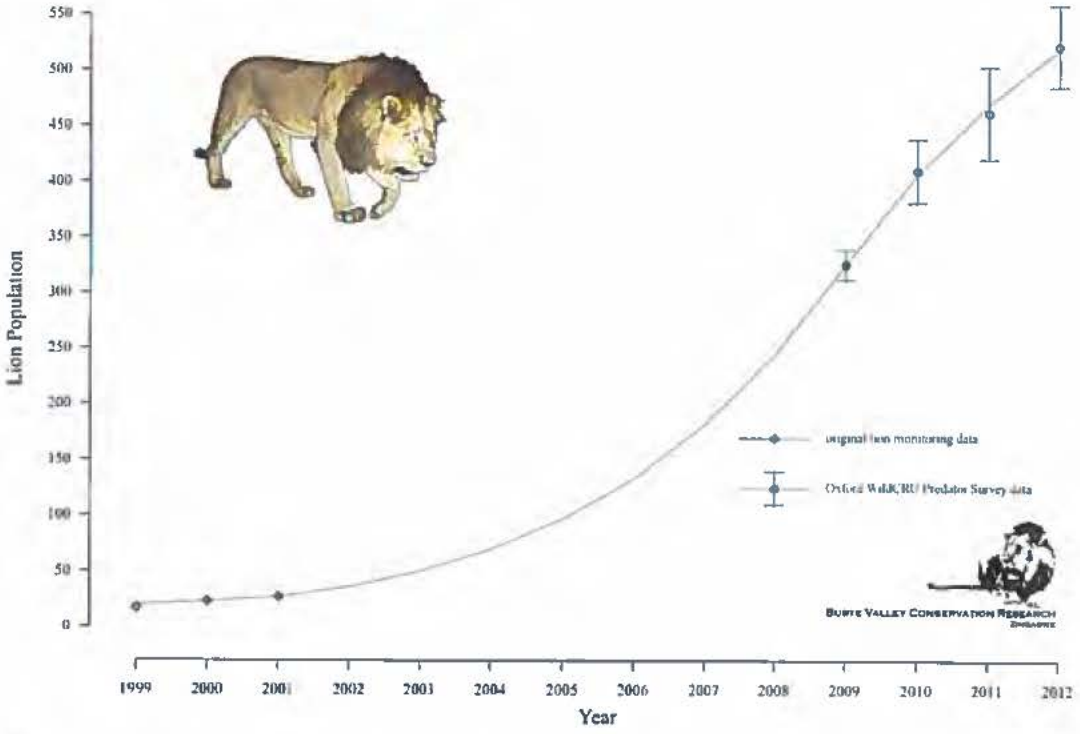


Figure 7: The Bubye Valley Conservancy lion population has grown exponentially since the reintroduction of lions in 1999. Diamonds represent the known lion abundance from monitoring of the original individuals introduced; Points indicate lion abundance calculated from spoor transect analyses; error bars represent the standard error of the mean.

Table 4: *Summary of the Bubye Valley Conservancy support to the surrounding local communities (2011 - 2015)*

Boreholes:	- 1 x Jompembi Village 2 - 1 x Penemene - 1 x Jompembi Village 4 - 1 x Nyimani village (Mwenezi) - 1 x Driehoek School - 1 x Mgaladhivha School - 2 x Mtetengwe to supply water to the clinic site
	- 2 new bush pumps (complete) purchased and installed at Village 2 & Village 3 and troughs built at both sites *Drinking trough for cattle built at Village 2 borehole* *All boreholes equiped with new bushpumps, piping and cylinders* *Boreholes at Village 3, Mtetengwe, Mdzwiti, Vumani and Penemene and Makado Police post repaired and maintained* *All new piping and pumps etc. are supplied by BVC*
Buildings:	- Mtetengwe Clinic's main building built - 3 x F13 staff houses built *Clinic and House fenced - everything funded and built by BVC* *The clinic is a standard large Government clinic - male & female wards + maternity ward and outpatients* *Storerooms, offices etc. also built* *All houses and buildings are electrified, painted and supplied with running water*
	- Mtetengwe School school office block and staff room built and painted *All classroom windows repaired and the schools second borehole repaired.*
	- Secure engine house was built at the second borehole site - Borehole equipped with BH15S mono pump unit driven by a rebuilt Lister LT 1 engine
	- 5000 litre header tank and stand erected - new 5000 litre header tank purchased and fitted - pipeline laid to connect the borehole to the clinic - another pipeline connected to the same borehole to supply the Mtetengwe school with fresh water
	- New coldroom and refrigeration unit purchased and fitted at the Lutumba butchery *Part of aid program to get the Beit Bridge RDC self funding projects up and running*
	- New coldroom and refrigeration unit was purchased and fitted at the Rutenga butchery *Part of aid program to get the Mwenezi RDC self funding projects up and running*
Meat Donations:	- BVC donates meat on a regularly basis to the Mwenezi Orphange
	- Numerous donations of meat were made to support school sports days & speech nights/prize giving events *Both Beit Bridge & Mwenezi districts*
	- 1600 kgs of meat has been donated each month since July 2011 to a Maranda trust *Administered by Chiefs andlocal headmen* *Excess meat sold and funds used for community projects* *Classroom roof replaced at Vhongwe school* *4 new classroom blocks constructed at other schools using funds from these monthly allocations*
	- 1000 kgs of meat per month is been donated to Beit Bridge communities since April 2014
	- 1000 kgs of meat per month is been donated to Mwenezi communities since August 2013
Miscellaneous:	- Sports uniforms for the Penemene school team purchased ($2600) *Sports uniforms required for inter-schools sports*
	- Transport the soccor teams representing Mgaladivha, Jompembi and Tongwe *To Lutumba for the inter-school competitions*
	- 2 sets of soccer goal posts & 2 sets of Netball poles were made for Mgaladivha School *New soccer field graded by BVC*
	- 2m security fencing supplied to Penemene School
	- Second hand door and window frames donated to Mapiri school (ex Mazunga School)
	- 1 new 3 1/2 " rod pump cylinder was purchased and fitted to the Vumhani borehole *All repairs to b/holes in the Vumhani area are done by BVC*
	- 26 bags of cement were donated to Mgaladivha School
	- Fencing donated to the Mgaladivha School
	- Supplied 10 x 5/8" mono shafts for the Botalele Clinic (Maranda) borehole
	- Water supply to Mielezi Clinic
	- 400 m pipeline laid to supply the Nyimani Villarge's cattle with water *3.5 m drinking trough build for this same project*
	- 60 bags cement donated to the Welkom for repairs to a dam wall
	- 6 loads of riversand and 20 cement donated to Vumani Preschool
	- Various school renovations in both the Beit Bridge and Maranda areas
Current Projects:	- Construction of a School admin block at Mgaladhivha School
	- Supply of 24 loads of riversand to Mdzwiti School (value $1200)
	- All roofing materials supplied to Mdzwiti School
	- Supply roofing materials, cement, all window and door frames for Vumani Preschool

THE SAVÉ VALLEY CONSERVANCY

History of the Savé Valley Conservancy

The Savé Valley was a wildlife-rich wilderness until the early 1900's, when the first cattle ranching initiatives started in the area. The establishment of Devuli Ranch and Angus Ranch in 1920 paved the way for seven decades of commercial cattle ranching in the area we know today as the Savé Valley Conservancy. Roads were cut, fences erected and an everlasting 'battle' ensued against the wildlife, especially against all predators.

The large predators, especially lions, were virtually eradicated (Pole 1999). However, by the late 1980's, declining range productivity, depressions and droughts forced the landowners to consider alternative options. Around that time, empirical evidence of the competitive advantage of wildlife over livestock began to emerge (Child 1988; Bond 1993), especially in arid areas (Jansen et al 1992; Cumming 1993), and wildlife was finally given serious consideration as a viable land use option.

In 1989, a proposal was drawn up (du Toit 1989) to turn what was then the Sabi Valley Intensive Conservation Area into a wildlife conservancy. The plan was to create a single large wildlife area, especially for the re-establishment of endangered species and overexploited species, with cattle remaining the primary income generator. The Savé Valley Conservancy was constitutionally inaugurated in June 1991, and following the severe 1991/1992 drought, wildlife ranching became the primary land-use. At the time this was the largest private wildlife conservancy in the world (3,410 km^2).

The conservancy members then restocked the wildlife, removed all internal fencing, erected a common perimeter fence and developed effective security systems. A double, electrified, veterinary-approved fence was completed in 1995, and the following decade saw a massive investment in wildlife re-stocking and security systems.

Sport-hunting was essential for the successful transition of the conservancy from cattle to wildlife. During the early years, wildlife densities were low, resulting in poor potential for ecotourism, and hunting generated the income needed to erect the fence, re-stock game, and improve security, especially because of the significant numbers of black rhinoceros now found there. Gradually, some of the ranchers shifted more into ecotourism. One property, Senuko Ranch, completed a 16 bed up-market lodge with a view of marketing non-consumptive safaris, offering game drives and bush walks and specializing in rhino walks and African wild dog *Lycaon pictus* den visits. Lodge occupancy rose from 0% in 1996 to 62% by the end of 1999.

However, the Zimbabwean land reform program, which was initiated in February 2000, soon made a strong negative impression in the international community, and resulted in travel bans and warning from most of Zimbabwe's source markets. This, together with the political instability meant that the wildlife industry and ecotourism industry collapsed over-night: sport-hunting became the only economically viable land use option, and has remained the only tangible source of income to the landowners of the Savé Valley Conservancy. In the case of the Senuko Lodge, for example, the land reform program resulted in a 98% cancellation of

the confirmed bookings. After four years of seeking alternative markets, the lodge could achieve no higher than 17% occupancy, and in 2005 moved back into a hunting-based operation.

A more direct impact of the land reform program for the Savé Valley Conservancy was the loss of 33% of the area of the conservancy to invading subsistence farmers (Lindsey et al 2008). The loss of land was catastrophic and the related pressure from wire snare poaching was extreme. In the following eight years (2001 to 2009), 10,520 illegal hunting incidences were recorded, 84,396 wire snares were removed and at least 6,454 wild animals killed (Lindsey et al. 2011).

Savé Valley Conservancy Community Support and Anti-Poaching

In 2012, conservancy members provided over US$ 100,000 worth of support to adjacent villages or farmers in the resettled areas. Assistance included drilling boreholes, maintaining boreholes, dredging of dams, assisting with building projects in clinics and schools, assisting with repairs, maintenance and materials at schools, education initiatives, school field trips, provision of computer equipment in schools, craft programs and regular donations of meat.

Moreover, the conservancy recently entered into a mutually dependent agreement with the Chiefs representing the communities surrounding the Savé Valley Conservancy. The agreement links the communities to the Natural Resource Utilisation that occurs through the business operation of the conservancy and opens up opportunities for the local indigenous populations to share in any wealth creation. This agreement strengthens relations between the conservancy and the surrounding local communities and creates an environment that helps to protect, conserve and sustain the natural assets of the area. The hunting tourism of the conservancy is currently the only form of income by which the surrounding communities can benefit. Revenues from trophy lion hunting constitute a significant portion of inflow and thus an important part of the community benefits. Any reduction would seriously jeopardise the growth of this infant positive relationship and community empowerment initiative.

The Savé Valley Conservancy is thus pioneering private-community partnerships in Zimbabwe, and trade restrictions on lion trophies will indirectly adversely affect these already seriously impoverished communities through a reduction in available income to share with communities. This is very likely to have a knock on impact on the lions themselves with a significantly reduced tolerance and an increase in retaliatory poisoning of lions for livestock predation. Without a demonstration of income from lions, the political pressure from the surrounding communities to remove them from the conservancy altogether will be a challenge to resist.

Savé Valley Conservancy Lion Monitoring and Management

After the Conservancy was formed, and persecution stopped, lions, mainly males, recolonized the area and their numbers started to increase in the late 1990's / early 2000's. Few lionesses were observed until 2003, when small family groups and male-female pairs were seen, and by 2004 - 2005 there were some reports of cubs. During this period 13

lions were also reintroduced into the Savé Valley Conservancy. After an initial lag phase the lion population on the Savé Valley Conservancy has increased dramatically and at present is growing exponentially (Figure 8; Groom and Watermeyer 2015).

Monitoring of the lion population began in 1999 (Pole 1999) with track index or call-up surveys being conducted sporadically until 2006. From 2007 to present, annual conservancy-wide track index surveys have been conducted using a standardized methodology (Groom and Watermeyer 2015). The resulting population estimates were verified in 2011 by a baited lion call-up survey and a collation of managers' estimates, all of which provided similar results.

Prey availability models (Hayward et al. 2007) suggest that the carrying capacity for the lion population in the Savé Valley Conservancy is approximately 271 lions. The population estimate for 2015 was 284 lions, suggesting lions have reached their ecological carrying capacity, even whilst being responsibly hunted.

A professional lion management plan was commissioned by the conservancy in 2011 (Funston 2011), to provide the Savé Valley Conservancy members with a science-based plan to help them ethically and sustainably manage their lion population. This plan specifically advocates the use of hunting as a conservation management tool. It also demonstrates willingness by the conservancy to guide their lion management based on science and advice from professionals.

Savé Valley Conservancy Lion Hunting

Lions have been hunted in the Savé Valley Conservancy since 2002, although that was largely for removal of problem animals. Hunting began properly in 2005 with quotas increasing annually to a maximum of seven per year from 2009 onwards (Table 5), with the quota being raised to ten for 2016 based on trophy ages.

Despite offtakes of lions through sport-hunting, the lion population has continued to increase in the Conservancy. The revenue generated from hunting lions has enabled landowners to invest in proper land management, anti-poaching, water provision and fence maintenance, all of which benefit the lion population (especially as lions seem to be vulnerable to being caught in wire snares; Becker et al 2013; R. Groom, pers. obs.).

Table 5: *The Savé Valley Conservancy annual lion hunting quota and offtake from 2002 to 2015.*

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Approved quota	5	5	1	3	3	4	6	7	7	7	4	2	3	5
Quota taken	1	0	1	3	3	3	3	6	5	3	4	1	3	5
Percentage success	20	0	100	100	100	75	50	86	71	43	100	50	100	100

Any data showing what is being provided to community?

Sport-hunting of lions brings considerable revenue to the Conservancy, revenue that is vital for the continued functioning of the area for wildlife conservation. Without the costs of lions being offset by the income from sport-hunting, landowners cannot reasonably be expected to tolerate such high lion densities, and their numbers would have to be reduced significantly.

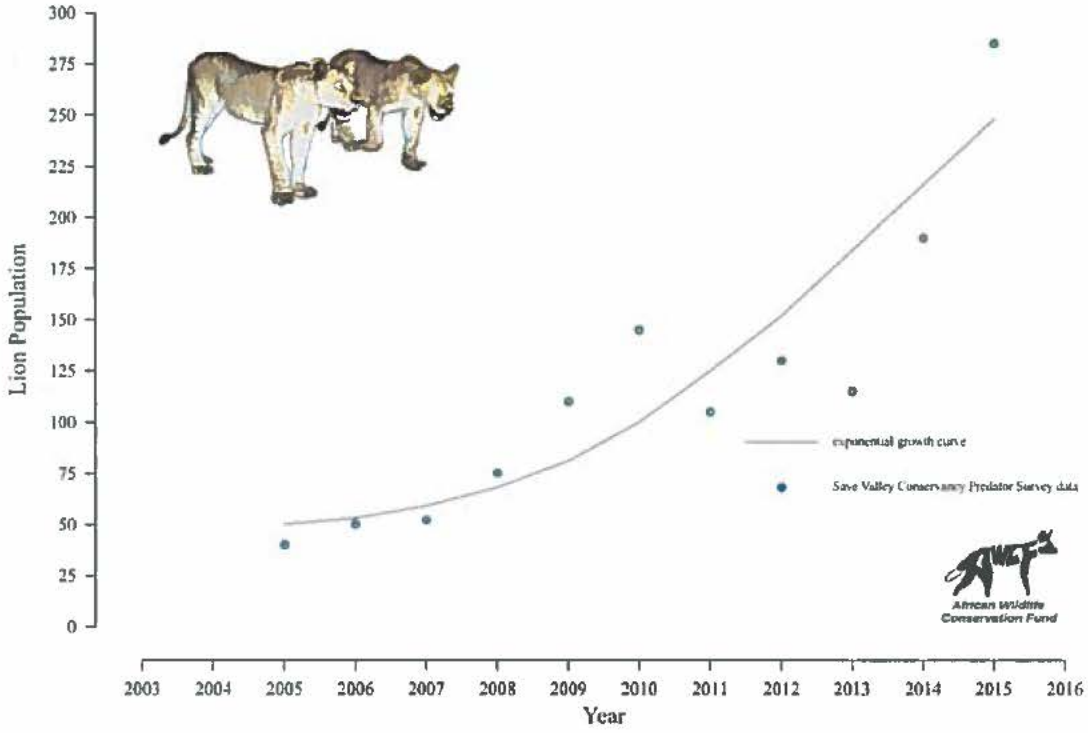


Figure 8: The Savé Valley Conservancy lion population, like that of the Bubye Valley Conservancy, has grown exponentially. Points indicate estimated lion abundance calculated from field surveys; the line represents the exponential growth curve.

THE PROS AND CONS OF CONSERVING LIONS

The saturation of lions in wildlife areas on both state and private land is positive for their future conservation security; but it is also critical to that of incidentally conserved endangered species, such as both species of rhinoceros on private wildlife conservancies in Zimbabwe (Lindsey et al. 2009; Suzuki 2001), which benefit from the same resources and protection that are incentivised and provided by the revenue generated from sport-hunting. The Bubye Valley Conservancy now boasts the world's third largest black rhinoceros population (N. Anderson [Lowveld Rhino Trust]. pers. comm.), which is classified as Key 1 by the African Rhino Specialist Group and means that this population is considered key to the overall survival of the species. The Savé Valley Conservancy has the second largest black rhinoceros population in Zimbabwe after Bubye. These are not coincidences. These rhinoceros (and other endangered species, such as wild dog) strongholds are the result of the incidental conservation benefits derived entirely from sport-hunting activities - there are no photographic tourists visiting either the Bubye Valley or Savé Valley Conservancies, and the rhinoceros are not hunted. Having rhinoceros on the land therefore generates no revenue - and in fact there is a significant cost associated with protecting these animals; US$ 590,000 (not including incentive and reward bonuses donated for these purposes) was spent on anti-poaching by the Bubye Valley Conservancy during 2015 (K. Leathem, pers. comm.), and US$ 546,000 is spent annually on anti-poaching by the Savé Valley Conservancy (Lindsey et al. 2012). This expense is covered mainly by the revenue generated by sport-hunting with additional donations from the clients; and most importantly, the habitat for the rhinoceros is preserved by maintaining the land as a conservation area, as opposed to converting it into agricultural or grazing land for example.

However, the high densities of lion populations achieved within commercial wildlife areas have the potential for intense intraguild persecution. Lions are aggressively competitive, and research on the relationship between lions and leopards has shown that high densities of lions can negatively affect leopard population density, demographic structure, cub survival, and spatial ecology down to even the step-wise decisions that leopards make regarding habitat use and behaviour based on both the actual and potential risk of encountering lions (du Preez 2014; du Preez 2015). Leopards are a generalist species that are able to cope with persecution by adapting their behaviour and ecological niche, and even they suffer under a burgeoning lion population; ecological specialists and endangered species, such as cheetah *Acinonyx jubatus* and wild dog, do not fare nearly as well under such intense competitive pressure. In fact, competition with lions has been directly linked to reductions in cheetah (e.g. Durant 1998, 2000; Laurenson 1995) and wild dog (e.g. Creel 2001; Creel and Creel 1996; Vucetich and Creel 1999) densities, both of which face local extinction where lion abundance, and the respective level of persecution, is high. Excessive lion densities may also result in population declines of ungulate prey (e.g. Wegge et al. 2009). It is vital to holistic conservation that wildlife managers can understand and deal with the level of impact that lions exert on other species; particularly those that

are elusive difficult to observe, and which face decline if not carefully monitored. To this end, a conservation research initiative in partnership with WildCRU was established on the Bubye Valley Conservancy in 2009, and research conducted on the Savé Valley Conservancy since 2007.

Based on the number of kills made (du Preez et al. in prep.) and the current value of the meat (K. Leathem, pers. comm.), the Bubye Valley Conservancy lion population consumes hundreds of thousands of dollars worth of prey each year. These lions are mainly tolerated because of their ability to generate the revenue that helps to offset this expense - although it is estimated that economically it is still not worth keeping the lions whose cost outweighs their value (Funston et al. 2013).

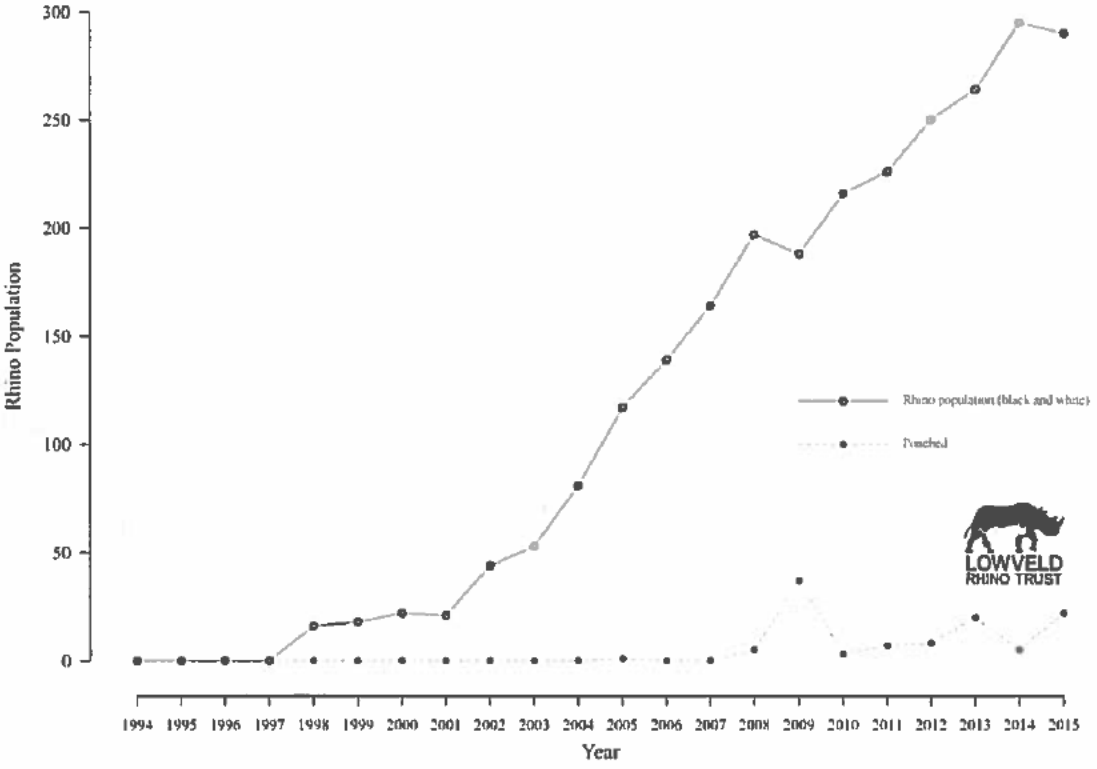


Figure 9: The Bubye Valley Conservancy black rhino population is rated as Key 1 by the African Rhino Specialist Group which means that the population is considered key to the overall survival of the species.

WHERE THE MONEY GOES: THE FINANCES OF LION SPORT-HUNTING AND REINVESTMENT IN THEIR CONSERVATION

Break-down of the finances involved in a typical lion hunt on the Bubye Valley Conservancy:

Lion Trophy fee: US$ 42,000
Lion Hunt Daily rate: US$ 2,950 day^{-1}
(Minimum lion hunt duration: 18 days [*total daily rate of US$ 53,100 lion hunt^{-1}*])

Additional costs include:
ZPWMA scout
Observers
Bait used
Other trophy species taken during the lion hunt, etc.
[*These additional costs average approximately US$ 6,500 lion hunt^{-1}*]

BUBYE VALLEY CONSERVANCY - LION SPORT-HUNTING REVENUE GENERATED (2015):

((18 days × 2,950 day^{-1}) + 42,000 trophy fee + 6,500 additional costs) × 12 lions
= **US$ 1,219,200**

Lion sport-hunting therefore represents approximately 33.9% of the Bubye Valley Conservancy's total annual revenue generation (which includes post-hunt meat and hide sales).

All of the revenue generated from lion sport-hunting on the Bubye Valley Conservancy has gone back into the running costs of the Conservancy, which is all part of conservation, and which includes: anti-poaching and fence monitoring and maintenance (approximately US$ 506,000 year^{-1}), research (approximately US$ 34,700 year^{-1} not including client and sponsor donations), and community support assistance (approximately US$ 210,000 year^{-1}).

[*No profit after costs has been declared, nor dividends taken by shareholders, since the Bubye Valley Conservancy was formed in 1994. All revenue generated to date has been spent on running costs, improvements and restocking.*]

DISCUSSION

Here we have shown that since their reintroduction after historical eradication, both the Bubye Valley and Savé Valley Conservancies' lion populations have increased exponentially - not despite sport-hunting, but because of sport-hunting and the incentive it provides for protection.

The success of the Bubye Valley and Savé Valley Conservancies, in terms of both of their hunted lion and non-hunted rhinoceros populations, may also provide the motivation for other areas in the country to sustainably manage their wildlife resource. A case in point is the Nuanetsi Ranch, a wildlife area that is also a legacy of failed cattle ranching, located almost directly between the Bubye Valley and Savé Valley Conservancies in Zimbabwe (Figure 3). At present there is a single lion on the Nuanetsi Ranch but management is not able to justify introducing more due to the current uncertainty over the future of lion hunting (B. Lees-May [Nuanetsi Ranch Conservator], pers. comm.). The Nuanetsi Ranch is a wildlife area of 1,489 km^2, and could conceivably sustainably hold between 201 and 278 lions (based on the most recently estimated lion densities of the Savé Valley [0.135 lions km^{-2}; Groom and Watermeyer 2015]; and Bubye Valley [0.187 lions km^{-2}; du Preez et al. 2015] Conservancies respectively). However, the Nuanetsi Ranch has invested in building up an abundant wildlife population, which is sport-hunted, and the management will not risk losing a significant amount of valuable game, that could otherwise be sold as trophies or meat, to a species from which it can not recuperate lost revenue, and instead that requires further investment in control measures (B. Lees-May [Nuanetsi Ranch Conservator], pers. comm.).

Between 2005 and 2015 the United States market has represented 70.4% of the total Zimbabwean lion sport-hunting industry (http://trade.cites.org/en/cites_trade/ [accessed 2015-01-19]), though in reality it constituted over 90% for both the Bubye Valley and Savé Valley Conservancies. If this market was effectively lost due an inability of prospective clients to import their trophies, based on the economics involved it would become unviable to continue managing the Bubye Valley Conservancy as a wildlife area in its current form, and lions would either have to be re-exterminated, or at least severely reduced via culling; or else what is the largest privately owned wildlife area in the world would be converted back into a cattle ranching area (K. Leathem, pers. comm.). This is the reality of any business, in that it needs to cover costs and pay staff and cannot run at a loss for luxury of conservation. Child (1993) states "*A refusal to treat wildlife in the same way as other resources and maintenance of centralised protectionist management prejudices its survival. Only by raising its commercial value will wildlife be able to compete for space on the scarce African landscape. Trade bans which detract from wildlife's commercial value prejudice its chances of survival in the long term*".

Although the USFWS understandably categorises lion conservation by country for simplicity, rather than individual properties, the Bubye Valley and Savé Valley Conservancies currently and deservedly hunt more than a third of the total Zimbabwean lion quota between them. Here we have shown that this sport-hunting does not negatively affect the lion population, which remains in positive growth despite off-take. In addition

to this, other areas, such as the Nuanetsi Ranch, could be incentivised to invest in lion conservation if the ability to sustainably utilise the lions as a resource was guaranteed.

The USFWS identified five primary factors that threaten lion survival in the wild, namely: habitat loss; loss of prey; retaliatory killing due to increased human-lion conflicts; inadequate regulatory mechanisms: and weak management of protected areas (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). Each and every point on this list, which notably does not include sport-hunting, supports the fact that incentivising tolerance for lions through sustainable use would enhance the species' overall survival.

As responsible conservationists, we are not arguing against tight regulation of sport-hunting, especially with regard to sensitive species such as lions, and we support the need for transparency and accountability within the industry. However, this reform is a process being driven from within, as any indiscretion is an affront on all stakeholders. For example, long-term lion monitoring by WildCRU in Hwange National Park (HNP), Matabeleland North, Zimbabwe, documented a 'vacuum effect' and reduction in male lion density in the Park as a result of sport-hunting in the surrounding areas (Loveridge et al. 2007). A result of this research was the recommendation that ZPWMA implement a hunting moratorium in western Zimbabwe, which was accepted and enforced from 2005 to 2008 (Davidson 2009). Subsequent monitoring of the HNP lion population showed that the perturbation effects caused by sport-hunting were reversed during the moratorium, and sport-hunting was reinstated at a reduced, more sustainable quota (Davidson 2009). This example demonstrates both the relationship between independent researchers and ZP-WMA, and that the research assists ZP-WMA in robust decision making. This study has also shown that the lion population was able to recover quickly, and that a blanket-ban would have been as unnecessary as it would have been detrimental to overall lion conservation in the country.

In addition to the self-imposed hunting moratorium in the Matabeleland North district, Zimbabwe has voluntarily stopped sport-hunting of any lioness. The fixed-quota concept, in which hunting quotas had to be paid for upfront before the hunting season even began, and which was resultantly attributed to poor quality trophies and young animals being hunted, has also been abandoned. The adaptive quota management system for lion hunting based on the ages of lions hunted has been accepted and embraced by all stakeholders. This adaptive quota management system has not only led to a reduced national lion hunting quota, but has also resulted in a significant increase in the age of harvested lions to a level that is considered to have minimal ecological impact, being old individuals that are no longer contributing to the gene pool nor protecting cubs.

The IUCN Red List lion conservation status has remained unchanged for 20 years even in the face of Africa's ever-changing landscape. Despite fears that lion abundance is decreasing overall, in southern Africa it is in fact increasing (Bauer et al. 2015b).

CONCLUSION

Given the evidence presented, the arguments against sport-hunting would appear to be based more in emotion than logic and reality (e.g. Lindsey et al. 2015). Conservation, however, is not about individuals within populations, but the overall populations themselves. Sustainable sport-hunting of lions is just that: *sustainable* - and ironically, without it, the lions themselves become unsustainable. Conservation objectives need to be balanced with both social and economic factors if they are to be achieved.

The USFWS states "Well-managed conservation programs use trophy hunting revenues to sustain lion conservation, research and anti-poaching activitie" (http://www.fws.gov/endangered/what-we-do/lion.html [accessed 2015-01-19]). The Bubye Valley and Savé Valley Conservancies both fully meet each one of these conditions: clearly contributing to lion conservation in Zimbabwe; having long-term conservation research programs; and self-funded anti-poaching units.

The histories regarding the formation of both the Bubye Valley and Savé Valley Conservancies were both presented in this report, despite being remarkably similar; the point being that lion conservation in both areas, and many others, has the same fate either way. The Bubye Valley and Savé Valley Conservancies are both excellent examples of focussed and determined efforts to make wildlife based land use viable in an otherwise cattle dominated landscape. However, the fact remains that the cost of having lions, both ecologically and financially, is high. Simply increasing the abundance of one species at the expense of another cannot be considered a conservation success.

REFERENCES

Barnett, R., Yamaguchi, N., Shapiro, B., Ho, S.Y., Barnes, I., Sabin, R., Werdelin, L., Cuisin, J., Larson, G., 2014. Revealing the maternal demographic history of Panthera leo using ancient DNA and a spatially explicit genealogical analysis. Bmc Evolutionary Biology 14.

Bauer, H., Chapron, G., Nowell, K., Henschel, P., Funston, P., Hunter, L., Macdonald, D., Packer, C., 2015a. Lion (Panthera leo) populations are declining rapidly across Africa, except in intensively managed areas. Proceedings of the National Academy of Sciences of the United States of America-Biological Sciences 10.

Bauer, H., Packer, C., Funston, P.F., Henschel, P., Nowell, K., 2015b. Panthera leo. The IUCN Red List of Threatened Species 2015.

Bauer, H., Van Der Merwe, S., 2004. Inventory of free-ranging lions Panthera leo in Africa. Oryx 38, 26-31.

Becker, M., McRobb, R., Watson, F., Droge, E., Kanyembo, B., Murdoch, J., Kakumbi, C., 2013. Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. Biological Conservation 158, 26-36.

Bond, I., 1993. The economics of wildlife and landuse in Zimbabwe: An examination of current knowledge and issues. WWF Multispecies Project Paper No 36, Worldwide Fund for Nature, Harare, Zimbabwe.

Brassine, M.C., Parker, D.M., 2012. Does the presence of large predators affect the diet of a mesopredator? African Journal of Ecology 50, 243-246.

Child, B., 1988. The role of wildlife utilization in the sustainable economic development of semi-arid rangelands in Zimbabwe. D.Phil. Thesis, University of Oxford, Oxford, UK.

Child, B., 1993. Using wildlife as a development tool in Zimbabwe.

Creel, S., 2001. Four factors modifying the effect of competition on carnivore population dynamics as illustrated by African wild dogs. Conservation Biology 15, 271-274.

Creel, S., Creel, N.M., 1996. Limitation of African wild dogs by competition with larger carnivores. Conservation Biology 10, 526-538.

Creel, S., Creel, N.M., 1997. Lion density and population structure in the Selous Game Reserve: Evaluation of hunting quotas and offtake. African Journal of Ecology 35, 83-93.

Cumming, D.H.M., 1993. Multi-species systems: Progress, prospects and challenges in sustaining range animal production and biodiversity in East and southern Africa. In Proceedings VII World Conference on Animal Production, Edmonton, Alberta, Canada

Davidson, Z., 2009. Lion ecology and socio-spatial impacts of trophy hunting in Zimbabwe. D.Phil. Thesis, University of Oxford, Oxford, UK.

du Preez, B., Hart, T., Loveridge, A.J., Macdonald, D.W., 2015. Impact of risk on animal behaviour and habitat transition probabilities. Animal Behaviour 100, 22-37.

du Preez, B.D., 2014. The impact of intraguild competition with lion Panthera leo on leopard Panthera pardus behavioural ecology. D.Phil. Thesis, University of Oxford, Oxford, UK.

du Toit, R.,.1989. Proposal for Savé Valley Conservancy. Unpublished report for the Intensive Conservation Areas Committee, October 1989, Harare, Zimbabwe

Durant, S.M., 1998. Competition refuges and coexistence: an example from Serengeti carnivores. Journal of Animal Ecology 67, 370-386.

Durant, S.M., 2000. Living with the enemy: avoidance of hyenas and lions by cheetahs in the Serengeti. Behavioral Ecology 11, 624-632.

Funston, P.J., 2008. Conservation and management of lions in Southern Africa: status, threats, utilization and the restoration option, In Management and conservation of large carnivores

in West and Central Africa. eds B. Croes, H.H. Delongh, H. Bauer, pp. 109-131. Leiden, Institute of Environmental Sciences.

Funston, P.J., 2011. The Savé Valley Conservancy Lion Management Plan, 2011. Report for the Savé Valley Conservancy.

Funston, P.J., Groom, R.J., Lindsey, P.A., 2013. Insights into the Management of Large Carnivores for Profitable Wildlife-Based Land Uses in African Savannas. Plos One 8.

Groom, R.J., P., W.J., 2015. Carnivore densities in the Savé Valley Conservancy: 2015. Report for the Savé Valley Conservancy.

Hayward, M.W., O'Brein, J., Kerley, G.I.H., 2007. Carrying capacity of large African predators: predictions and tests. Biological Conservation 139, 219-229.

Hunter, L.T.B., Pretorius, K., Carlisle, L.C., Rickelton, M., Walker, C., Slotow, R., Skinner, J.D., 2007. Restoring lions Panthera leo to northern KwaZulu-Natal, South Africa: short-term biological and technical success but equivocal long-term conservation. Oryx 41, 196-204.

IUCN, 2006. Conservation strategy for the lion in eastern and southern Africa. IUCN SSC Cat Specialist Group, Gland, Switzerland and Cambridge, UK.

IUCN, 2015. The IUCN Red List of Threatened Species. Version 2015-4.

Jansen, D.J., Child, B., Bond, I., 1992. Cattle, wildlife, both or neither: Results of a financial and economic survey of commercial ranches in southern Zimbabwe. WWF Multispecies Project Paper No 27, Worldwide Fund for Nature, Harare, Zimbabwe.

Kettles, R., Slotow, R., 2009. Management of free-ranging lions on an enclosed game reserve. South African Journal of Wildlife Research 39, 23-33.

Laurenson, M.K., Wielebnowski, N., Caro, T.M., 1995. Extrinsic Factors and Juvenile Mortality in Cheetahs. Conservation Biology 9, 1329-1331.

Leader-Williams, N., Milledge, S., Adcock, K., Brooks, M., Conway, A., Knight, M., Mainka, S., Martin, E.B., Teferi, T., 2005. Trophy hunting of black rhino Diceros bicornis: Proposals to ensure is future sustainability. Journal of International Wildlife Law & Policy and Politics 8, 1-11.

Lindsey, P., du Toit, R., Pole, A., Romanach, S., 2008. Savé Valley Conservancy: a large scale African experiment in cooperative wildlife management. Chapter 11, pages 163-184 in B. Child, H. Suich and A. Spenceley, "Evolution and innovation in wildlife conservation in southern Africa." Earthscan, London.

Lindsey, P.A., Alexander, R., Frank, L.G., Mathieson, A., Romanach, S.S., 2006. Potential of trophy hunting to create incentives for wildlife conservation in Africa where alternative wildlife-based land uses may not be viable. Animal Conservation 9, 283-291.

Lindsey, P.A., Balme, G.A., Booth, V.R., Midlane, N., 2012. The Significance of African Lions for the Financial Viability of Trophy Hunting and the Maintenance of Wild Land. Plos One 7.

Lindsey, P.A., Balme, G.A., Funston, P.J., Henschel, P.H., Hunter, L.T.B., 2015. Life after Cecil: channelling global outrage into funding for conservation in Africa. Conservation Letters 0, 1-6.

Lindsey, P.A., Balme, G.A., Booth, V.R., Midlane, N., 2012. The Significance of African Lions for the Financial Viability of Trophy Hunting and the Maintenance of Wild Land. Plos One 7.

Lindsey, P.A., Romanach, S.S., Davies-Mostert, H.T., 2009. The importance of conservancies for enhancing the value of game ranch land for large mammal conservation in southern Africa. Journal of Zoology 277, 99-105.

Lindsey, P.A., Romanach, S.S., Tambling, C.J., Chartier, K., Groom, R., 2011. Ecological and financial impacts of illegal bushmeat trade in Zimbabwe. Oryx 45, 96-111.

Lindsey, P.A., Roulet, P.A., Romanach, S.S., 2007. Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. Biological Conservation 134, 455-469.

Loveridge, A.J., Searle, A.W., Murindagomo, F., Macdonald, D.W., 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation 134, 548-558.

Macdonald, D.W., Loveridge, A.J., Nowell, K., 2010. Dramatis personae: an introduction to the wild felids, In Biology and Conservation of Wild Felids. eds D.W. Macdonald, A.J. Loveridge, pp. 3-58. Oxford University Press Inc., New York, United States.

Miller, S.M., Funston, P.J., 2014. Rapid growth rates of lion (Panthera leo) populations in small, fenced reserves in South Africa: a management dilemma. South African Journal of Wildlife Research 43, 1-13.

Mills, M.G.L., 1995. Notes on wild dog Lycaon pictus and lion Panthera leo population trends during a drought in the Kruger National Park. Koedoe 38, 95-99.

Mosser, A., Packer, C., 2009. Group territoriality and the benefits of sociality in the African lion, Panthera leo. Animal Behaviour 78, 359-370.

Nowell, K., Jackson, P., 1996. Leopard, Panthera pardus, In Wild Cats: Status Survey and Conservation Action Plan. p. 406. IUCN, Switzerland.

Packer, C., Brink, H., Kissui, B.M., Maliti, H., Kushnir, H., Caro, T., 2010. Effects of Trophy Hunting on Lion and Leopard Populations in Tanzania. Conservation Biology 25, 142-153.

Packer, C., Kosmala, M., Cooley, H.S., Brink, H., Pintea, L., Garshelis, D., Purchase, G., Strauss, M., Swanson, A., Balme, G., Hunter, L., Nowell, K., 2009. Sport Hunting, Predator Control and Conservation of Large Carnivores. Plos One 4.

Packer, C., Loveridge, A., Canney, S., Caro, T., Garnett, S.T., Pfeifer, M., Zander, K.K., Swanson, A., MacNulty, D., Balme, G., Bauer, H., Begg, C.M., Begg, K.S., Bhalla, S., Bissett, C., Bodasing, T., Brink, H., Burger, A., Burton, A.C., Clegg, B., Dell, S., Delsink, A., Dickerson, T., Dloniak, S.M., Druce, D., Frank, L., Funston, P., Gichohi, N., Groom, R., Hanekom, C., Heath, B., Hunter, L., Delongh, H.H., Joubert, C.J., Kasiki, S.M., Kissui, B., Knocker, W., Leathem, B., Lindsey, P.A., Maclennan, S.D., McNutt, J.W., Miller, S.M., Naylor, S., Nel, P., Ng'weno, C., Nicholls, K., Ogutu, J.O., Okot-Omoya, E., Patterson, B.D., Plumptre, A., Salerno, J., Skinner, K., Slotow, R., Sogbohossou, E.A., Stratford, K.J., Winterbach, C., Winterbach, H., Polasky, S., 2013. Conserving large carnivores: dollars and fence. Ecol Lett 16, 635-641.

Pole, A., 1999. The behaviour and ecology of African wild dogs, Lycaon pictus, in an environment with reduced competitor density. PhD thesis, University of Aberdeen, Aberdeen, Scotland.

Pusey, A.E., Packer, C., 1987. The Evolution of Sex-Biased Dispersal in Lions. Behaviour 101, 275-310.

Schaller, G.B., 1972. The Serengeti Lion: A Study of Predator-Prey Relations. University of Chicago Press.

Smuts, G.L., 1978. Effects of Population Reduction on Travels and Reproduction of Lions in Kruger National Park. Carnivore 1, 61 - 72.

Spong, G., 2002. Space use in lions, Panthera leo, in the Selous Game Reserve: social and ecological factors. Behavioral Ecology and Sociobiology 52, 303-307.

Suzuki, Y., 2001. Drifting Rhinos and Fluid Properties: The Turn to Wildlife Production in Western Zimbabwe. Journal of Agrarian Change 1, 600-625.

Trinkel, M., Funston, P., Hofmeyr, M., Hofmeyr, D., Dell, S., Packer, C., Slotow, R., 2010. Inbreeding and density-dependent population growth in a small, isolated lion population. Animal Conservation 13, 374-382.

Vucetich, J.A., Creel, S., 1999. Ecological interactions, social organization, and extinction risk in African wild dogs. Conservation Biology 13, 1172-1182.

Wegge, P., Odden, M., Pokharel, C.P., Storaas, T., 2009. Predator-prey relationships and responses of ungulates and their predators to the establishment of protected areas: A case study of tigers, leopards and their prey in Bardia National Park, Nepal. Biological Conservation 142, 189-202.

Whitman, K., Starfield, A.M., Quadling, H.S., Packer, C., 2004. Sustainable trophy hunting of African lions. Nature 428, 175-178.

Williams, P.H., Burgess, N.D., Rahbek, C., 2000. Flagship species, ecological complementary and conserving the diversity of mammals and birds in sub-Saharan Africa (vol 3, part 3, pg 258, 2000). Animal Conservation 3, 365-365.

ZPWMA, 2015. Conservation Status of the African Lion (Panthera leo) in Zimbabwe. Unpublished Report for the USFWS.

DEPARTMENT OF THE INTERIOR Mail

Tapia, Brenda <brenda_tapia@fws.gov>

Fwd: [African-elephant] Zimbabwe: Elephant Hunting Dispute Slows Football Stadium Construction

2 messages

Vannorman, Tim <tim_vannorman@fws.gov> Wed, Jan 25, 2017 at 12:31 PM
To: Brenda Tapia <brenda_tapia@fws.gov>

---------- Forwarded message ----------
From: Simukai Nyasha <snyasha@zimparks.co.zw>
Date: Fri, Jul 8, 2016 at 6:26 AM
Subject: RE: [African-elephant] Zimbabwe: Elephant Hunting Dispute Slows Football Stadium Construction
To: "Vannorman, Tim" <tim_vannorman@fws.gov>

I thought you had already received the priorities from the Director General. Let me verify with him and then I update you.

Regards

Simukai Nyasha

International Conventions Manager

Cell: +263-772 678 351

From: Vannorman, Tim [mailto:tim_vannorman@fws.gov]
Sent: Wednesday, July 06, 2016 8:47 PM
To: Simukai Nyasha <snyasha@zimparks.co.zw>
Subject: Fwd: [African-elephant] Zimbabwe: Elephant Hunting Dispute Slows Football Stadium Construcŏon

Simukai,

I hope all is well with you. I wanted to follow up on my message below regarding priorities for implementing the elephant management plan. I am anxious to finalize my review and updated finding but am at a loss in how to rectify the Director General's statement without more information. Any additional clarification that you could provide would be greatly appreciated.

Sincerely,

Tim

---------- Forwarded message ----------
From: Vannorman, Tim <tim_vannorman@fws.gov>
Date: Tue, May 24, 2016 at 1:13 PM
Subject: Re: [African-elephant] Zimbabwe: Elephant Hunting Dispute Slows Football Stadium Construction
To: Simukai Nyasha <snyasha@zimparks.co.zw>, Edson Chidziya <wsithole@zimparks.co.zw>, Edson Chidziya
(b) (6)

Dear Director General,

Thank you for your May 9, 2016, letter providing more information on the football stadium. Based on your statement, I take it that the proceeds generated from only 10 elephant hunts was being allocated for the construction of the stadium. This would be more in line with our perception that the hunting revenue received by CAMPFIRE are for smaller community projects, as oppose to larger construction or capital gains projects.

I fully recognize that the limitations that have occurred due to the suspension of elephant trophy imports has affected your budget and ability to fully implement the 2015-2020 Management Strategy. However, has your department prioritized the activities identified in the strategy to fully utilize the albeit budget allocated to elephant management? I ask this not to require additional work from your staff, but to better quantify the statement made in the strategy and, if possible, strengthen my enhancement finding to authorize imports of trophies.

I look forward to your response,

Sincerely,

Tim

On Mon, May 9, 2016 at 9:01 AM, Simukai Nyasha <snyasha@zimparks.co.zw> wrote:

> My apologies for responding late to your email. Herewith aù ached please find a response leù er to the issues raised in your email.
>
> It's true Olivia is no longer with Zim Parks and we had not seen the correspondence that you emailed on 4th April. For all future correspondences, please communicate through my email and copying the Director General also if need be.
>
> Regards
>
> Simuk**ai Ny**asha

International Conventions Manager

Cell: +263-772 678 351

From: Vannorman, Tim [mailto:tim_vannorman@fws.gov]
Sent: Monday, April 25, 2016 4:18 PM
To: snyasha@zimparks.co.zw; Edson Chidziya <wsithole@zimparks.co.zw>; Edson Chidziya
(b) (6)
Subject: Fwd: [African-elephant] Zimbabwe: Elephant Hunting Dispute Slows Football Stadium Construcǒon

Dear Edson,

I was informed last week by John Jackson that Olivia is no longer with ZPWMA. If this is the case, I am concerned that the e-mail I sent her on April 4th may not have been seen. I am hoping that this additional information can allow me to finalize the USFWS position for imports of 2016 elephant trophies.

If you have any questions, please let me know.

Sincerely,

Tim

---------- Forwarded message ----------
From: Vannorman, Tim <tim_vannorman@fws.gov>
Date: Mon, Apr 4, 2016 at 1:06 PM
Subject: Fwd: [African-elephant] Zimbabwe: Elephant Hunting Dispute Slows Football Stadium Construction
To: Olivia Mufute <omufute@zimparks.co.zw>

Dear Olivia,

I hope all is well with you. I am trying to finalize our finding for 2016 for Zimbabwe elephant trophies and a question arose.

An article in Newsweek (below) raised questions about how funds are used by RDC. It is my understanding the funds generated from trophy hunts goes back to the community for activities to benefit the communities, such as clinics, schools, and salaries for game scouts. I have some doubts about what the article identifies, but could you or someone on your staff elaborate on the article?

In addition, in reviewing the 2015-2020 Management Strategy, it states that the plan, if fully implemented, would require a greater amount of money than is currently available. I would assume that part of the reason for this statement is because for the last two years, US hunters have declined to hunt in Zimbabwe and therefore less money has been generated than in previous years. Fully recognizing the financial situation that your department is in, what aspects of the management plan is do you anticipate could not be carried out at this time? Also, is it anticipated that if the US again allowed imports of elephant trophies in 2016, sufficient revenue would be generated to facilitate full implementation of the plan in 2017?

Thank you for assistance in this matter.

Sincerely,

Tim

---------- Forwarded message ----------
From: Save The Elephants News Service <stenews@elephantnews.org>
Date: Tue, Mar 22, 2016 at 5:03 PM
Subject: [African-elephant] Zimbabwe: Elephant Hunting Dispute Slows Football Stadium Construction
To: african-elephant@elephantnews.org

Zimbabwe: Elephant Hunting Dispute Slows Football Stadium Construction

Conor Gaffey, Newsweek

March 22, 2016

The construction of a football stadium in rural western Zimbabwe is being stalled by a dispute over its unusual source of funding—elephant hunting.

Zimbabwe's environment minister Oppah Muchinguri has been forced to deny claims that she is blocking pre-sanctioned elephant hunts, the funds from which would be used to start building the stadium in Tsholotsho.

Under Muchinguri's predecessor Saviour Kasukuwere, the Tsholotsho Rural District Council (RDC) was issued with hunting permits for some 70 elephants, with the funds raised from the hunt to be put towards building the stadium, Zimbabwe's state-owned Chronicle newspaper reported.

The chairperson of Tsholotsho RDC, Cde Alois Ndebele, accused Muchinguri of holding up the process on Sunday, according to the Chronicle. "We have all the documents in the office but after the new minister was appointed, things just started stalling, there has not been any movement," said Ndebele, referring to Muchinguri's replacement of Kasukuwere as environment minister in July 2015 in a cabinet reshuffle by President Robert Mugabe.

But Muchinguri dismissed the criticism on Monday, saying that the hunts had been suspended after elephants were killed in the area by poachers laying cyanide. "The country suffered bad publicity from the cyanide poisoning and it was felt that the hunts be stopped while the poaching issue was being handled," said Muchinguri, according to the Chronicle.

Tsholotsho borders Hwange National Park, where scores of elephants were killed by poachers using the poison in 2015, with most of the elephants having their tusks removed. Hwange is overpopulated with elephants, currently hosting twice its carrying capacity with 53,000 of the creatures, and hunting is often cited as a means of generating funds for local communities impacted by elephant populations. Elephant hunting packages sell for around $30,000 online.

http://www.newsweek.com/zimbabwe-elephant-hunting-dispute-slows-football-stadium-construction-439504

This news service is provided by Save the Elephants.

For further information on elephants please see Save the Elephants' web site
at http://www.savetheelephants.org

Disclaimer:
Please note that we cannot guarantee the accuracy of any news story. In addition, we do not endorse any of the views expressed therein. We simply try to represent fairly what is in the media on elephants. If a reader finds inaccuracies in an article, we are happy to circulate corrections, if these can be verified.

Recipients: You can manage your own subscriptions, including unsubscribing, subscribing, and changing your email address, all by clicking on the appropriate listserv link below. Also, if you feel you are receiving too many emails, you can sign up for the 'Daily Digest' option. Note that archived news stories are linked to at the top of each page.

African Elephant News:
http://elephantnews.org/mailman/listinfo/african-elephant_elephantnews.org

Asian Elephant News:
http://elephantnews.org/mailman/listinfo/asian-elephant_elephantnews.org

All Scientific Papers:
http://elephantnews.org/mailman/listinfo/allpapers_elephantnews.org

_____
African-elephant mailing list
African-elephant@elephantnews.org

This news service is provided by Save the Elephants.

For further information on elephants please see Save the Elephants' web site
at http://www.savetheelephants.org

Disclaimer:
Please note that we cannot guarantee the accuracy of any news story. In addition, we do not endorse any of the views expressed therein. We simply try to represent fairly what is in the media on elephants. If a reader finds inaccuracies in an article, we are happy to circulate corrections, if these can be verified.

Too many emails? Sign up for the Daily Digest. Also manage your subscriptions, including unsubscribing, subscribing, and changing your email address, all by clicking on the appropriate listserv link below. Note that archived news stories are linked to at the top of each page.

African Elephant News:
http://elephantnews.org/mailman/listinfo/african-elephant_elephantnews.org

Asian Elephant News:
http://elephantnews.org/mailman/listinfo/asian-elephant_elephantnews.org

All Scientific Papers:
http://elephantnews.org/mailman/listinfo/allpapers_elephantnews.org

--

Michelle Gadd, Ph.D.

Program Officer, African Elephant and African Rhino Programs

Division of International Conservation

U.S. Fish and Wildlife Service

5275 Leesburg Pike, MS: IA

Falls Church, VA 22041-3803

michelle_gadd@fws.gov

--

Timothy J. Van Norman, Chief

Branch of Permits

Division of Management Authority

U.S. Fish and Wildlife Service

(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

--

Timothy J. Van Norman, Chief

Branch of Permits

Division of Management Authority

U.S. Fish and Wildlife Service

(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

--

Timothy J. Van Norman, Chief

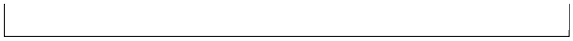
Branch of Permits

Division of Management Authority

U.S. Fish and Wildlife Service

(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!



--

Timothy J. Van Norman, Chief

Branch of Permits

Division of Management Authority

U.S. Fish and Wildlife Service

(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!



--
Timothy J. Van Norman, Chief
Branch of Permits

Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

Vannorman, Tim <tim_vannorman@fws.gov> Wed, Jan 25, 2017 at 12:40 PM
To: Brenda Tapia <brenda_tapia@fws.gov>

this one may be outside the time frame. If so, make sure we did not have an earlier FOIA that this should have gone with

Tim

---------- Forwarded message ----------
From: Simukai Nyasha <snyasha@zimparks.co.zw>
Date: Mon, May 9, 2016 at 9:01 AM
Subject: RE: [African-elephant] Zimbabwe: Elephant Hunting Dispute Slows Football Stadium Construction
To: "Vannorman, Tim" <tim_vannorman@fws.gov>

[Quoted text hidden]

--
[Quoted text hidden]

ZimParks Response.pdf
500K

ZIMBABWE PARKS AND WILDLIFE MANAGEMENT AUTHORITY

Telephone : 263-4-792786-9
: 707624-9

Fax : 263-4-708180
: 793867, 250658

Email : info@zimparks.co.zw

All correspondence to be directed to ***Director General***

Head Office

Botanical Gardens
Cnr Borrowdale Rd/Sandringham Dr
P.O.Box CY 140
Causeway
Harare

www.zimparks.org

Ref: B/3/15

09 May 2016

Chief Branch of Permits
U.S Fish and Wildlife Service
Division of Management Authority
Washington D.C 20240
USA

Attention: Mr Timothy J. Van Norman

Dear Sir

I make reference to your email of 25 April 2016.

As you may be aware Zimbabwe subscribes to the sustainable utilisation principle and this has been the practice in Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) areas where proceeds from wildlife utilisation have been used to develop rural communities. The Tsholotsho case is one such initiative where proceeds from the sustainable utilisation of natural resources in the area has had a positive impact on the Tsholotsho community.

With reference to the article which appeared in the Newsweek of March 22, 2016, alleging that hunting permits for 70 elephants were issued, the correct position is that a hunting permit was issued for only 10 elephants with only one elephant having been utilized to date. It is true that the funds generated from trophy hunting go back to the community for activities that benefit communities such as schools, clinics etc. However, it is not the prerogative of the Parks Authority at any time to determine the priority list of community development projects which can be funded from CAMPFIRE proceeds.

It is important to note that Tsholotsho has been one of the communal areas linked to cases of elephant poisoning in Hwange National Park and it is critical that such communities are assisted in seeing the positive benefits of wildlife conservation in general, and sustainable utilisation of elephants in particular.

It goes without saying that before the ban on imports of sport hunted elephant trophies into USA, the US market contributed approximately 60% of all big game hunters coming to Zimbabwe.Equally, it is true that full implementation of the Elephant Management Plan would require a greater amount of money than is currently available. It was clear from the outset that additional resources would be mobilized externally as usual, and as is the case with many other countries with similar plans.

With regards to your question as to which aspects of the Elephant Management Plan will be negatively impacted by the US ban, every aspect of the plan requires funding and any decline in income will ultimately affect it. However, in our case, while we are diversifying our markets, this was exacerbated by the lack of prior communication and/or engagement on the part of the US, prior to the ban, as this was done abruptly.

We hope that the above will suffice regarding your enquiry.

E. Chidziya
DIRECTOR GENERAL

Conservation Strategy and Action Plan for the Lion (*Panthera Leo*) in Zimbabwe



Zimbabwe Parks and Wildlife Management Authority
Ministry of Environment and Tourism

1520

Acronyms used

AA	Appropriate Authority
AWCF	African Wildlife Consultative Forum
CAMPFIRE	Community Areas Management Programme for Indigenous Resources
CRG	Carnivore Research Group
CITES	Convention on International Trade in Endangered Species of Flora and Fauna
HACSIS	Human Animal Conflict Scheme for Insurance
IUCN	International Union for the Conservation of Nature
MOMS	Management Oriented Monitoring System
NGO	Non Government Organisation
NP	National Park
PAC	Problem Animal Control
PWMA	Parks & Wildlife Management Authority
RDC	Rural District Council
SASUSG	Southern Africa Sustainable Use Specialist Group
SOAZ	Safari Operators Association of Zimbabwe
TFCA	Transfrontier Conservation Area
THT	Tiki Hywood Trust
WWF	World Wide Fund for Nature
ZATSO	Zimbabwe Association of Tour and Safari Operators
ZNSPCA	Zimbabwe National Society for the Prevention of Cruelty to Animals
ZPH&GA	Zimbabwe Professional Hunters & Guides Association
ZPWMA	Zimbabwe Parks and Wildlife Management Authority

Table of Contents

1. INTRODUCTION 5
2. BACKGROUND 6
3. ISSUES RELATING TO LION CONSERVATION IN ZIMBABWE 7
3.1 Management & research 7
3.2 Capacity needs 7
3.3 Mitigation 7
3.4 Socio-economic 8
3.5 Communication and information dissemination 8
3.6 Framework for captive breeding 8
3.7 Trade and regulation 8
3.8 Regional collaboration 8
4. STRATEGY FOR THE CONSERVATION OF THE LION IN ZIMBABWE 9
4.1 Vision (Long term objective) 9
4.2 Goal (Immediate objective or purpose) 9
4.3 Goal Targets 9
4.3.1 Target 1 9
4.3.2 Target 2 9
4.3.3 Target 3 9
4.4 Outputs (Results and outcomes) 9
4.4.1 Lion Management 9
4.4.2 Lion Research 11
4.4.3 Mitigation 11
4.4.4 Socio-economic 13
4.4.5 Regulation 14
4.4.6 Communication, Awareness and Information Dissemination 14
4.4.7 Regional and Trans-boundary Collaboration 15
5. ROLES & RESPONSIBILITIES 16
5.1 PWMA- Lion Coordinator 16
5.2 PWMA: Utilisation Unit 16
5.3 PWMA Field Stations: Ecologists, Wardens 16
5.4 CAMPFIRE Association and RDCs with AA status 16
5.5 Carnivore Research Group (CRG) 16
5.6 Lion conservation & management co-ordinating committee (LCMCC) 16
5.7 SOAZ 17
5.8 Lion Captive Breeders Association 17
6 IMMEDIATE ACTIONS 18
7 REFERENCES 19

FOREWORD

Zimbabwe is one of the few lion range states in Africa, where large areas of land which have been set aside as protected areas, still have viable lion populations. In some parts of Africa, lions have been completely wiped out through uncontrolled hunting, revenge killings, habitat loss and other factors with the only record to indicate their existence in the past now left as anecdotal evidence. The lion is a powerful African symbol, it is a flagship species and yet its future is under threat. The conflict with local communities and the threat to livestock and human lives in many parts of the world including Zimbabwe is well documented. While its attraction in ecotourism as one of the most beautiful and graceful cats, and as a trophy animal in sport hunting, its economic benefits are huge. Its social and cultural values are an integral part of the Zimbabwean lifestyle, therefore efforts to ensure lion conservation need to be strengthened.

The Zimbabwe Conservation Strategy and Action Plan for the Lion will guide the conservation and management of this important top predator. The strategy and action plan is the outcome from a workshop in which stakeholders representing the wildlife industry, technocrats, inter and non-governmental organizations, wildlife producers etc, actively participated. Hence the strategy and action plan addresses the needs of this country. It, at the same time responds to regional and international standards set by Treaties such as CITES and CBD etc.

Collaborative work on Research and Monitoring on lion needs to be strengthened to ensure that adaptive management is practiced and is also based on sound scientific data. The strategy and action plan also sets the stage for the sharing of experiences between stakeholders and therefore creates a conducive environment for researchers, protected area managers, policy makers and local communities to map the way forward for lion management. We need to mindful of the need to put communities who bear the largest cost of living with the lion at the centre of all conservation efforts.

1. INTRODUCTION

The lion *Panthera leo is* a powerful cultural symbol of Africa and an important indicator of an area's wilderness qualities where it occurs. It is also a key species for tourism, research and trophy hunting, the last embedded in mythology and reflecting the pinnacle of success in a classical African hunting safari.

Increasingly threatened, with much of its former range now lost, the lion is a major predator of domestic livestock, presenting challenges and hardship to those who live amongst lions. Whilst an economic and dangerous liability, the lion is also a major source of economic benefit being one of Africa's most important tourism attractions.

In Zimbabwe, the lion population is estimated to be between 1,000-1,700 animals (Chardonnet 2002, Bauer and Van Der Merwe 2004,) with a current range of c. 60,000-90,000 km' compared to their distribution over approximately 250,000 km' in the early 60s (Child and Savory 1964, Smithers 1983). Occasional records indicate the presence of lions from time to time in a number of unexpected localities, e.g. lions are presently stock raiding around Nyanga NP in Zimbabwe's Eastern Highlands. The present range is less than one quarter than 50 years ago and probably no more than 20% of the country's total land area.

Information on population status, current distribution and trends (as opposed to range) still remains lacking for most major wildlife areas although there are estimates of numbers for some areas. Lion specific surveys and research has been limited to areas of the Parks & Wildlife Estates, namely Hwange NP and Matetsi SA in northwest Matabeleland, and Mana Pools and Matusadona NPs in the Zambezi Valley (Loveridge 2002, Purchase 2002, Monks 2005), and the Save Valley Conservancy.

2. BACKGROUND

At the 13th Conference of the Parties to the Convention on International Trade in Endangered Species of Flora and Fauna (CITES), which took place in Bangkok, Thailand in October 2004, Kenya submitted a proposal on the African lion calling for the transfer of the lion population from Appendix 11 to Appendix I, for consideration by the Parties. In response, Parties recommended a detailed examination of the issues surrounding the conservation of the African lion, through a series of regional workshops.

IUCN together with other key stakeholders, organized two sub-regional workshops on the conservation of the African lion. The first workshop brought together 14 West and Central African lion range states to a workshop in Douala, Cameroon in October 2005. The second workshop brought together 15 lion range states from Eastern and Southern African to a workshop that took place in Johannesburg, South Africa in early January 2006 (Bauer, Chardonnet and Nowell 2005). Participants at each workshop included Directors of Wildlife Conservation Departments and their technical advisors, safari operators, community leaders, non-governmental organisations involved in conservation, as well as researchers on the African lion.

The workshops came up with a number of recommendations which included:

- The need for African lion range States to follow up the workshops by developing and implementing national lion management plans.
- The need for a Pan African Conservation strategy to form the basis of a region wide collaboration in the conservation of the lion and which would also form the basis for the management of other wildlife species on regional scale.

In the spirit of following up the first recommendation, the Zimbabwe Parks and Wildlife Management Authority (PWMA), together with IUCN, convened a workshop to develop a national lion conservation strategy and action plan for the African lion in Zimbabwe. It is intended that this strategy and plan will motivate for increased lion conservation activity. Attended by conservation NGOs, the private sector, and Rural District Councils (RDCs), as well as PWMA and IUCN, the workshop was held in late October-early November 2006.

3. ISSUES RELATING TO LION CONSERVATION IN ZIMBABWE

3.1 Management & research

Management decisions, including technical advice, policy formulation and management interventions, need to be based on sound scientific information, with research programmes addressing specific problems encountered by conservation managers (Funston 2006, Loveridge 2006). Some key issues that need attention include:

- The need to develop and decide upon standardized lion census methods for application.
- The need to initiate standardized surveys in areas within Zimbabwe where the status of lion is unknown.
- Improved understanding of the ecology and biology of the lion, including its habitat and prey. These may be changing under human influences, or in the longer term, as a result of climate change.
- Changes in lion population trends and range as a result of habitat change, hunting, and increased informal killing to protect livestock and people.
- Determination of morphological or other features that facilitate the rapid identification of adult male trophy animals in the field.
- Protocols and data base requirements for monitoring population status, trophy hunting and PAC off takes, and the use of this data for future management and development of best hunting practices.
- The socio-economic impacts of lion conservation and the need for stakeholder inclusion in decision making.
- The need to continuously review the legal and institutional frameworks that provide incentives for the expansion of wildlife as form of land use.
- The need to clarify policy in the context of banning the use of female lions as trophy animals.

3.2 Capacity needs

Capacity requirements reflect the adequacy of human, financial and material resources. Under-resourced wildlife agencies are a major constraint to performance and the realisation of the potential of wildlife as a serious economic sector activity (Child 2004). Pertinent issues include:

- Capacity for management, monitoring and scientific research.
- Appropriate PWMA and other Government staff training programmes at different levels and for other key stakeholders, such as CAMPFIRE Association, RDCs, SOAZ and relevant NGOs.
- The need to identify appropriate training programs and institutions. This should include in-house training.
- The need for capacity to manage problem animals including discretionary control work, data collection, analysis, synthesis and feedback.
- The need for capacity to administer and manage CITES requirements.

Given that most State wildlife agencies never have adequate human, financial and material resources, there is the need to focus on innovative and accountable ways of fund raising.

3.3 Mitigation

Lions kill livestock and occasionally humans, and vengeful killings are frequent. This is a fundamental reason for the decline in lion populations in many African countries (Woodroffe et al. 2006). Being highly emotive, the issue has potential to undermine lion conservation efforts if not addressed properly. The objective is to minimise and where possible to eliminate human-lion related conflicts. Some issues for consideration include:

- A framework for rapid PAC response. Parks needs to work closely with RDCs on this matter.
- Setting up databases for monitoring human-lion conflict.
- Participatory planning to minimize human-lion conflict.
- Designing mechanisms (including traditional ones) to reduce livestock predation.
- The need to create awareness and education on lion conservation issues.
- The possible translocation and reintroductions of problem animals in areas far removed from human habitation.

3.4 Socio-economic

Linked very closely to mitigation of lion problems and lion-human interactions are the associated costs and benefits of long-term lion conservation. Costs need to be minimised and benefits maximised within equitable arrangements. This is especially important amongst rural communities who bear the cost of living with wildlife. CAMPFIRE has made considerable progress in this regard and any lion strategy needs to build on such progress. For example, the benefits of lion conservation need to be more explicitly recognised in the distribution of revenues from safari hunting and ecotourism activities in CAMPFIRE and other areas. Moreover, further devolution of revenues earned from CAMPFIRE, to below that of RDC is needed. In this regard a promising start has been made in some districts with Appropriate Authority 'status whereby wildlife producer communities are now being paid hunting revenues directly (Taylor 2006, Taylor and Murphree 2007).

3.5 Communication and information dissemination

Information is key to decision making. Information is required at different levels and the type of information may vary with the level of the stakeholder.

- Policy makers and resource managers require information to establish effective management systems.
- Parks managers need information to ensure lions are sustainably managed in their areas of jurisdiction.
- Parliamentarians need information to assist them to understand the ecological, socioeconomic and cultural issues relating to lion conservation to enable them to debate these issues with understanding.
- Communities need to know how to mitigate the effects of lions on their livestock.
- Trophy hunters need information to help them maximize their hunting opportunities.

3.6 Framework for captive breeding

In recent years there has been an increase in the number of captive lion breeders in the country. The issues here include the following:

- Critical analysis of the value of captive lion breeding to conservation efforts.
- Examination and critical analysis (costs/benefits) of the introduction of captive bred lions to the wild.
- Examination and critical analysis of market opportunities and threats for captive bred lions, e.g. canned lion hunting.
- The need and requirements for the regulation of captive lion breeding in the country.

3.7 Trade and regulation

In southern Africa, illegal trade in lion and lion products is not yet a major problem. However the situation may change in time. Consideration may need to be given to the following issues:

- The need to ensure non-detriment findings related to lion trophy export quotas under CITES.
- The need to train and coordinate law enforcement officers (Immigration, Customs, Police) to identify lion products.
- The need to review national legislation and policies.
- The need to set up systems to share information with other States.

3.8 Regional collaboration

Collaboration across national borders is an important step in building up-bilateral and regional lion conservation strategies. During the eastern and southern African lion workshop, the pooling of knowledge from surrounding African states on the distribution of lions clearly showed that lions in and around the various countries adjacent to Zimbabwe are a shared resource. It is appropriate in such cases to develop shared systems for lion conservation. This includes some of the following:

- Collaborative and standardized conservation approaches.
- Shared systems for data collection.
- Similar or comparable management systems.

- Communication and sharing of information.

4. STRATEGY FOR THE CONSERVATION OF THE LION IN ZIMBABWE

Analysis of the above set of issues led to the formulation of a conservation strategy for lions in Zimbabwe, together with an accompanying logical framework and action plan. Targets and their indicators were established at the Goal and Output levels.

4.1 **Vision** (Long term objective)

Lions conserved and managed sustainably for their aesthetic, cultural and ecological values, and the socio-economic development of Zimbabwe.

4.2 **Goal** (Immediate objective or purpose)

To secure and where possible, restore as many viable lion populations as possible in Zimbabwe whilst mitigating their negative impacts and enhancing their value for the benefit of people through sustainable use.

4.3 Goal Targets

4.3.1 Target 1

Ensure the persistence of key lion populations and other important populations including those of doubtful viability

4.3.2 Target 2

Human and livestock loss reduced

4.3.3 Target 3

Optimize wildlife conservation-related net benefits to local communities

4.4 **Outputs** (Results and outcomes)

4.4.1 Lion Management

Output 1. Lion populations, their habitats and wild prey effectively conserved and managed in collaboration with local stakeholders

Target 1.1:

Establish a baseline survey and monitoring programme for identified lion populations and their range inside and outside the Parks & Wildlife Estate

Activities

1) Undertake baseline surveys, and where necessary, identify populations outside Parks & Wildlife Estate
2) Design, develop and set up simple but robust monitoring protocols for key variables (populations, habitats, prey)
3) Set up systems for carrying out collaborative surveys and monitoring across boundaries with shared lion populations (National Park, Safari Area, Forest Area, Communal Land, Large/Small Scale Commercial Farming and/or International)

Target 1.2:

Maintain and strengthen capacity for lion conservation, management, monitoring and research within PWMA and amongst other key stakeholders

Activities

1) Undertake training needs assessment
2) Identify and secure funding resources
3) Provide training and capacity strengthening within PWMA and amongst other key stakeholders e.g. RDCs
4) Train personnel in data capture, management and analysis

Target 1.3:

Identify and implement best management standards and practice for all trophy hunted lion populations, ensuring their viability and sustainable, equitable and adaptively managed trophy quotas

Activities

1) Implement Quota Setting Methodology rigorously and consistently across all hunting areas
2) Review and analyse annual quotas and offtakes to ensure these are adaptive and responsive to population changes, trophy quality and levels of PAC over time
3) Allocate quotas at a scale reflective of lion ecological and biological functionality which invariably differs across different land unit sizes or land uses
4) Refine and update the hunt return form [TR2] and the trophy hunting database and review annually thereafter
5) Ensure centralised database and cost-effective system for data collection from hunting areas and subsequent collation, entry, analysis, reporting and feedback to key stakeholders in the wildlife industry (PWMA, RDCs, SOAZ, conservation NGOs, Researchers etc)
6) Replicate Matetsi Safari Area hunt data collection system in all Parks and non-Parks hunting areas and train PWMA, RDC and other relevant field staff to gather and collate hunting data as per the Matetsi system
7) Train PWMA, RDC and other relevant field staff in the Quota Setting Methodology
8) Review system of fixed and optional quotas (and auctioned hunts) to improve incentives to hunt trophy male lion only, including quota-based incentives/disincentives
9) Review trophy fees to maximise benefit and generate additional revenue
10) Review and put in place criteria for age-based identification of male trophy animals

Target 1.4:

Develop and implement a national lion captive breeding management policy[1]

Activities

1) Identify captive breeding enterprises and establish purpose
2) Consult with stakeholders including breeders, ZNSPCA, IUCN Captive Breeding Specialist Group, and others e.g. Tikki Hywood Trust (THT)
3) Establish destination and role of captive bred lions upon reaching maturity
4) Relate captive bred lions to existing captive breeding policies for crocodiles, ostriches and operations for other captive bred wild species, e.g. Lion & Cheetah Park, Chipangali
5) Review existing policies and/or guidelines
6) Appoint Working Group to develop captive lion breeding policy as appropriate or necessary e.g. WWF-SARPO, NSPCA, THT, Captive Breeders, Wildlife Veterinary Unit.

[1] There was no representative of the captive lion breeders present at the Workshop

Target 1.5:

Develop and implement co-management frameworks for wildlife management

Activities

1) Develop a national lion action plan that articulates collaborative co-management of lion populations amongst different land categories and users in the four major wildlife areas of the country: NW

Matabeleland, Sebungwe Region, Zambezi Valley and SE Lowveld
2) Ensure adoption and implementation of co-managements plans by stakeholders including conservancies
3) Develop and implement participatory monitoring of implementation of plans

Target 1.6:

The geographic distribution range of the lion population expanded

Activities

1) Conservancies and neighbouring communities to work together and incorporate neighbouring communal lands into conservancies where possible.
2) TFCAs to develop programmes to increase jointly managed lion populations

4.4.2 Lion Research

Output 2:

Information for effective and adaptive lion conservation management generated

Target 2.1:

Initiate targeted research on lion ecology, management and mitigation of conflict

Activities

1) Identify gaps in knowledge of lion ecology and biology that require research
2) Identify areas where collaborative (including cross boundary/border) research is required
3) Standardise methodology where collaborative research is required
4) Develop cost-effective age determination methods for lions
5) Identify population ecology research questions in key lion populations
6) Explore predator-prey relationships
7) Identify socio-ecological research needs.
8) Assess the impact of key threats to lion populations in Zimbabwe at present, with particular focus on human-lion conflict, snaring (both direct mortality of lions in snares and depletion of prey populations), and the sustainability of hunting quotas

4.4.3 Mitigation

Output 3:

Human-lion related conflicts minimized and, where possible, eliminated

Target 3.1:

Develop and establish databases on lion/human conflict

Activities

1) Collect PAC (Problem Animal Control) reports on lion related problems
2) Analyse reports & produce evaluation matrix
3) Produce report with recommendations on appropriate PAC monitoring system, e.g. MOMS Oriented Monitoring Systems)
4) Undertake community training on MOMS

Target 3.2:

Identify and implement methods to reduce and mitigate livestock losses and lion attacks on humans

Activities

1) Undertake participatory planning on how to mitigate livestock losses and lion attacks on humans
2) Undertake field work to identify weakness in livestock husbandry in relation to mitigation
3) Review literature, capitalise on experiences and lessons learned elsewhere, e.g. Namibia, and undertake community leadership exchange visits
4) Examine and design appropriate farmer-based compensation schemes, e.g. HACSIS, Namibia
5) Provide training on lion mitigation methods
6) Implement mitigation methods as appropriate at selected sites

Target 3.3:

Trained and properly staffed PAC Units established to conduct rapid response, restrained and precisely targeted problem animal control

Activities

1) Undertake needs assessment and capacity for managing PAC Units at PWMA field station and/or RDC levels
2) Define the role and responsibility of Units
3) Train and equip Units
4) Training and capacity building for PAC to be delegated to the responsible appropriate authority (RDC) and sub-district levels
5) Collaborative and effective PAC techniques developed and implemented within 5 years

Target 3.4:

Incidents of human-lion conflict reduced by at least 30% in 5 years while also reducing retaliatory killing

Activities

1) Specific awareness and education package on lion conservation and management developed and implemented within 5 years
2) Mechanisms developed with the livestock sector to reduce livestock predation by lions by at least 35% from the current level within 5 years

Target 3.5:

Number of lions killed through indiscriminate killings reduced by at least 30% in 5 years after baseline established.

Activities

1) Country specific awareness and education package on lion conservation and management developed and implemented within 5 years
2) Develop incentives for communities to use legal PAC in identified 3 hotspots within 5 years.

Target 3.6:

Incidences of lion attacks on humans reduced by at least 30% from the current levels in 5 years

Activities

1) Develop and implement collaborative and effective PAC techniques
2) Develop appropriate educational and awareness programmes to promote avoidance of potentially lethal encounters between humans and lions

4.4.4 Socio-economic

Output 4:

The costs and benefits of long-term lion management equitably distributed

Target 4.1:

Complete an inventory of stakeholders directly affected by lion conservation

Activities

1) Identify stakeholder groups (e.g. local communities, CAMPFIRE RDC representatives, commercial safari hunting operators (SOAZ, ZPH&GA), tourism operators ZATSO) at the appropriate scale
2) Identify the financial impacts of lion conservation on each stakeholder group
3) Determine extent and magnitude of socio-economic impacts on each stakeholder group
4) Prioritise groups for intervention based on extent and magnitude of socio-economic impacts

Target 4.2:

Deliver appropriate training and capacity building to prioritised stakeholders

Activities

1. Identify representative stakeholders groups per wildlife region
2. Identify training needs in consultation with identified stakeholders
3. Develop training materials and implement training programmes
4. Review effectiveness of training material and programme in consultation with identified stakeholders
5. Implement adaptive programme across 4 wildlife regions

Target 4.3:

Agree and implement collaboratively developed area-specific lion management plans with identified stakeholder groups in each wildlife region within 5 years-.

Activities

1) Consult identified stakeholders
2) Determine the scope and scale of the key activities of the management plan
3) Identify and integrate 'best practices', making provisions for:

    - Ownership issues
    - Zoning for wildlife
    - Mutually binding agreement
    - Verifiable compliance
    - Suitable wildlife utilization plan (e.g. tourism, trophy hunting)
    - Income flows and cost distribution (including rainy-day funds to anticipate uncertainties in tourist revenues)
    - Appropriate husbandry techniques
    - Conflict-mitigation measures
    - Regulation of human immigration
    - Adequate wildlife and conflict monitoring
    - Annual environmental audits

4) Implement management plan
5) Review plan annually and amend where necessary

Target 4.4:

Implement transparent mechanisms to equitably distribute lion-related/generated income to identified stakeholders (groups and/or communities)

Activities

1) Identify income generated from lion conservation (see CAMPFIRE generated revenues)
2) Ensure that benefits of protecting lion populations reach local stakeholders
3) Distribute generated income according to intensity of lion impact (Apply CAMPFIRE Producer Community/Ward principles)
4) Provide appropriate incentives, e.g. implementation of mitigation measures and/or local re-location of people in high-conflict areas to low-conflict areas
5) Provide appropriate incentives e.g. participatory land use planning, to discourage immigration into lion and other wildlife range

4.4.5 Regulation

Output 5:

Effective regulation of consumptive lion utilisation ensured

Target 5.1:

Implement approved policy and practice at national and local levels regarding problem animal control (PAC) of lions within 2 years

Activities

1) Review, and revise where necessary, current policy and practice at national and local levels regarding problem animal control of lions (PAC)
2) Identify key responsibilities of the Appropriate Authority (AA), i.e. the land occupier in respect of problem animal control of lions, given the vulnerable status of lions and recent changes in land tenure
3) Incorporate PAC offtakes with trophy hunting quota offtake to ensure that the overall offtake (i.e. total quota) is sustainable.
4) Determine need for regulation of PAC, including the provision of incentives/disincentives
5) Establish database for lion PAC (see Targets 1.5 & 3.1 above)
6) Ensure PAC policy and practice conforms to the appropriate scale of lion ecological functionality, temporally and spatially, and that this is recognised as an AA responsibility with respect to hunting and PAC offtakes

4.4.6 Communication, Awareness and Information Dissemination

Output 6:

Promote awareness in lion conservation and management

Target 6.1:

To carry out awareness programmes in 50% of the districts in Zimbabwe within the next three 3 years

Activities

1) Identify target groups that need awareness
2) Identify awareness needs for different target groups e.g. hunters, politicians. farmers
3) Develop and package awareness materials for different target groups, e.g. multi-media tools, TV, internet, radio
4) Implement awareness programmes

5) Create feedback mechanisms for target groups
6) Provide extension, information and interpretative services to surrounding communities

Target 6.2:

Create lion conservation and management information units within one year

Activities

1) Facilitate flow of information from various sources
2) Document and process information from various sources
3) Create information database
4) Use Mushandike Natural Resources College as a training centre
5) Define personnel needs and resource requirements
6) Training, M&E, Research

4.4.7 Regional and Trans-boundary Collaboration

Output 7:

Regional conservation and management of trans-boundary lion populations achieved through effective collaboration

Target 7.1:

Undertake an inventory of national strategies for lion management

Activities

1) Make a presentation at the AWCF Meeting in November 2006
2) Develop a budgeted proposal seeking funds to undertake the inventory
3) Appoint 1/. a consultant or 2/. design questionnaire or 3/. use TFCA Conservation Committee or a combination of 2 & 3

Target 7.2:

Encourage the development of national lion conservation strategies where these are missing &/ or incomplete

Activities

1) Seek consensus from the AWCF for the development & implementation of national lion conservation strategies
2) Contact counterparts before the AWCF Meeting
3) Present national lion strategies where applicable and/or available
4) Obtain support from neighbouring countries for the development of national lion conservation strategies
5) Persuade neighbours to develop national lion conservation strategies

Target 7.3:

Develop an integrated and harmonised lion management strategy for Transfrontier Conservation Areas (TFCAs)

Activities

1) Within 2-3 years (medium term) develop the SADC strategy for lion conservation and management
2) Develop appropriate framework:

    - Develop National strategies

- Seek consensus through AWCF
  Incorporate into TFCA Treaties
- Develop SADC strategy

Target 7.4:

Implement lion conservation strategy and management plan

Activities

1) Incorporate strategy into TFCA Conservation Committee workplans [& other stakeholder workplans]
2) Seek funding as required
3) Carry out half-yearly compliance reviews
4) Report back annually to all stakeholders especially those not involved in implementation

5. ROLES & RESPONSIBILITIES

5.1 PWMA- Lion Coordinator

- Put in place management protocols for lion populations requiring special protection.
- Coordinate all national activities on the lion conservation, research and management including (i) census surveys, (ii) setting up monitoring needs, (iii) coordinating data collection including on human-lion conflicts.
- Make submission of trophy data by safari operators mandatory.
- Identify key areas for data collection, e.g. ecological & biological; trade; hunting; socio-economic data.
- Together with Utilisation Unit and Carnivore Research Group, design and develop database systems for data capture, collation, analysis, feedback and dissemination.

5.2 PWMA: Utilisation Unit

- Ensure compliance with hunting regulations and submission of Hunt Return Forms and TR2 Forms.
- Maintain databases for safari hunting and PAC & mitigation measures

5.3 PWMA Field Stations: Ecologists, Wardens

- Procure and make available needed resources for anti-poaching and law enforcement activities (staff, vehicles, fuel, camping equipment etc) .
- Collate and ensure submission of Hunt Return Forms and TR2 Forms.
- Enforce compliance with hunting regulations.
- Liaise with Utilisation Unit and Coordinator .

5.4 CAMPFIRE Association and RDCs with AA status

- Ensure compliance with hunting regulations and submission of Hunt Return Forms and TR2 Forms.
- Facilitate PAC data collection on a regular basis according to PAC monitoring protocols; other data as requested from time to time.
- Facilitate training and capacity building.

5.5 Carnivore Research Group (CRG)

- Explore more comprehensive set of measures of trophies shot (photos, blood for genetic/ disease screening, other skull and tooth measures) (ecologists on field stations, Co-ordinating committee, carnivore researchers).

5.6 Lion conservation & management co-ordinating committee (LCMCC)

- To be chaired by PWMA/Lion Coordinator and to include representation of all parties involved in lion

conservation and management.

- All parties, including PWMA, Carnivore Research Group and conservation NGOs through Coordinating Committee to contribute to the LCMCC Fund.

5.7 SOAZ

- Safari Operators and PHs to ensure compliance with hunting regulations and submission of Hunt Return Forms and TR2 Forms. Training as required.
- SOAZ to facilitate appropriate training of members.

5.8 Lion Captive Breeders Association

- To be reflected in Lion Captive Breeding Policy

6 IMMEDIATE ACTIONS

Immediate actions which need to be taken are:

- Overall: Appoint a Lion Coordinator for PWMA, to be followed up by the establishment of A Lion Conservation & Management Co-ordinating Committee.
- Establish baseline data as soon as possible and build databases.
- Specific outputs to include:

1. Management: Develop Lion Captive Breeding Policy
2. Research: Constitute the Carnivore Research Group
3. Mitigation: Review and undertake needs assessment for PAC Units
4. Socio-economic: Pursue CAMPFIRE fiscal devolution aggressively
5. Apply regulations as required, e.g. mandatory trophy measurements
6. Disseminate and publicise the development and implementation of this Strategy
7. Inform regional partners, i.e. range states.

7 REFERENCES

Bauer, H and Van Der Merwe , S 2004. Inventory of free-ranging lions P *leo* in Africa. *Oryx 38(1), 26*-31.

Bauer, H, Chardonnet, Ph and Kristin Nowell 2005. Status and distribution of the lion *(Panthera leo)* in East and Southern Africa. Background paper for the East and Southern African Lion Workshop, Johannesburg, 2006. IUCN, Pretoria.

Chardonnet, Ph. (ed) 2002. Conservation of the African Lion: Contribution to a Status Survey. International Foundation for the Conservation of Wildlife, Paris.

Child, B (ed) 2004. Parks in Transition: Biodiversity, Rural Development and the Bottom Line. Earthscan, London.

Child, G and Savory, CR 1964. The distribution of large mammal species in Southern Rhodesia. *Arnoldia* 1(14),1-15.

Funston, P 2006. Population ecology of the African lion. Presentation at the Workshop to develop a conservation strategy and action plan for the lion in Zimbabwe. Harare, October 2006.

Loveridge, AJ 2002. Hwange Lion Project. Workshop on Ecological Research in Hwange National Park. Wildlife Conservation Unit, Oxford.

Loveridge, AJ 2006. The impact of sport hunting and edge effects on lion populations. Presentation at the Workshop to develop a conservation strategy and action plan for the lion in Zimbabwe. Harare, October 2006.

Monks, N 2005. Lion management plan: Zimbabwe: Research and management needs. Presentation at the Workshop to develop a conservation strategy and action plan for the lion in Zimbabwe. Harare, October 2006.

Purchase, G 2002. Aspects of the ecology and behaviour of lions *(Panthera leo)* and spotted hyaenas *(Crocuta crocuta)* in Matusadona National Park, a closed woodland savannah system: Is there any evidence of competition between the two species? PhD Thesis, University of Aberdeen.

Taylor, RD 2006. CAMPFIRE, Zimbabwe: Case studies on successful southern African NRM initiatives and their impacts on poverty and governance. Draft report to IUCN on behalf of USAID FRAME. IUCN South Africa, Pretoria.

Taylor, RD and Murphree, MW 2007. Masoka and Gairesi Field Site Assessments: Case studies on successful southern African NRM initiatives and their impacts on poverty and governance. Draft report to IUCN on behalf of USAID FRAME. IUCN South Africa, Pretoria.

Smithers, RHN 1983. The Mammals of the Southern African Subregion. University of Pretoria, Pretoria.

Woodroffe R, Frank, LG, Lindsey, PA, ole Ranah, SMK and Romahach, S 2006. Livestock husbandry as a tool for carnivore conservation in Africa's community rangelands: a case-control study. Biodivers. Conservation, Springer B.V.

Tapia, Brenda <brenda_tapia@fws.gov>

Fwd: Zimbabwe's Lion NDF Submission-Final Report

1 message

Vannorman, Tim <tim_vannorman@fws.gov> Wed, Jan 25, 2017 at 12:14 PM
To: Brenda Tapia <brenda_tapia@fws.gov>

---------- Forwarded message ----------
From: Patience Gandiwa <pgandiwa@zimparks.co.zw>
Date: Mon, Dec 5, 2016 at 4:08 AM
Subject: Zimbabwe's Lion NDF Submission-Final Report
To: tim_vannorman@fws.gov
Cc: Patience Gandiwa (b) (6)

Dear Tim

Gree ou received the email I sent earlier on the submission of the Lion NDF Report by the Republic of Zimbabwe. Reference is made to the email below

Kindly note tha ter 9 of the report describing the Socio-economic findings had been omitted from the version that was sent through to you…(I am s orward to receive acknowledgement of receipt thereof, which I haven't receiv ve been mistakenly delet ocess, and now is has been put back in the document

The corrected final version is attached herewith.

Sincerely,

Pa a (Interim CITES Coordinator)

For DIRECTOR GENERAL-ZIMPARKS

Patience Gandiwa| International Coordinator

Transfrontier Conservation Areas Unit| Botswana South Africa Zimbabwe

Zimbabwe Parks and Wildlife Management Authority (ZIMPARKS) Headquarters

Corner Borrowdale Road and Sandringham Drive|Alexandra Park|Harare

P.O Box CY 140|Causeway|Harare|Republic of Zimbabwe

Tel + 263 (0)4 707 626|Cellphone: +263 (0)772 916988|

E-Mail:patience.gandiwa@gmail. com |pgandiwa@zimparks.co.zw



From: Pa a [mailto:pgandiwa@zimparks.co.zw]
Sent: 29 November 2016 1:08 PM
To: 'tim_vannorman@fws.gov' <tim_vannorman@fws.gov>
Cc: 'Geofreys Ma gmatipano@zimparks.co.zw>; 'pmupazviriho@environment.gov.zw' <pmupazviriho@environment.gov.zw>
Subject: Zimbabwe's Lion NDF Submission

Dear Tim

Gree om southern Africa and hope this email finds you well in North America.

Kindly find attached letter and document-being Zimbabwe's Non-Detriment Findings for Pan*thera leo*

Looking forward to your feedback,

Pa a (Interim CITES Coordinator)

For DIRECTOR GENERAL-ZIMPARKS

Patience Gandiwa| International Coordinator

Transfrontier Conservation Areas Unit| Botswana South Africa Zimbabwe

Zimbabwe Parks and Wildlife Management Authority (ZIMPARKS) Headquarters

Corner Borrowdale Road and Sandringham Drive|Alexandra Park|Harare

P.O Box CY 140|Causeway|Harare|Republic of Zimbabwe

Tel + 263 (0)4 707 626|Cellphone: +263 (0)772 916988|

E-Mail:patience.gandiwa@gmail. com |pgandiwa@zimparks.co.zw



--
Timothy J. Van Norman, Chief
Branch of Permits
Division of Management Authority
U.S. Fish and Wildlife Service
(703) 358-2350

Sign up for our e-newsletter to learn how we're working around the globe to protect species and their habitats!

2 attachments

Zimbabwe Lion NDF_Enhancement Finding_Final.pdf
3867K

Zimbabwe Lion NDF_Enhancement Finding_Cover letter.pdf
270K

ZIMBABWE PARKS AND WILDLIFE MANAGEMENT AUTHORITY

Telephone : 263-4-792786-9
: 707624-9

Fax : 263-4-708180
: 793867, 250658

Email : info@zimparks.co.zw

All correspondence to be directed to ***Director General***

Head Office

Botanical Gardens
Cnr Borrowdale Rd/Sandringham Dr
P.O.Box CY 140
Causeway
Harare

www.zimparks.org

Ref: USFWS/L/1116-02

29 November 2016

The United States Fish and Wildlife Service (USFWS)
U.S. Department of the Interior
1849 C Street, NW
Washington, DC 20240
United States of America

Attention: Mr. Tim Van Norman (Email: tim_vannorman@fws.gov)

Dear Sir

Ref: Zimbabwe's Enhancement and Non-Detriment Findings for Lion *(Panthera leo)* to the United States Fish and Wildlife Service (USFWS)

The government of Zimbabwe hereby submits the Enhancement and Non-Detriment Findings (NDF) for the African Lion (*Panthera leo*) in Zimbabwe. The NDF submission is in line with our obligations under article III and IV of the Convention on International Trade in Endangered Wild Flora and Fauna (CITES) which state that any import or export of a species/ specimen from a species under Appendix 11 shall only be granted when the Scientific Authorities involved have advised that the import/export will not be detrimental to the survival of the species. Zimbabwe subscribes to the precautionary principle of sustainability in the management and conservation of our lion population and application of practically effective environmental stewardship ethics for the benefit of our local communities and species survival, rooted on sound ecological principles and science.

We hope the Scientific Authority of the United States of America will find this document useful for reference in executing its functions in line with the requirements of CITES and any other applicable instruments in the Homeland. Kindly find attached document on **Zimbabwe's Enhancement and Non-Detriment Findings for *Panthera leo***

With regards,

G. Matipano
ACTING DIRECTOR GENERAL

Board of Directors: Mr.T.E.Mundangepfupfu (Chairman), Mrs.I.E.Mupamhanga (Vice chairperson), Mr.W.Mutinhima, Mr.C.Mudenda, Mr.N.Mutsvangwa, Mr.I.D.Kunene, Dr.H.Rukato, Mrs.D.Mabika, Mr.E.Chidziya(Ex Officio)

Republic of Zimbabwe

Enhancement and Non-Detrimental Findings for

Panthera leo in Zimbabwe

Zimbabwe Parks and Wildlife Management Authority



October 2016

Contents

1 Introduction 1
2 Status and Distribution of Lion in Zimbabwe 2
2.1 The extent of lion distribution in Zimbabwe 2
2.2 Minimum population of lion in Zimbabwe 5
2.2.1 Captive Breeding Facilities 7
3 Conservation and Management 7
3.1 Policy And Legislation 7
3.2 The Zimbabwe Parks and Wildlife Management Authority 8
3.3 Conservation Strategy and Action Plan for Lion 9
3.3.1 National Lion Captive Breeding Policy 14
4 Population Trend Data For Key Lion Populations In Zimbabwe 14
4.1 Lion survey techniques 15
4.2 Results of regional lion surveys 15
4.2.1 Gonarezhou National Park 15
4.2.2 Save Valley Conservancy 16
4.2.3 Bubiana Valley Conservancy 16
4.2.4 Mana Pools National Park 17
4.2.5 Hwange National Park 17
4.2.6 Zambezi National Park and Units 6 and 7 19
4.2.7 Chizarira National Park and Chirisa/Sengwa Safari Area 19
5 Conservation in Zimbabwe 19
5.1 Staff Establishment 20
5.2 Transport operations 20
5.3 Law enforcement 21
5.3.1 Illegal Harvesting of Wildlife 21
5.3.2 Illegal trophy hunting – the “Cecil” effect 22
5.4 Human Wildlife Conflict 23
5.4.1 Case Study of Human- Lion Conflict from Hwange National Park 24
5.5 Trend in Financial Performance of the Authority 26
6 Stakeholder involvement in lion management and conservation 27
6.1 Beneficiaries of Wildlife Based Land Use 27
6.2 Contribution of the Private Sector 28
6.3 CAMPFIRE Community programmes 30
7 Management and Administration of the Safari Hunting Industry in Zimbabwe 34
7.1 Performance of the industry 34
7.1.1 Global earnings of the industry 34

7.1.2 Quota allocation, Utilisation and Total Trophy Fees Earned 35
7.1.3 Total trophy fees generated by land category 36
7.5 Quota Setting Process 37
7.6 Points system for adaptively managing lion quotas in Zimbabwe 39
7.6.1 Results of the Adaptive Lion Quota Management System: 2013 to 2016 40
7.6.2 Case study: Safari Hunting surrounding Hwange National Park 43
8 Threats and Mitigation 43
8.1 Human-lion conflict 44
8.2 Habitat loss 44
8.3 Illegal Trade in Lion Products 44
8.4 Bushmeat Poaching 45
8.5 Prey Abundance 46
9 Assessment of the Enhancement and Non-Detriment Findings 53
11 References 61
12 Appendices 64
12.1 Annex I: Summary of National Parks Estate, Forestry, Communal and Private Land where lion are known to occur 64
12.2 Annex II: Summary of primary legislation and regulations 69
12.2.1 The Policy for Wild Life of 1992 69
12.2.2 Wildlife Based Land Reform Policy 70
12.2.3 Parks and Wild Life Act Chapter 20:14 of 1996 as amended in 2001: 72
12.2.4 The Rural District Councils Act Chapter [29:13] 2002 77
12.2.5 The Forest Act of 1948 78
12.3 Annex III: Analysis of Total Revenue by Country of Destination 78
12.4 Annex IV: Analysis of Total Revenue by Species 80

1 INTRODUCTION

The United States Fish and Wildlife Service (USFWLS) made a ruling in terms of its Endangered Species Act of 1973 (ESA) that the status of the southern and eastern African lion subspecies (*Panthera leo melanochaita*) is threatened (see http://www.regulations.gov). This ruling, which came into effect on January 22, 2016, now requires that the importation of all trophy lion from Zimbabwe will require an import permit. The decision whether to issue an import permit will in future be based on a Non-Detrimental Finding (NDF) that takes into consideration four main factors outlined under 50 CFR 17.22 and 17.32. These are:

- What direct and indirect impacts would occur on the wild population?
- Would issuing a permit conflict with any known programs intended to conserve the species?
- Would the purposes of the permit reduce the threat of extinction facing the species?
- What are the opinions of experts?

In addition to these factors USFWLS will also take into consideration the IUCN Species Survival Commission (SSC) *Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives, Ver. 1.0* (IUCN/SSC 2012). This document identifies five guiding principles of a hunting program that creates "*incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources*" and recognizes that trophy hunting can contribute to biodiversity conservation and the conservation of the hunted species.

These are:

- **Biological sustainability** i.e. the hunting program:
  - Cannot contribute to the long-term decline of the hunted species
  - It should not alter natural selection and ecological function of the hunted species or any other species that share the habitat
  - It should not inadvertently facilitate poaching or illegal trade in wildlife by acting as a cover for such illegal activities
  - It should also not manipulate the ecosystem or its component elements in a way that alters the native biodiversity.

- **Net Conservation Benefit** i.e. the biologically sustainable hunting program should be:
  - Based on laws, regulations, and scientifically based quotas, established with local input, that are transparent and periodically reviewed
  - It should produce income, employment, and other benefits to create incentives for reducing the pressure on the target species
  - It should create benefits for local residents to co-exist with the target species and other species

- **Socio-Economic-Cultural Benefit** i.e. a well-managed hunting program can serve as a conservation tool when:
  - It respects the local cultural values and practices
  - It involves and benefits residents in an equitable manner
  - It adopts business practices that promote long-term economic sustainability

- **Adaptive Management: Planning, Monitoring, and Reporting** i.e. can the hunting programme enhance the species when it is based on appropriate resource assessments and monitoring (e.g., population counts, trend data), upon which specific science-based quotas can be established. Resource assessments should be objective, well documented, and use

the best science available. Adaptive management of quotas, based on the results of resource assessments and monitoring, is essential

- **Accountable and Effective Governance** i.e. a biologically sustainable trophy-hunting program should be subject to a governance structure that clearly allocates management responsibilities. The program should account for revenues in a transparent manner and distribute net revenues to conservation and community beneficiaries, and take steps when needed to eliminate corruption and ensure compliance with national and international requirements and regulations.

To address the points raised above, a systematic review of the status of lion in Zimbabwe has been undertaken with the full cooperation of stakeholders from the Government, Private Hunting Sector, Community NGOs and research organisations to demonstrate that the lion populations in Zimbabwe are being managed sustainably for benefit of both the conservation of the species and that the management programme is also providing economic incentives for local communities to protect and expand lion habitats. In doing so this assessment addresses the following issues:

- That the Zimbabwe hunting industry is based on sound scientific information and identifies mechanisms that would arrest the loss of habitat or increase available habitat (where feasible) and ensuring adequate protection from human encroachment.
- Demonstrate that there are government incentives in place to encourage habitat protection by private landowners and communities and incentives to local communities to reduce human-wildlife conflicts.
- Demonstrate that hunting concessions are managed to ensure the long-term survival of the listed species and its habitat.
- That trophy hunting provides financial assistance to the Zimbabwe Parks and Wildlife Management Authority, including the communal CAMPFIRE programme and private sector, to carry out various wildlife management programmes. It will also highlight how local communities directly and indirectly benefit from the presence of lion in their areas.
- Finally, this document will demonstrate how the participation of U.S. hunters in the Zimbabwe hunting industry contribute to the overall management of lion within the country.

2 Status and Distribution of Lion in Zimbabwe

Bauer et al (2015) summarise time series data for 47 lion populations across West, Central, East and Southern Africa where regular survey data are available. Using a Bayesian state space model to estimate growth rate-λ for each population, this study concludes that lion populations are declining everywhere across Africa, except in four southern countries (Botswana, Namibia, South Africa, and Zimbabwe). The population models indicate a 67% chance that lions in West and Central Africa will decline by one half, while estimating a 37% chance that lions in East Africa will also decline by one-half over two decades. It is concluded that almost all lion populations that historically exceeded ~500 individuals are declining, *but lion conservation is successful in southern Africa, in part because of the proliferation of reintroduced lions in small, fenced, intensively managed, and funded reserves.* This statement reflects the situation in Zimbabwe where lion populations in the conservancies have flourished under sound management regimes. They have also recovered rapidly in instances where appropriate actions have been taken to arrest unsustainable practices (i.e. Hwange) and where protected areas are receiving adequate funding (i.e. Gonarezhou).

2.1 The extent of lion distribution in Zimbabwe

The Zimbabwe Parks and Wildlife Management Authority (ZPWMA) is responsible for managing one of the largest estates in the country which constitutes approximately 5 million hectares of land or 13%

of the Zimbabwe's total land area (see Table 1 below). The bulk of Zimbabwe's wildlife occurs within the Parks Estate which includes 11 national parks, 16 safari areas, 16 recreational parks, 6 sanctuaries, 12 botanical reserves and 3 botanical gardens, all spread across the country, among other wildlife tourism related activities (Parks and Wildlife Act 2001 Chapter 20:14).

Wildlife populations also occur on the state Forest Areas, Communal CAMPFIRE areas and private conservancies dedicated to wildlife-based land use (Figure 1). Table 1 below provides a summary of these different categories, and whether they support lion populations (see Annex 1 for the details of each area).

Table 1. Summary of the National Parks Estate, CAMPFIRE, Forestry and Conservancies where lion populations are resident

Land Category		**Presence of Lion**				**Total (ha)**	**Total (km^2)**
		Yes (ha)	**%**	**No (Ha)**	**Migratory (Ha)**		
Parks Estate	National Parks	2,608,710	96	61,850	47,150	2,717,710	27,177
	Safari Area	1,745,300	92	146,600	-	1,891,900	18,919
	Botanical gardens	-	-	2,069	-	2,069	21
	Sanctuary	-	-	18,980	-	18,980	190
	Recreational	-	-	357,161	-	357,161	3,572
Forestry		436,165	47	491,701	-	927,866	9,279
CAMPFIRE		8,953,700	36	5,435,100	10,319,000	24,707,800	247,078
Private Conservancies		758,200	66	243,500	150,897	1,152,597	11,526
Matetsi Farms		-	-	-	155,627	155,627	1,556
Total Ha		**14,502,075**		**6,756,961**	**10,672,674**	**31,931,710**	**319,317**
Total km^2		**145,021**		**67,570**	**106,727**	**319,317**	
Percentage		**45%**		**21%**	**33%**		

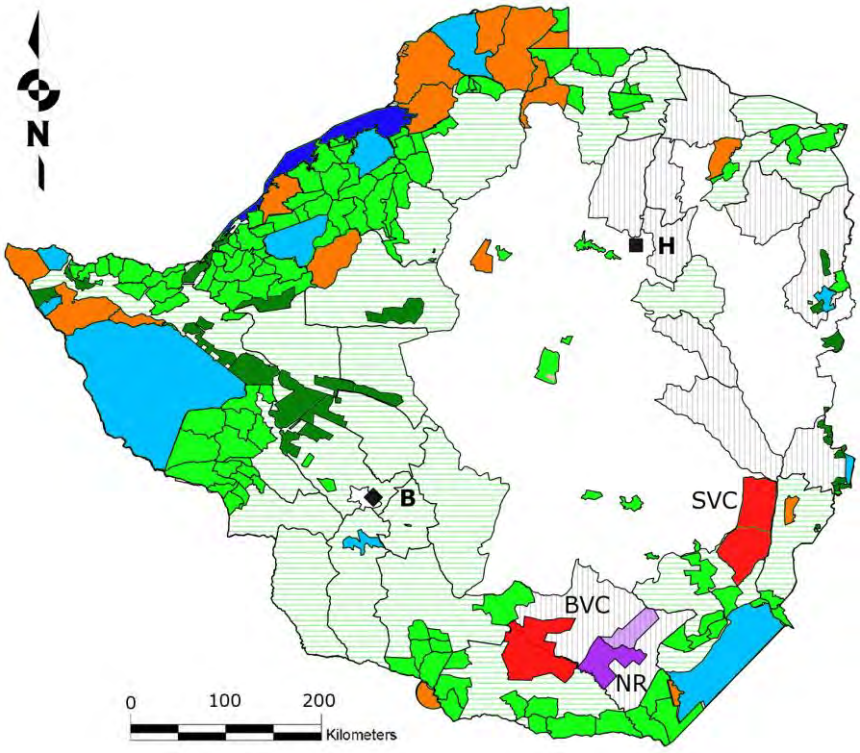


Figure 1: Map of Zimbabwe's main wildlife areas: [i] National Parks are represented in light blue; [ii] Safari areas are represented in orange; [iii] Forestry areas are represented in dark green; [iv] Community and Private wildlife areas are represented in light green; [v] Communal Land (CAMPFIRE Areas) in which sport-hunting may occur is represented by light green horizontal stripes; [vi] Communal Land in which sport-hunting does not occur is represented by grey vertical stripes. [vii] The Bubye Valley [BVC] and Savé Valley [SVC] Conservancies are represented in red. [viii] The Nuanetsi Ranch [NR] on which sport-hunting takes place is represented in dark purple (light purple represents the Nuanetsi Ranch cattle area); [ix] Lake Kariba is represented in dark blue. Harare (the capital city) is represented by a black square and letter '**H**'. Bulawayo is represented by a black diamond and letter '**B**'. Sport-hunting may occur in areas: ii, iii, iv, v, vii & viii (from du Preez, B. Groom, R., Mufute, O., Mandisodza-Chikerema, R. and Booth, V. (2016).

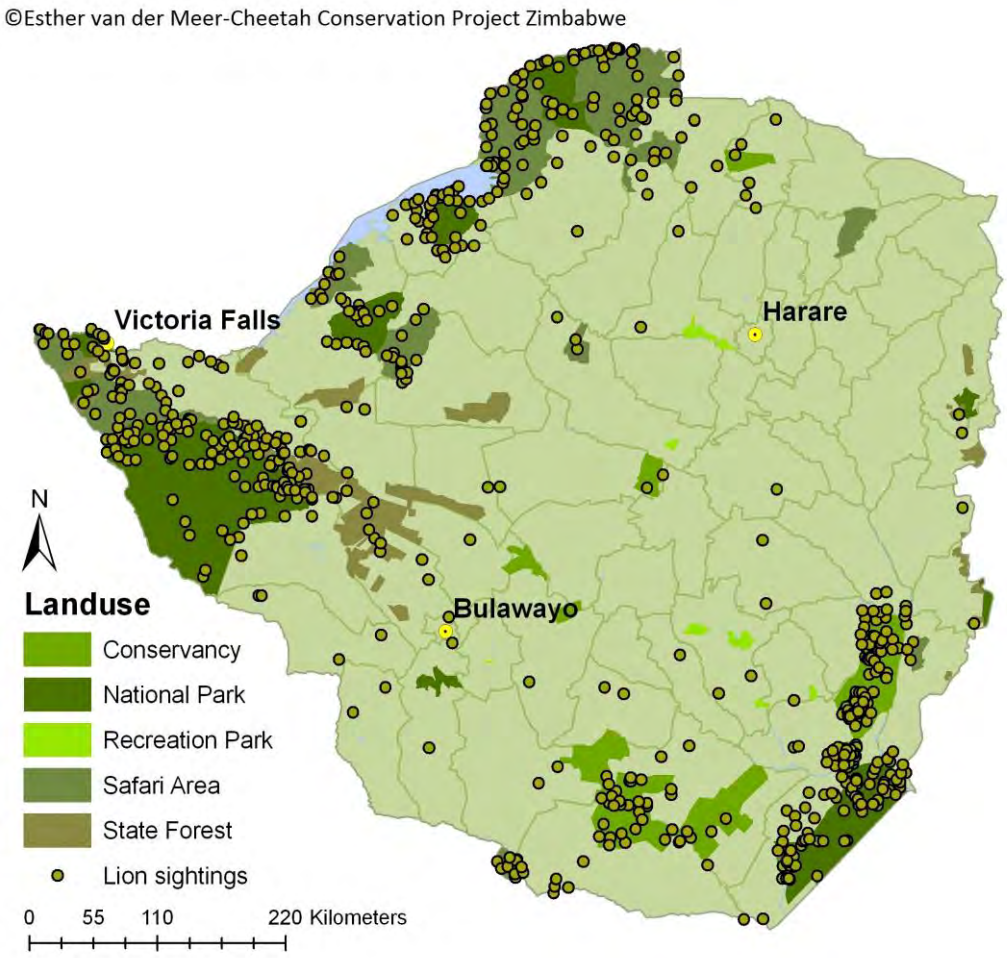


Figure 2: Range of African Lion Distribution in Zimbabwe

There are approximately 319,317 km^2 of land where some form of wildlife based land use is practiced in Zimbabwe. Lion occur permanently in 45% of this available range (c. 145,00km^2), with the majority occurring in State protected national parks (96%) and safari areas (92%). Lion also occur permanently in 47% of the State forest areas and 66% of privately owned Conservancies. The CAMPFIRE areas comprise approximately 247,000km^2 and lion occur in 36% of these areas. Lion are transient in CAMPFIRE, Conservancy and resettled areas adjacent to the major protected areas, and move across the border into Zambia, Mozambique, South Africa and Botswana (Figure 2).

There are two established Transfrontier Conservation Areas (TFCAs), the Great Limpopo Transfrontier Park (GLTP) which includes Gonarezhou National Park, and the Limpopo/Shashe TFCA. Other TFCAs that are at various stages of development are the Kavango-Zambezi (KAZA), Lower Zambezi-Mana Pools, Zimbabwe-Mozambique-Zambia (ZiMoZa) and Chimanimani.

2.2 Minimum population of lion in Zimbabwe

The minimum number lion that occur in approximately 51,642km^2 of land where reliable survey data are available is estimated to be c.1,917 (range 1,800 – 2,000) and is summarised in Table 2. The Western sector of the country dominated by Hwange National Park and the surrounding safari areas, forest areas, communal areas and private conservancies supports c.737 lion (or 38% of the overall population). The Southern sector dominated by the two major conservancies (Save and Bubye) and

Gonarezhou National Park supports c. 896 lions (48%) while the Central and Northern sectors of the country support c.284 lions (15%).

Table 2: Estimated minimum population of Wild Lion populations in Zimbabwe – September 2016 (Data compiled from a variety of reports)

REGION	AREA	AREA (km^2)	Estimated Number of Lions	Percentage
Western	Hwange NP	14,900	559	38%
	Matetsi Units 1-5	1,934	59	
	Matetsi Units 6-7 and Zambezi NP	1,585	67	
	Kazuma Pan NP	313	20	
	Kazuma Forest	240		
	Panda Masuie Forest	355		
	Matetsi ECA	1,556	15	
	Ngamo and Sikumi Forest	1,386	6	
	Gwaai Conservancy	927	22	
	Hwange Communal Land	392	2	
	Tsholotsho buffer adjacent HNP	1,275	7	
Subtotal		**24,863**	**737**	
Central	Chizarira NP	1,948	31	4%
	Chirisa SA	1,713		
	Omay	1,865	10	
	Matusadona NP	1,427	31	
Subtotal		**6,953**	**72**	
Northern	Chewore North and South	1,648	45	11%
	Dande	1,155	21	
	Hurungwe (Nyakasanga and Rifa)	1,709	32	
	Charara/Mukuti	1,692	20	
	Mana Pools	1,287	94	
Subtotal		**7,491**	**212**	
Southern	Gonarezhou National Park	5,053	125	48%
	Malilangwe	400	37	
	Bubye Valley Conservancy	3,440	450	
	Save	3,442	284	
Subtotal		**12,335**	**896**	
Overall Total		**51,642**	**1,917**	

2.2.1 Captive Breeding Facilities

Currently there are only two properties registered as captive lion breeders (Lion and Cheetah Park, and Antelope Park) and < 10 non-registered captive lion breeding operations (Table 3). Most of these centres keep lions for non-consumptive tourism and environmental education purposes with only a few keeping lions as pets. Altogether there are 345 lions held in captivity.

Table 3: Record of lions held in captivity – September 2016

Property	TOTAL
Doddieburn	13
Lion & Cheetah Park	40
Sentinel	2
Vhuka	5
Antelope Park	114
Safari Par, Masuwi Lodge (Lion Encounter)	4
Mhondoro Game Park	2
Chedgelow Farm	9
Chengeta	5
Turk Mine	6
Bally Vaughan	8
Mwanga Lodge	8
Masvingo	17
Karoi	2
Oscro	10
Simply Wild	19
Sondelani	9
Ruwazi	7
Imire	2
Makado Ranch	2
Chipangali	32
Crocodile Farm, Victoria Falls	1
Kuimba Shiri	2
Pamuzinda	6
Shearwater	10
Inyathi Ecogame Park	10
Total	**345**

3 Conservation and Management

3.1 Policy And Legislation

The Ministry of Environment, Water and Climate has a comprehensive suite of policies and legislation that provides the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) with a mandate to conserve and protect all fauna and flora in the country.

The legal framework is enshrined in the National Legislation and associated Regulations that are informed by the Wildlife Policy (1992) that seeks to maintain a protected area network for the conservation of the nation's wild resources and biological diversity. Amongst others it seeks to create

economic activity to enhance rural development and encourages the conservation of wild animals and their habitats outside the protected areas.

The ZPWMA is established by the Parks and Wildlife Act of 1996 (Chapter 20:14) as amended by Act Number 19 of 2001 which came into operation on the 1st of June 2002 through a Statutory Instrument 144C of 2002. The Act provides for the:

- Establishment of a Parks and Wildlife Board;
- Confers functions and imposes duties on the Board;
- Establishment of national parks, botanical reserves, botanical gardens, sanctuaries, safari areas and recreational parks;
- The preservation, conservation, propagation or control of wildlife, fish, and plants of Zimbabwe and the protection of her natural landscape and scenery;
- Conferment of privileges on owners and occupiers of alienated land as custodians of wildlife, fish and plants;
- Giving of certain powers to environment committees (formerly intensive conservation area committees); and matters incidental to or connected with the foregoing.

The Act that was originally passed by Parliament in 1975 was unique in that it provided a legal basis for the devolution of Authority to private landowners over all wildlife on their land which resulted in in the rapid development of the country's wild life industry. It also paved the way for the partial extension of this principle to the Communal Lands through the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in the 1980s that granted Appropriate Authority Status to the communal areas to manage the wildlife resources for their own benefit.

The Act was subsequently revised in 1996 and 2001 with the latest revision paving the way for the establishment of the current Parks and Wild Life Management Authority to replace the former Department of National Parks and Wild Life Management.

The legal and regulation framework applicable to the conservation and protection of lion and all other species includes:

- Parks and Wildlife Act; Chapter 20:14 (1996) as amended in 2001.
- Environmental Management Act; Chapter 20:27.
- Forest Act; Chapter 19:05.
- Statutory Instrument 362 of 1990: Parks and Wildlife (General) Regulations, 1990.
- Statutory Instrument 76 of 1998: Import and Export of Wildlife Products.
- Statutory Instrument 40 of 1994: Parks and Wildlife Act (General) Amendments.
- Statutory Instrument 26 of 1998: Parks & Wildlife Act (General) Amendment.
- Statutory Instrument 92 of 2009: Compensation Values for Wildlife.
- Statutory Instrument 93 of 2009: Compensation Values for Trapping of Animals.
- Trapping of Animals Control Act 20.16.

A summary overview of these instruments is provided in Annex II.

3.2 The Zimbabwe Parks and Wildlife Management Authority

The Parks and Wildlife Management Authority is mandated by the Parks and Wildlife Act [Chapter 20:14] with the responsibility of conserving Zimbabwe's wildlife heritage through effective, efficient and sustainable protection and utilisation of natural resources for the benefit of present and future generations. The Authority was established to allow it to retain the revenue that it generates for

funding its operations and thereby reducing its dependence on Treasury. This entailed introducing a commercial dispensation and putting in place effective revenue generation and financial management systems.

The ZPWMA has the mandate to manage the entire wildlife population of Zimbabwe, whether on state, private and communal land. Vision, mission and core values of ZPWMA are as follows:

Vision: *To be the world leader in sustainable conservation*.

Mission: *To conserve Zimbabwe's wildlife heritage through effective, efficient and sustainable utilisation of natural resources for the benefit of present and future generations and stakeholders*

Core Values: Teamwork, Commitment, Transparency, Professionalism, Integrity, Accountability, Fairness, in harmony with nature.

While private landowners may utilise the wildlife on their land, they are still accountable to the ZPWMA for the welfare of the wildlife in terms of Statutory Instrument 26 of 1998, which, among other things, states that "*No person shall permit any person who is not ordinarily resident in Zimbabwe to hunt on any land for which he is the appropriate authority any animals other than those entered on the authority to hunt…*'

3.3 Conservation Strategy and Action Plan for Lion

A *Conservation Strategy and Action Plan for the Lion (Panthera leo) in Zimbabwe* was prepared in 2006 by the ZPWMA, local and international NGOs. This was in response to the proposal submitted by Kenya at the 13th Conference of the Parties to the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) calling for the transfer of the lion population from Appendix II to Appendix I. The Parties recommended a detailed examination of the issues surrounding the conservation of the African lion, through a series of regional workshops.

IUCN responded to this and together with other key stakeholders, organised the first workshop in 2005 which involved the 14 West and Central African lion range states. The second workshop brought together 15 lion range states from Eastern and Southern African in January 2006 (Bauer, Chardonnet and Nowell, 2005). Each workshop included the Directors of Wildlife Conservation Departments and their technical advisors, safari operators, community leaders, non-governmental organisations involved in conservation, as well as researchers on the African lion.

The workshops came up with several recommendations which included:

- The need for African lion range States to follow up the workshops by developing and implementing national lion management plans.
- The need for a Pan African Conservation strategy to form the basis of a region wide collaboration in the conservation of the lion and which would also form the basis for the management of other wildlife species on regional scale.

Responding to the first recommendation, the ZPWMA, together with IUCN, convened a workshop in November 2006 to develop a national lion conservation strategy and action plan for Zimbabwe attended by conservation NGOs, the private sector, and Rural District Councils (RDCs), as well as ZPWMA and IUCN (Conservation Strategy and Action plan for the Lion (*Panthera leo*) In Zimbabwe, 2006).

The deliberations of this workshop identified the following issues related to lion conservation in Zimbabwe:

- Management and research including technical advice, policy formulation and management interventions
- Capacity needs as reflected by adequate human, financial and material resources
- Mitigation of human-wildlife conflict
- Socio-economic costs and benefits of long-term lion conservation
- Communication and information dissemination for key decision makers at different levels
- Framework for captive breeding of lions
- Trade and regulations to ensure non-detriment findings related to trade in all lion related products
- Regional collaboration to strengthen bilateral and regional lion conservation strategies

The analysis of these issues led to the formulation of the conservation strategy whose vision is that *Lions (*are*) conserved and managed sustainably for their aesthetic, cultural and ecological values, and the socio-economic development of Zimbabwe*. The immediate objective of this strategy is *to secure and where possible, restore as many viable lion populations as possible in Zimbabwe whilst mitigating their negative impacts and enhancing their value for the benefit of people through sustainable use*.

Three broad targets were identified to achieve this objective:

1. Ensure the persistence of key lion populations and other important populations including those of doubtful viability;
2. Human and livestock loss reduced, and
3. Optimize wildlife conservation-related net benefits to local communities

Table 4 summaries the progress with achieving the results identified in the strategy:

Table 4: Summary of implementation progress of the 2006 lion conservation strategy.

Output 1. Lion Management - Lion populations, their habitats and wild prey effectively conserved and managed in collaboration with local stakeholders	
Target 1.1 Establish a baseline survey and monitoring programme for identified lion populations and their range inside and outside the Parks & Wildlife Estate	Baseline surveys have been completed for the Parks Estate using monitoring protocols for key variables (populations, habitats, prey). Selected surveys undertaken of areas outside National Parks in conservancies and some communal land and forest areas.
Target 1.2 Maintain and strengthen capacity for lion conservation, management, monitoring and research within PWMA and amongst other key stakeholders	Carnivore research programmes undertaken by NGOs (Mana, Matusadona, Gonarezhou, Zambezi and Hwange NPs, Matetsi, Chirisa SA) and research institutions (Bubye and Save Conservancies) in various parts of the country. Personnel trained in data collection and capture, management, lion aging and analysis.
Target 1.3 Identify and implement best management standards and practice for all trophy hunted lion populations, ensuring their viability and sustainable, equitable and adaptively managed trophy quotas	Quota setting methodology reviewed and annual quotas and offtakes analysed considering population changes, trophy quality and levels of PAC over time. Trophy hunting database in place and in process of being refined to provide cost-effective system for collation, entry, analysis, reporting and feedback to key stakeholders in the wildlife industry (ZPWMA, RDCs, SOAZ, ZPHGA, conservation NGOs, Researchers etc.). System of fixed and optional quotas reviewed and age-based criteria for male trophy animals in place and functioning.
Target 1.4 Develop and implement a national lion captive breeding management policy	Policy in place (see discussion below).
Target 1.5 Develop and implement co-management frameworks for wildlife management	Collaborative national lion action plans to co-management lion populations in place for NW Matabeleland and SE Lowveld, including three conservancies (Bubye Valley, Save and Malilangwe).
Target 1.6 The geographic distribution range of the lion population expanded	Conservancies and neighbouring communities are working together to maintain existing geographic distribution of lion populations. Zimbabwe proactive in the KAZA and GLTFCA programmes.
Output 2. Lion Research - Information for effective and adaptive lion conservation management generated	
Target 2.1 Initiate targeted research on lion ecology, management and mitigation of conflict	Extensive research programmes focussing on lion ecology and biology undertaken in Hwange, Bubye, Save, Malilangwe, Matusadona, Chizarira and Chirisa. ZPWMA have cooperated with NGOs, such as Panthera, to develop cost-effective age determination methods for lions. Key threats to lion populations, with focus on human-lion conflict, snaring and poisoning, undertaken and continually monitored.
Output 3. Mitigation - Human-lion related conflicts minimized and, where possible, eliminated	

Target 3.1 Develop and establish databases on lion/human conflict	Data on Problem Animal Control (PAC) reports on lion related problems collated.
Target 3.2 Identify and implement methods to reduce and mitigate livestock losses and lion attacks on humans	Approaches to mitigate livestock losses and lion attacks on humans being tested and implemented in Hwange. Methods to mitigate lion attacks on livestock being implemented as appropriate at selected sites (e.g. Tsholotsho).
Target 3.3 Trained and properly staffed PAC Units established to conduct rapid response, restrained and precisely targeted problem animal control	PAC Units at ZPWMA field station and/or RDC levels partially established.
Target 3.4 Incidents of human-lion conflict reduced by at least 30% in 5 years while also reducing retaliatory killing	Specific awareness and education package on lion conservation and management developed and implemented in Matusadona, Hwange and Gonarezhou regions.
Output 4. Socio- Economic - The costs and benefits of long-term lion management equitably distributed	
Target 4.1 Complete an inventory of stakeholders directly affected by lion conservation	Stakeholder groups (e.g. local communities, CAMPFIRE RDC representatives, commercial safari hunting operators (SOAZ, ZPHGA), tourism operators (ZATSO) identified. Financial impacts of lion conservation and extent and magnitude of socio-economic impacts on each stakeholder group completed.
Target 4.2 Deliver appropriate training and capacity building to prioritised stakeholders	Representative stakeholder groups in some regions identified (Hwange, Matusadona, Gonarezhou). Limited training undertaken. Implement adaptive programme across four wildlife regions
Target 4.3 Agree and implement collaboratively developed area-specific lion management plans with identified stakeholder groups in each wildlife region within 5 years	In progress. Hwange NP Management Plan approved.
Target 4.4 Implement transparent mechanisms to equitably distribute lion-related/generated income to identified stakeholders (groups and/or communities)	Scale of income generated from lion conservation reviewed and use of funds to encourage protection of lion populations reach local stakeholders undertaken (see CAMPFIRE generated revenues)
Output 5. Regulations - Effective regulation of consumptive lion utilisation ensured	
Target 5.1 Implement approved policy and practice at national and local levels regarding problem animal control (PAC) of lions within 2 years	Current policy and practice regarding problem animal control of lion reviewed, at national and local levels. PAC offtakes reconciled with trophy hunting quota offtake to ensure that the overall offtake (i.e. total quota) is sustainable.
Output 6. Communication, Awareness and Information Dissemination	

Target 6.1 To carry out awareness programmes in 50% of the districts in Zimbabwe within the next three 3 years	Awareness programmes initiated at a national level, with professional hunters, communities and NGO community. Awareness campaigns being carried out by the Extension and Interpretation Unit in all the regions.
Target 6.2 Create lion conservation and management information units within one year	Databases established at some key research centres using dedicated external research programmes (e.g. WILDCRU).
Output 7. Regional and Trans-Boundary Collaboration	
Target 7.1 Undertake an inventory of national strategies for lion management	Done.
Target 7.2 Encourage the development of national lion conservation strategies where these are missing &/ or incomplete	National lion conservation strategies discussed at AWCF (meeting held under auspices of KAZA).
Target 7.3 Develop an integrated and harmonised lion management strategy for Transfrontier Conservation Areas (TFCAs)	Lion conservation strategies for SADC discussed at AWCF meeting held under auspices of KAZA.
Target 7.4 Implement lion conservation strategy and management plan	Strategy under review.

3.3.1 National Lion Captive Breeding Policy

A target of the Conservation Strategy and Action Plan for the Lion in Zimbabwe was to develop and implement a National Lion Captive Breeding Management Policy. This was achieved in 2011 when the ZPWMA met with lion breeders, keepers and animal welfare organizations to define the purpose of breeding and keeping lions; identify and discuss issues related to breeding and keeping of lions in captivity and to chart the way forward on the breeding and keeping of lions in captivity.

The objectives of the policy are to provide a national approach and minimum standards to all aspects relating to the management of captive bred lions including the role of captive bred lions upon reaching maturity and regulate the import and export of captive bred lions. The policy also defines the measures to protect the genetic integrity of indigenous lion populations. The use and welfare of captive bred lions is monitored by a captive lion inspection team.

In terms of this policy, lions that are kept in captivity for species conservation and commercial purposes are subject to the following conditions:

1. No permit for the keeping of lions in captivity will be issued before the facility has been inspected and approved by ZPWMA as a Captive Lion Holding Facility.
2. Lions may not be allowed to breed in captivity unless the holding facility is registered as a Captive Lion Breeding Centre. If a breeding permit is not issued, it is the responsibility of the owner to ensure that the animals do not breed. If breeding occurs without a permit the owner will be fined and the animals are subject to confiscation and possible destruction by ZPWMA.
3. Lions may not be captured from the wild population and kept in captivity unless the animal is orphaned or injured and is captured with the purpose of rehabilitating the animal and returning it to the wild within as short a time as possible.
4. Captive bred lions may not be released into the wild or transferred from the facility without prior permission from ZPWMA, and are subject to an approved release plan.

No lion can be transported without the necessary internal and national permits and without being micro-chipped, and all transportation of live animals must comply with CITES Resolution Conf. 10.21(Rev. CoP 14). To safeguard the integrity of the indigenous gene pool, no import permits will be issued for non-indigenous lions. Any lion that are to be transported must be issued a certificate of health by a competent veterinarian confirming that the premises of origin has been free from anthrax, panleukopenia and canine distemper for six months, and that each predator is free from diseases such as FIV, BTB or any other disease which may threaten local populations. The animal should also have been vaccinated for rabies and treated with a broad spectrum de-wormer and acaricide.

It is an offence to export lions from Zimbabwe without a ZPWMA export permit, and all export permit will only be considered if the exporting facility holds a current permit to keep captive lions. Moreover, an export permit will only be issued if the importing facility, in the country of import, conforms to regulations laid out in this policy document.

4 Population Trend Data For Key Lion Populations In Zimbabwe

Zimbabwe has in recent years taken proactive actions to enhance the conservation of lion populations both inside and outside the protected areas. These have included implementing moratoriums on hunting, reducing quotas, implementing an age-based hunting regulation and undertaking independent monitoring programmes conducted by international research institutions. Emerging from this is evidence that by implementing appropriate regulatory, management and monitoring actions, coupled with raising awareness, the lion populations respond rapidly and recover to near

former levels. The section below summarises the data from key range areas both inside and outside the National Parks Estate to substantiate this.

4.1 LION SURVEY TECHNIQUES

The population estimates of lions in Zimbabwe are determined through carnivore spoor surveys, systematic lion collaring and call-up surveys. With the strategy to maintain the wilderness values of most protected areas, there is low road penetration in the parks estates, however all suitable roads are used as transects, and in areas of suitable substrate, spoor surveys have shown to be an effective and efficient means to assess wildlife densities (Stander 1998, Fuston et al. 2001, Davidson and Romanach 2007). Patrol reports, field observations by ZPWMA rangers and other sightings by tour operators and tourists also contribute to the knowledge of the status of lions in Zimbabwe's protected areas. Similarly, the occurrence of lion in Safari Areas is recorded by resident safari operators, including those operating in CAMPFIRE areas.

4.2 RESULTS OF REGIONAL LION SURVEYS

Lion population surveys provide indices of abundance that can be used to determine spatial distribution, as well as temporal trends in population numbers. The results of the different survey methods are used to generate information for setting sustainable lion trophy hunting quotas and for population management.

4.2.1 Gonarezhou National Park

Spoor count surveys of the Gonarezhou National Park have been conducted since 2009 using the same methodology to obtain direct estimates of lion populations to compared actual lion densities with potential density estimates (Groom, 2009, Groom et. al. 2014). Table 5 below illustrates the growth of the lion population in the Park (Groom and Watermeyer, 2015).

Table 5: Population estimates of lion in the whole of Gonarezhou National Park (extrapolated from survey area) from 2009 – 2015 (Groom and Watermeyer, 2015).

2009	2010	2011	2012	2013	2014	2015
31	45	72	64	77	116	125

As with many lion populations anthropogenic factors can be key drivers of lion population dynamics, and in areas with high human impact lion numbers may be significantly lower than those predicted by prey biomass models. This was found to be the case in the Gonarezhou National Park. Groom et. al. (2014) concluded that high hunting quotas either within or around the protected area were the most likely cause of the low lion numbers, with quotas in some areas being as high as seven lions per 1,000km^2 in some years. Other factors included persecution, poisoning and problem animal control, as well as disease and competition with spotted hyaenas (*Crocuta crocuta*).

Following decisions to halt lion hunting, and reducing human-lion conflict, the lion population responded and steadily increased, reaching a density of 2.5 lions / 100km^2 in 2014 (as compared with 0.6 / 100km^2 in 2009). Relative to other populations (average over Kruger NP, Hwange NP, Selous GR and Serengeti NP = 9.6 lions / 100km^2) this is still low, suggesting the population could continue to increase further. Groom et. al. (2015) conclude that the lack of artificial water in Gonarezhou means that natural carrying capacity will be lower but based on prey biomass availability predictions of lion carrying capacity could support between 200 and 300 lions (Groom 2010). It is therefore still possible that the lion population in the park could at least double before reaching carrying capacity (especially because prey biomass is now greater than it was in 2010 – see Section 8.5 below).

4.2.2 Save Valley Conservancy

The African Wildlife Conservation Fund carries out an annual large carnivore spoor survey to assess population trends of the carnivores in the Savé Valley Conservancy (SVC) to aid management decisions. A standardised methodology is used to ensure consistency through time and comparability with other studies. Since 2008, the spoor surveys have been done using the same roads and the same observer. The results of these surveys are provided in Table 6 showing that the lion population has increased from 40 in 2005 to 284 in 2015 (Groom and Watermeyer, 2015, du Preez et al, 2016).

Table 6: Population estimates of lion in the whole of Savé Valley Conservancy from 2005 – 2015

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
40	50	52	76	114	143	105	130	115	182	284

The lion population has increased substantially in the last two years, and there are now an estimated 284 lions in the whole of the conservancy. This is a notable increase since the 2013 estimate of 115 lions and 2014 estimate of 182, and is perhaps a latent effect of no hunting for over several years. Of the 149 lion tracks encountered, 28% were big adult males with 53% identified as females/juveniles and 15% as young cubs (3% of tracks were unidentified). The number of lions in SVC equates to a density of 11.7 lions/100km². This is slightly higher than other population estimates of 9.6 lions/100km² (average over Kruger, Hwange, Selous and Serengeti).

4.2.3 Bubiana Valley Conservancy

After originally being eradicated by cattle ranchers in the area, 13 lions were reintroduced to the Bubye Valley Conservancy in 1999, and four young males broke into the Conservancy that same year. From the original 17 animals present in 1999, the Bubye Valley Conservancy lion population was estimated at approximately 280 individuals in 2009 when robust population surveys were initiated by a team from the University of Oxford Wildlife Conservation Research Unit (WildCRU), and this population has continued to grow. Today it is estimated that there are over 500 lions on the Bubye Valley Conservancy (Figure 3, du Preez et. al., 2016).

The exponentially increasing Bubye Valley Conservancy lion population currently exists at one of the highest densities in Africa (~0.190 lions/km^2: du Preez et al. 2015, du Preez et al. 2016), greater than that of the Serengeti, Tanzania (0.10 lions/km^2), Selous, Tanzania (0.080 – 0.130 lions/km^2: Creel and Creel 1997), Kruger National Park, South Africa (0.096 – 0.112 lions/km^2: Mills et. al. 1995), and Hwange National Park, Zimbabwe (0.027 lions/km^2: Loveridge et. al. 2007). This equates to the largest contiguous lion population in Zimbabwe.

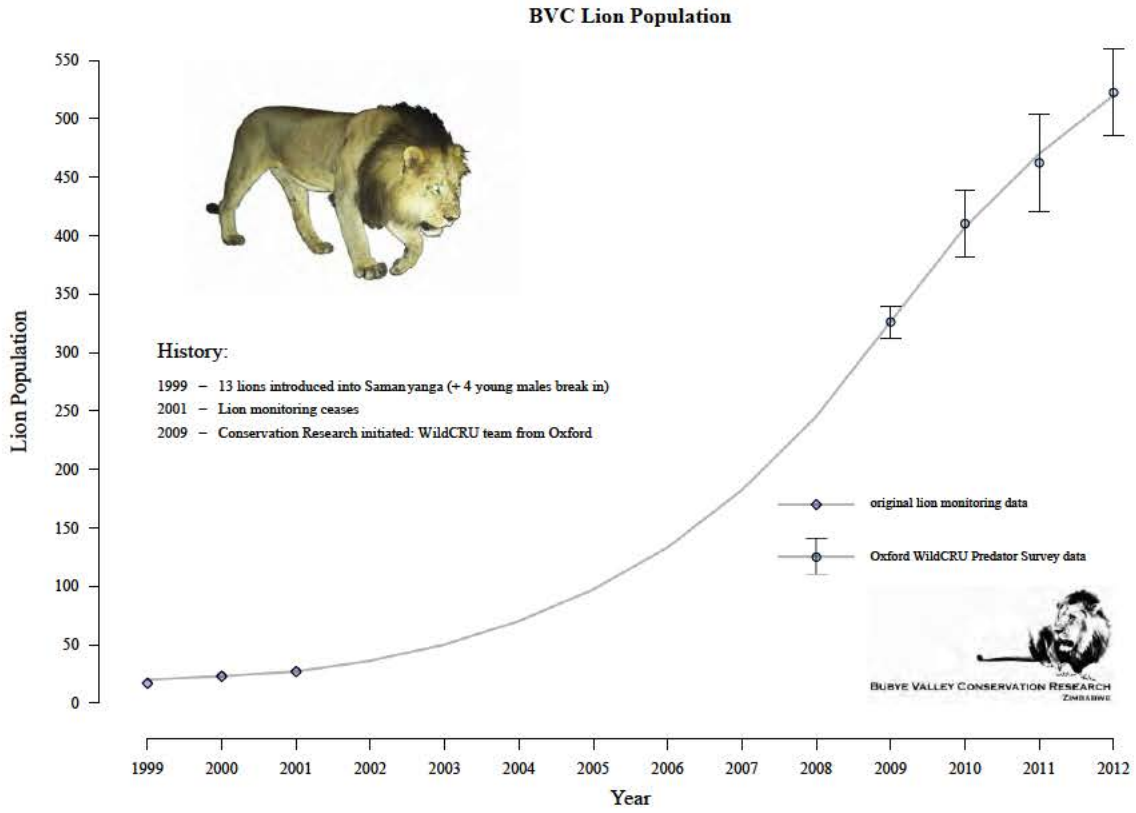


Figure 3: The Bubye Valley Conservancy lion population has increased exponentially since the original reintroduction of the species to the conservancy in 1999.

4.2.4 Mana Pools National Park

In conjunction with ZPWMA, Zambezi Society and the Cheetah Conservation Project, the Wildlife Conservation Research Unit (WILDCRU) based in Oxford (U.K.) conducted a camera trap and spoor count survey of Mana Pools National Park with the objective of:

- To undertake park wide surveys to estimate population density, distribution and habitat occupancy of common predator species in Mana Pools National Park.
- To contribute to Cheetah Conservation Project Zimbabwe's (CCPZ) cheetah monitoring protocol.
- To provide presence/absence data on all the larger mammal species.

A Facebook page was also created for the survey that was regularly updated on the progress of the survey (Facebook.com/Mana Pools Survey 2015).

The preliminary results of this survey identified 67 individual lions from the 267 images captured. When combined with the spoor count surveys, the population was estimated at 94 lions at a density of 4.5 lion/km^2 (Seymour-Smith and Loveridge, 2015),

4.2.5 Hwange National Park

The Hwange Lion Research Project undertaken by the Wildlife Conservation Research Unit (WILDCRU, Oxford University) works in association with the Zimbabwe Parks and Wildlife Management Authority. Since 1999 this project has identified over 600 lions and currently monitors approximately 15 prides and 12 male coalitions in a 5,000km^2 study area. This is one of the most intensive and long-term lion

projects in Africa. A key finding of this research programme has been to demonstrate that the way lion trophy hunting is managed can rapidly improve the status of lion populations by implementing a biologically sustainable system of allocating quotas. This project has also increase the understanding of human related impacts on lion populations (and vice-versa) along the park boundary. More recent research is focussed on understanding connectivity between Hwange NP and other areas such as parks in Botswana and in Zimbabwe.

This project was initiated because there was a perception that levels of sport hunting of male lions' in the hunting concessions surrounding the Hwange National Park were having a negative impact on the conservation of the population (Loveridge, et. al. 2007). Data collected between 1999 and 2004 suggest that this was indeed the case and this contributed to a suspension of sport hunting of lions in the area surrounding the Park between 2005 and 2009. This was a crucial shift in management policy for this species and an important step towards sustainable management and conservation of lions. Following the imposition of the hunting moratorium, lion densities increased (Figure 4).

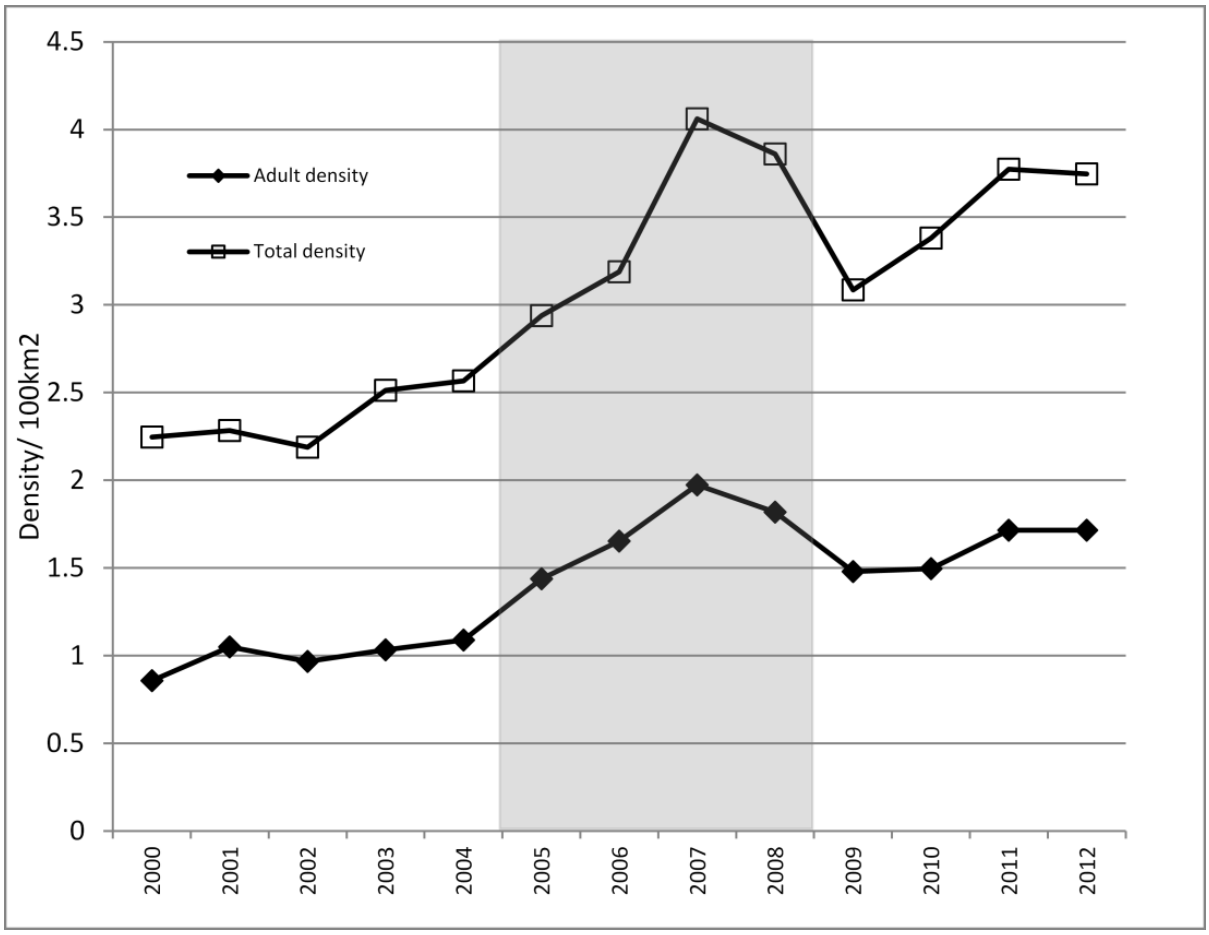


Figure 4: Lion densities in the Hwange area between 2000 and 2012

Following the lifting of the moratorium, and by implementing strict monitoring and hunting guidelines, the overall Hwange lion population has continued to show a positive trend, and is now estimated at over 550 animals.

4.2.6 Zambezi National Park and Units 6 and 7

Victoria Falls Wildlife Trust (VFWT) in collaboration with ZPWMA and the Hwange Lion Research Project has recently completed both spoor count transects and a camera trap surveys in Zambezi National Park, and Units 6 and 7 of the Matetsi Safari Area. The preliminary results of these surveys show that the lion population has increased since 2013 to approximately 67 (Rodger Parry, pers comm.).



Coalition males, Zambezi National Park, June 2016 (*Photo credit: Jessica Dawson, Victoria Falls Wildlife Trust)*

4.2.7 Chizarira National Park and Chirisa/Sengwa Safari Area

A survey was undertaken jointly by the Zimbabwe Parks and Wildlife Management Authority and the African Lion and Environmental Research Trust in September 2015 (Dr Norman Monks pers comm.). The survey area consisted of the 1,910 km^2 Chizarira National Park (a non-hunting area) and the adjoining 1,713 km^2 Chirisa/Sengwa Safari Area (a hunting area). No large carnivore counts using the call-up method had previously been conducted in these contiguous protected areas.

The survey method used the standardized protocol of audio broadcasts of a buffalo calf in distress. Spoor counts were not used for these surveys since previous research had shown that the call-up method was more precise, took less time, and was less costly to complete to achieve accurate results. Up to three stations were sampled nightly commencing just after sunset.

Twelve call-up sites were sampled. Response to the call-up stations by lions was low with only 2 of the 12 stations visited. The population abundance was estimated to be 31.6 (0.872 lion 100/km^2), suggesting a decline of 68.4% since 2004 when estimates of lion numbers were provided to Bauer and van der Merwe, (2004).

5 CONSERVATION IN ZIMBABWE

Zimbabwe Parks and Wildlife Management Authority (ZPWMA) falls under the Ministry of Environment, Water and Climate and it was established under the Parks and Wildlife Act of 1996 (Chapter 20:14) as amended by Act Number 19 of 2001. The rationale behind the establishment of the Authority was to allow it to retain all the revenue it generates to be ploughed back into conservation. The functions of the Authority are provided for in detail in section 4 of the Parks and Wildlife Amendment Act Number 19 of 2001. The Act gives the Authority power to control, manage and maintain Zimbabwe's wildlife resources.

Its **vision** is "*To be a World Leader in sustainable conservation*" and its **mission** is "*To conserve Zimbabwe's wildlife heritage through protection and sustainable utilisation of natural resources for the benefit of present and future generations*."

5.1 STAFF ESTABLISHMENT

The staff strength at the beginning of January 2015 was 2,043 and ended at 2,044 on 31, December 2015 (2015 Annual Report (unpublished). Fifty (50) rangers were recruited in 2015. The following is the staff status report as at 31st December, 2015 (Table 7).

Table 7: Summary Staff Establishment by Region

Position	Grade	HQ	VMU	Northern	Western	Southern	Central	Total
Executive	F & E	3	0	0	0	0	0	**3**
Department Managers/Sectional Heads	D3-D5	19	0	3	4	3	3	**32**
Ecologists/ Area Managers/Officers	D1-D2	11	1	19	19	13	4	**67**
Snr Rangers /Officers	C1-C5	29	6	64	89	49	34	**271**
Rangers/Clerical	B2-B5	33	12	507	461	310	197	**1,520**
Gen. Hands / Lodge Attendants	B1	2	2	30	66	33	17	**150**
TOTAL		**97**	**21**	**623**	**639**	**408**	**255**	**2,043**

The current remuneration levels have remained low with the lowest paid worker receiving a gross salary of $375 per month. The last salary increase of 23% was in January, 2014. A comparison with other Parastatals within the same parent ministry, shows that the Authority has the lowest salary scales.

5.2 TRANSPORT OPERATIONS

As indicated in Table 8, the total cost of operating the Parks transport fleet was is $1,547,172.82 (excluding insurance and licensing) in 2015. The existence of old and obsolete vehicles in the fleet increases costs as most of them require major component replacements thereby increasing vehicle downtime.

Table 8: Overall travel and fuel consumed by Region

Station	Km travelled	Fuel Consumed		Repairs & Maintenance Cost ($)	Total Cost ($)
		Litres	Cost ($)		
Head Office	1,489,294	190,644	272,620	136,419	409,039
Northern	1,429,260	149,577	213,895	147,113	361,007
Southern	1,075,077	110,111	157,458	59,548	217,006
Western	1,313,263	142,012	203,077	161,120	364,196
Central	392,885	47,995	68,632	127,288	195,920
TOTAL	**5,699,779**	**640,339**	**$915,684**	**$631,486**	**$1,547,172.**

Table 9 below summarises the status of the Authority's vehicle fleet as of 2015. Out of the fleet complement of 316 (including tractors and motor cycles), only 70% are in sound condition.

Table 9: Number of vehicles per region

Region	Runners	Non-Runner	Total	% of Non-Runner
Head Office	41	6	47	13
Northern	53	19	72	26
Southern	30	21	51	41
Western	80	39	119	33
Central	17	10	27	37
Total	**221**	**95**	**316**	**30**

The Authority also owns three aircraft: Bell Jet Ranger and Robinson R22 Beta 11 helicopters, and a Cessna 185. The Jet Ranger is based at Hwange National Park and is used for game capture and law enforcement. The remaining aircrafts are non-operational.

5.3 LAW ENFORCEMENT

A major component of the Authority's mandate is law enforcement. This has become increasingly more important with the escalation in illegal wildlife trade, particularly involving elephant and rhino. The Authority has an establishment of 2,146 rangers however by the end 2015, there were 1,448 rangers in post (67%). Of the 1,448 rangers in post, 1,004 are deployable for anti-poaching operations.

The level of effort of law enforcement over the last 3 year is summarised in Table 10. In 2015 there were 2,139 incursions detected, and arrest of 1,354 local and 129 foreign poachers. The number of armed contacts declined from 26 in 2014 to 23 in 2015, and number of poachers killed declined from 13 in 2014 to 11 in 2015. Recoveries made in the field included 25 rifles, 276 rounds of ammunition, 496 pieces of elephant ivory, 4 rhino horns and 5,133 wire snares.

Table 10: Detections, Arrests and Recoveries for 2013, 2014 and 2015

Year	No of Incursions	No of contacts		Number of poachers				Recoveries					Other recoveries and arrests		
				Killed		Arrested									
		Armed	Visual	Local	Foreign	Local	Foreign	Rifles	Ammunition	Ivory	Rhino horn	Snares	Gold	Poachers Camp	Dogs
2013	1842	27	344	9	0	1421	131	20	945	436	5	4415	93	264	180
2014	1571	26	362	10	3	4161	94	20	163	202	19	4864	221	186	272
2015	2139	23	356	6	5	1354	129	25	276	496	4	5133	134	339	167

5.3.1 Illegal Harvesting of Wildlife

Commercial wildlife poaching involving both local and foreign nationals continues to plague Zimbabwe, especially with respect to elephant and rhino located in the Zambezi Valley, Sebungwe, North-West Matabeleland, South-East Lowveld. The species targeted are shown in Table 11 and 12. Note that 21 lions were killed illegal between 2013 – 2015, with 6 animals killed through snaring in the area adjacent to Hwange National Park in 2015.

Table 11: Trends in wildlife poaching in the parks estate

Year	Illegally killed wildlife										
	Elephant	Buffalo	**Lion**	Kudu	Zebra	Impala	Warthog	Nyala	Eland	Crocodile	Waterbuc k
2013	293	65	**12**	65	21	67	22	5	6	2	15
2014	176	44	**2**	34	8	65	26	2	5	3	15
2015	317	78	**7**	76	21	92	46		9	17	6
2016*	101	23	**0**	23	22	54	12	1	4	1	5
Total	**807**	**210**	**21**	**200**	**72**	**278**	**106**	**8**	**24**	**23**	**41**

*To September 2016

Table 12: Illegally killed wildlife 2015 in the four regions

Region	Elephant	Buffalo	**Lion**	Kudu	Sable	Zebra	Croc	Impala	Eland	Warthog	B/Buck	waterbuck
Central	46	30	**0**	16	0	6	1	28	0	17	7	
Northern	75	6	**0**	6	0	0	0	0	0	0	0	0
Southern	65	38	**1**	42	0	9	4	31	4	25	1	6
Western	131	4	**6**	12	1	6	12	33	5	4	1	0
Total	**317**	**78**	**7**	**76**	**1**	**21**	**17**	**92**	**9**	**46**	**9**	**6**

5.3.2 Illegal trophy hunting – the "Cecil" effect

Professional hunter Theodor Bronkhorst was arrested for allegedly illegally hunting of a lion popularly known as 'Cecil' with a foreign client on Antoinette and Antoinette farm in Gwayi River Conservancy (which is adjacent to Hwange National Park). The same case involved Umguza Rural District Council in alleged illegal quota transfer[1]. At the time of writing, this case has not been brought before the court, and is still under judicial review[2].

The Authority immediately implemented the following measures in response to this incident:

- Hunting of lions, leopards and elephant in areas outside of Hwange National Parks required confirmation and authorization in writing by the Director-General of the Zimbabwe Parks and Wildlife Management Authority, and all hunts are to be accompanied by the Authority's staff whose costs will be met by the landowner.
- Bow hunting was suspended except with confirmation and authorization in writing by the Director-General of the Zimbabwe Parks and Wildlife Management Authority.
- Members of the hunting fraternity were reminded that it was illegal for quotas to be transferred from one hunting area to another. Any case of quota transfer would be regarded as poaching, and the Authority will not hesitate to arrest, prosecute, and ban for life any persons including professional hunters, clients and land owners who were caught on the wrong side of the law.

[1] This system facilitated the transfer of a quota from one property to another has since been suspended by the Authority.

[2] Note: This case has been dismissed by the court on 12th November 2016.

- 2015 hunting quotas and permits for Antoinette and Antoinette farm, Railway farm 33, Umguza Rural District Council and Kusile Rural District Council were suspended.
- Professional hunters' license for Theodor Bronkhorst was suspended.

5.4 HUMAN WILDLIFE CONFLICT

The Authority is called upon to deal with human-wildlife conflict (HWC) issues across the country, and this continues to be a challenge. A total of 863 reports of problem wild animals causing threat to human life and property were received in 2015 compared to 1,637 reports in 2014 (Table 13). From these incidents, a total of 39 human fatalities by crocodiles, elephants, lions and buffaloes were recorded in 2015 compared to the 27 fatalities in 2014.

Table 13: Trends of Human and Wildlife Conflict Incidents

Year	Total Reports Received	People killed	People Injured	Cattle killed	Goats killed
2013	1 088	21	16	67	65
2014	1 637	27	24	217	129
2015	863	39	23	232	213
Total	**3 588**	**87**	**63**	**516**	**407**

The scale and species involved in HWC is summarised in Table 14. The authority received 200 problem lion reports and responded to 177. One person was killed by lion, and 206 livestock. The Authority elected to capture problem lion (6) rather than destroy the animals.

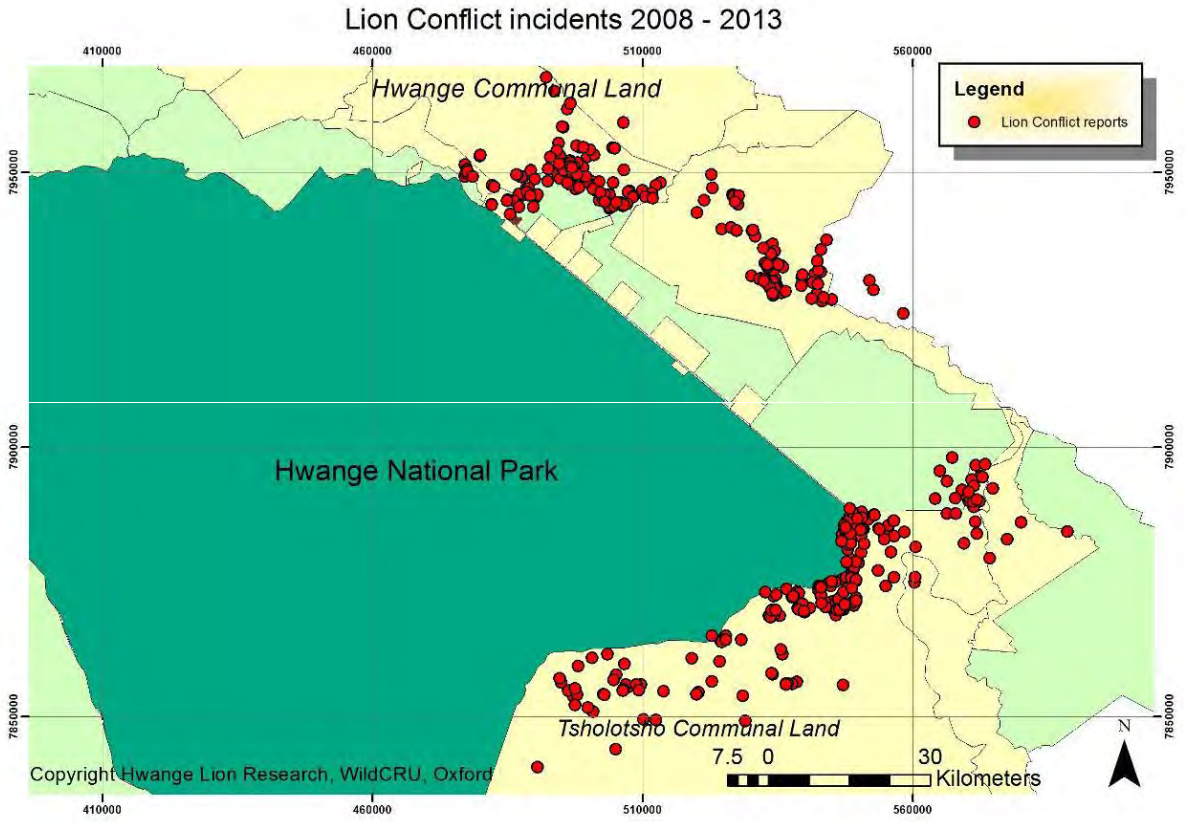
Table 14: Scale of countrywide human wildlife conflict in 2015.

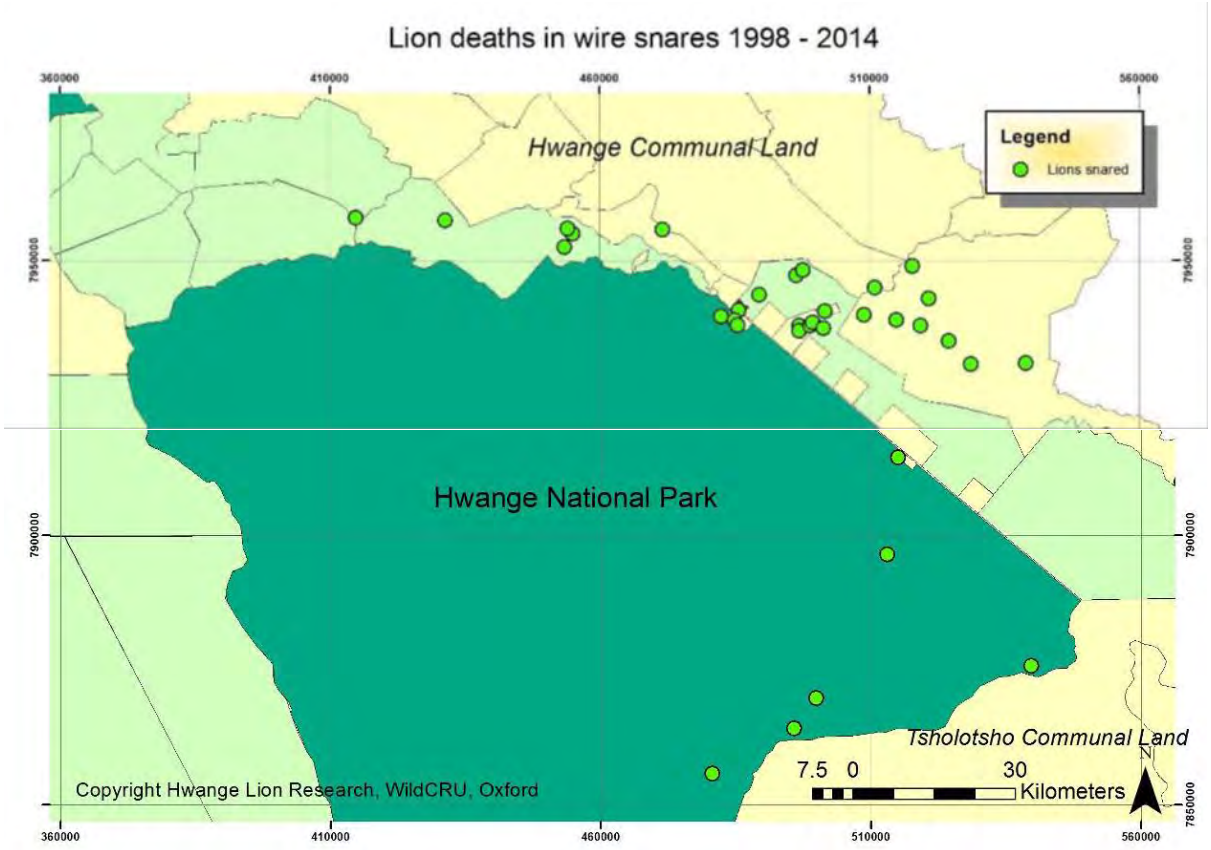
Species	Nature of problem	No of reports received	Reports attended	Number of animals eliminated		People		Livestock killed		
				Killed	Captured	Killed	injured	Cattle	Donkeys	Goats
Baboons	Damage to infrastructure, crop raiding, threat to humans	109	105	51	48	0	0		0	0
Buffalo	Threat to human life and crop raiding	46	40	0	15	2	1		0	0
Elephant	Threat to human life, crop raising, destroying property	216	177	0	38	4	5	0	0	0
Hippo	Threat to human life and crop raiding	131	87	0	34	0	0	0	0	0
Crocodile	Threat to human life and killing livestock	106	85	39	9	27	14	16	1	47
Hyenas	Killing livestock	36	18	0	7	0	0	68	2	54
Leopard	Killing livestock	19	11	0	1	0	0	32	0	33
Lion	**Threat to human life and livestock killing**	**200**	**177**	**0**	**6**	**1**	**0**	**115**	**12**	**79**
Total		**863**	**700**	**90**	**158**	**34**	**20**	**231**	**15**	**213**

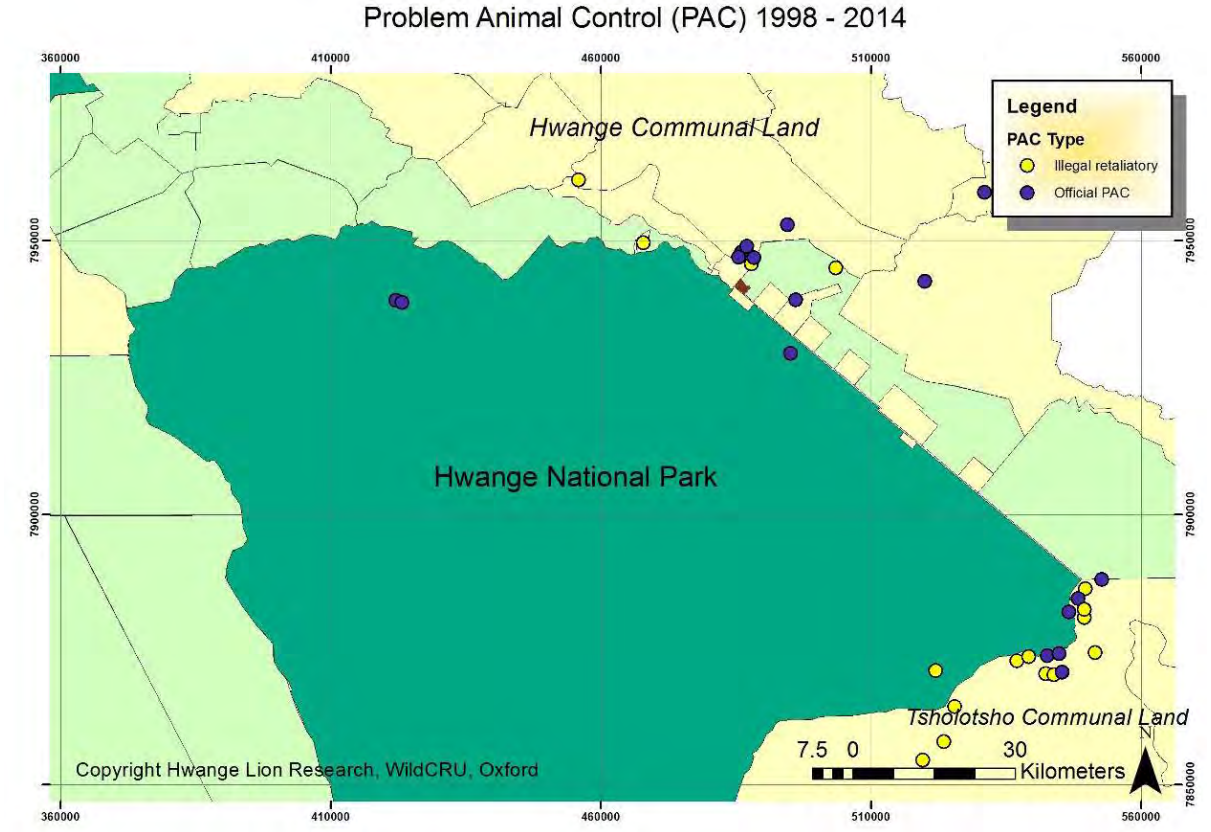
5.4.1 Case Study of Human- Lion Conflict from Hwange National Park

The following information has been extracted from the Hwange National Park Management Plan (ZPWMA, 2016) and is provided here to illustrate the challenges facing the management of lion populations residing adjacent to communal and commercial properties. Variations of the scenario described here apply to other areas of the country where hyaenas and lions are the most problematic carnivores in the communal areas adjacent to protected areas. Hyaenas are perceived to be more of a problem than lions as they account for large numbers of livestock (cattle, goats and sheep). The data presented here has been extracted from the WildCru Lion Research project in Hwange and considers only lions.

Since its inception in 2007 a significant component of the WildCru Lion Research project has focused on understanding the ecological and human socio-economic factors of conflict between the local agro-pastoralist people residing in Tsholotsho and Hwange Communal Land and lions. The project developed an intensive reporting system to record conflicts and has undertaken a detailed survey to record the baseline data on human wildlife conflict at the household level. Between 2007 and 2013 a total of 1,113 conflict incidents were recorded in the Hwange area in which 915 head of stock was lost to lions.







To mitigate this conflict, the project has initiated the "Long Shields Guardian Programme" whereby communities are notified of movements of collared into their areas via cell phone who then motivate the community to take appropriate action (i.e. moving the cattle, chase the lions etc.). In 2013 alone,

1,850 warnings were passed to the "Long Shields". In addition, the project is working on improving bomas and husbandry techniques as another way to lessen the conflict between lions and people, and although these actions may reduce the incidents of livestock marauding lions, cattle deaths still occur resulting in retaliatory killings or action on the part of National Parks to destroy the animals.

5.5 Trend in Financial Performance of the Authority

The average Income and Expenditure for the period 2010 – 2015 is shown in Table 15 that highlights the inability of the Authority to generate adequate revenue to cover both the capital and operating requirements. The average total income over this period is US$22.4 million (range US$16.5 – US$29.3 million). For the period ending December 2015, the Authority generated total revenue of $24,1million, which is 32% below the anticipated budget of $35.5 million. This includes a government grant of $716 000 and a donation of vehicles and equipment worth $2,1 million from the Government of China.

The average total expenditure for the period 2010 – 2015 is US$25.3 million (range US$18.1 – US$30.7 million). The Authority has thus incurred a loss of approximately US$2.8million/year. For the year ended December 2015, the Authority incurred a loss of US$5,4 million including depreciation.

The Authority is dependent on income from Conservation Fees (i.e. entry fees to Parks etc.) that accounted for 39% in 2015 (average 34%/year), hunting (13% in 2015) and leases (10% in 2015, Table 15).

Although individual salaries remained low, staff costs in 2015 were $20,7 million which is 71% of total revenue raised (average 64%). This is unsustainably high and leaves very limited resources for operation (16%), marketing (1%) and administrative expenses (7%, Table 15).

The major reasons for the budget deficits in the past six years can be attributed to:

- Declining income from hunting – this has been exacerbated by the recent bans imposed on elephant trophy imports into the United States by US Fish Wildlife Service (USFWS) and the much-publicised death of *Cecil the lion* that had a negative effect on revenue generated from hunting.
- Government Grant – The Authority has not received meaningful funding from the fiscus despite requests made by management that non-revenue generating activities which are of national nature be funded by Government.
- The Authority failed to dispose of its ivory stock pile due to the continued ban on ivory trade by CITES. The ivory stock which the Authority is currently holding exceeds 80 tons.

Table 15: Statement of Comprehensive Income for period 2010 – 2015 and the year ended 31 December 2015 (extracted from 2015 ZPWMA Annual Report).

Revenue	US$ 2015	%	Average 2010 - 2015	%
Conservation Fees Land	$7,879,987	33%	$6,506,508	29%
Conservation Fees River	$1,409,160	6%	$1,136,041	5%
Accommodation	$1,720,640	7%	$1,904,477	8%
Annual registration	$507,211	2%	$722,847	3%
Permits	$1,476,176	6%	$849,916	4%
Service and Facilities	$307,692	1%	$152,616	1%
Law enforcement (fines etc.)	$224,657	1%	$215,591	1%

Revenue	US$ 2015	%	Average 2010 - 2015	%
Hunting income	$3,256,698	13%	$5,049,089	22%
Fishing permits	$561,797	2%	$941,833	4%
Leases and rentals	$2,434,676	10%	$1,880,258	8%
Parks product sales	$623,084	3%	$767,347	3%
Examinations	$116,000	0%	$70,873	0%
Projects	$349,864	1%	$248,614	1%
Other income/donations	$2,555,729	11%	$907,169	4%
Government grant	$716,000	3%	$1,141,119	5%
Total	**$24,139,371**			
Expenditure				
Operational costs	$4,801,815	16%	$5,146,091	20%
Staff costs	$20,766,023	71%	$16,311,677	64%
Marketing and promotions	$212,406	1%	$147,334	1%
Administration costs	$2,056,681	7%	$2,631,019	10%
Depreciation	$1,531,000	5%	$1,069,138	4%
Total expenditure	**$29,367,925**		**$25,305,258**	
Operating surplice/deficit	**-$5,365,082**		**-$2,810,962**	

The Authority receives considerable support from many local and international NGOs who undertake a variety of routine management activities e.g. supply and maintain artificial game water supplies, provide logistic support to law enforcement operations. This is in addition to the support provided by hunting operators that hold concessions in the Safari Areas.

6 STAKEHOLDER INVOLVEMENT IN LION MANAGEMENT AND CONSERVATION

There are several private sector initiatives that are directly or indirectly involved with lion management and conservation both inside and outside the Parks estate. These stakeholders are represented by companies from the consumptive and non-consumptive sectors of the industry.

6.1 BENEFICIARIES OF WILDLIFE BASED LAND USE

Various forms of wildlife based land use occur in Zimbabwe that benefit different segments of the community depending on the authority for the land. Table 16 summarises these broad categories. The Authority is the direct beneficiary from the use of wildlife in National Parks and Safari Areas while the Forestry Commission is the beneficiary in Forestry Areas. In terms of the Act, Communal CAMPFIRE areas are the primary beneficiaries where the income generated from hunting is shared between the Rural District Council and Community Wards (see below). Similarly, private conservancies and land owners are the primary beneficiaries.

Collectively, these different management regimes contribute to the overall conservation of the wildlife both inside and outside the Parks Estate, and is supported through the existing policy and legal framework that facilitates incentives to promote wildlife based land use.

Table 16: Direct beneficiaries from Wildlife Based Land Use

Land category	Direct Beneficiary
National Parks and Safari Areas	Zimbabwe National Parks and Wildlife Management Authority
Forestry Areas	Forestry Commission
Communal Campfire Areas	Rural District Council and Wards
Private Conservancies	Private Landowners

6.2 CONTRIBUTION OF THE PRIVATE SECTOR

A questionnaire was circulated to all safari hunting operations to gather data on:

- Area and land category where hunting takes place
- Payments in terms of concession fees
- Number of people employed
- Approximate value of investment in assets
- Approximate costs of the hunting operations
- Hunter days generated through various packages
- Indication of the prey base

Data from 18 companies that have been allocated lion on quota and offer these trophies as part of their hunting packages is summarised below (Table 17). These data indicate that

- The average hunting concession covers 1,590km^2 and generates $178,488 in concession fees annually.
- Each company on average employs 109 people of which 24 are seasonal staff (22%). Law enforcement staff make up 26% of the staff complement.
- On average, each company has invested approximately $1.3 million in fixed and moveable assets (buildings, tents, vehicles, equipment etc.).
- On average, each company incurs approximately $1 million in expenses annually, with staff wages (24%) and operating expenses (27%) forming the bulk of these costs.
- Lion safaris contribute approximately 9% (126 hunter days) to the 3-year average number of hunter days generated (1,405) with the bulk of hunter days generated from buffalo safaris (see below for more details on the financial significance of this contribution).
- On average, each hunting area supports 2,000 large mammals, 3,000 medium sized mammals and 6,000 small sized mammals. However, there are large differences between state, forestry, CAMPFIRE and conservancies areas. State areas tend to support more large animals (buffalo, giraffe) while conservancies support greater numbers of medium and small animals.
- Observations on the status of lion populations indicates that each area supports on average 5 prides of 7 animals (i.e. 35 lions) although there is a wide variation in these numbers with more prides occurring in the conservancies than on Forest and CAMPFIRE areas. In these areas, the operators report that lion are transient/migratory rather than permanent.
- All areas report incidents of human-lion conflict, including incidents of snared animals.

Table 17: Summary of 18 hunting company statistics where lion hunting occurs

Companies (N=18)	**Total**	**Average**	
Total Hunting Area (ha)	2,872,932	159,607	
Concession fee	$2,141,860	$178,488	
Number people employed			
Owner/Manager	65	4	3%
Administration	59	3	3%
Camp Maintenance	308	17	16%
Safari operations	295	17	16%
Professional Hunters	82	5	4%
Skinners	59	3	3%
Trackers	138	8	7%
Law enforcement	449	28	26%
Seasonal/Casual staff	379	24	22%
Average Staff employed/company		**109**	
Approximate Asset Value (US$)	**$21,557,610**	**$1,347,351**	
Major Expense Items			
Central Government Licenses:	$415,700	$25,981	3%
ZNWMA Fees:	$1,932,472	$128,831	13%
Community Development:	$525,378	$35,025	4%
Law Enforcement:	$1,319,562	$87,971	9%
Staff wages & Welfare:	$3,601,439	$211,849	24%
Administrative costs:	$1,870,267	$116,892	13%
Operating expenses:	$3,986,619	$249,164	27%
Management and Marketing costs	$661,974	$41,373	4%
Any other costs	$411,693	$25,731	3%
Overall costs	**$14,725,104**	**$922,818**	
Hunter days generated over 3 years			
Lion	2,137	126	9%
Leopard	4,565	269	19%
Buffalo	10,344	608	43%
Elephant	3,131	184	13%
Plains game	999	59	4%
Total Hunter days	**25,294**	**1,405**	
Prey base status			
Large mammals (Buffalo, Giraffe)	28,190	2,014	
Medium mammals (Eland, zebra, kudu, waterbuck etc.)	53,273	3,552	
Small mammals (Bushbuck, warthog, impala)	82,297	5,878	
Status of lion population			
Number of prides	71	5	
Average pride size	80	7	

Companies (N=18)	Total	Average	
Number of cubs	243	19	
Number Coalition males	89	7	
Monitoring of lion population			
Natural deaths	4	1	
Reports of Human-Lion Conflict	33	5	
Incidents of infanticide recorded	6	2	

6.3 CAMPFIRE COMMUNITY PROGRAMMES

The right to exploit and benefit from wildlife was extended to communal areas through granting of Appropriate Authority Status over their wildlife resources to Rural District Councils in 1982. The intention was to return rights of access to natural resources through legislative change, devolve responsibility and economic empowerment. The CAMPFIRE model focuses on three main criteria:

- Voluntary interest in participation by communities and their Rural District Councils (RDCs),
- Presence of wildlife populations capable of producing sustainable and economically significant revenues.
- Benefit sharing for local communities based on:
    - The number of animals harvested within a local community's area each hunting season.
    - The extent of wildlife habitat present within a local community's area annually.

Currently 58 Rural Districts have been granted the Appropriate Authority status to manage wildlife resources in their areas, however only 16 are actively engaged in some form of wildlife based land use (see Figure 5).

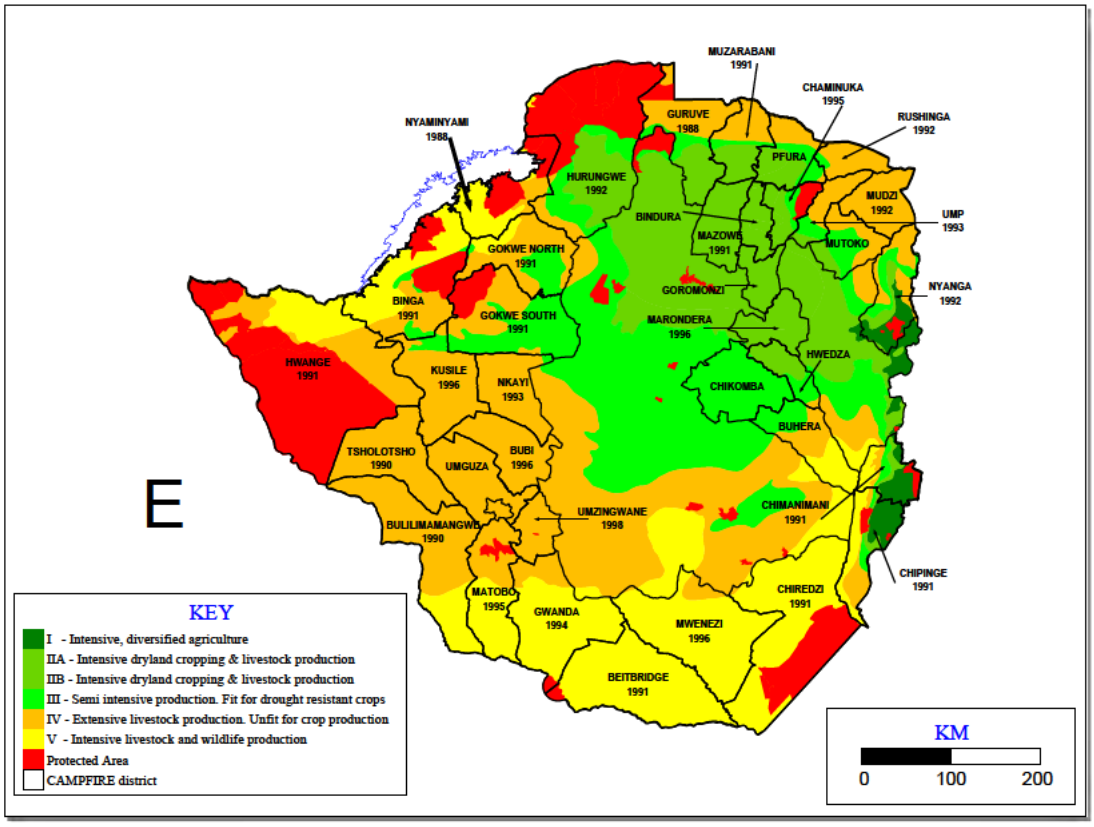


Figure 5: Map of Zimbabwe showing CAMPFIRE districts and year of establishment

The performance of ten key CAMPFIRE Districts is summarised below to illustrate the level of benefits that flow to RDCs, Wards and households, and the role that income from lion play in this process.

1. **OVERALL QUOTA ALLOCATION, UTILISATION AND INCOME GENERATION FROM KEY SPECIES: All Districts: 2010 - 2015**

	Elephant	Lion	Leopard	Buffalo	Hippo	Crocodile	Total
Quota	1,079	140	487	2050	602	471	
Offtake	655	45	193	908	270	305	
% Utilisation	61%	32%	40%	44%	45%	65%	
Total income N=6 years)	**$7,129,658**	**$240,000**	**$532,675**	**$2,263,150**	**$464,000**	**$441,903**	**$11,071,386**
Average/year	**$1,188,276**	**$40,000**	**$88,779**	**$377,192**	**$77,333**	**$73,651**	**$1,845,231**
Percentage	64%	2%	5%	20%	4%	4%	

The overall income generated over a 6-year period was US$11 million. An overall quota of 140 lions (average 23/year) were allocated to the CAMPFIRE programme over which 45 (32%) were utilised (8 per year). This generated US$240,000 or 2% of the overall income.

2. **SOURCE OF CLIENTS AND GROSS INCOME TO SAFARI OPERATIONS:2010 - 2015**

Origin of Clients	USA	Canada	South America	Europe	Asia	Middle East	Oceania	Africa	Total (N=6 years)
Total	**880**	**16**	**54**	**456**	**82**	**9**	**51**	**131**	**1679**
Percentage	51%	1%	3%	27%	5%	1%	3%	8%	
Total	**$8,624,059**	**$150,987**	**$543,003**	**$5,201,168**	**$550,062**	**$781,076**	**$394,208**	**$567,897**	**$16,812,459**
Average/year	**$1,462,508**	**$25,165**	**$90,500**	**$866,861**	**$91,677**	**$130,179**	**$65,701**	**$94,650**	**$2,802,077**
Percentage contribution	**51%**	**1%**	**3%**	**31%**	**3%**	**5%**	**2%**	**3%**	

Hunting clients from the USA are by far the most numerous (880 over 6 years) contributing 51% (or US$8.6 million) of the estimated US$16 million generated from hunting in CAMPFIRE areas from 2010 - 2015.

3. **INCOME TO DISTRICTS: 2010 - 2015**

	Hides (US$)	Trophy fees (US$)	Percentage of daily rate	Hunting concession fees	Photographic (lease fees/bed night levy)	Other (vehicle hire, grinding mill etc.)	Total	Average (N=6)
Total	$131,741	$10,618,127	$1,277,525	$862,721	$737,613	$731,218	$14,358,945	$2,393,158
Percentage	1%	74%	9%	6%	5%	5%		

The CAMPFIRE districts that benefit from hunting rely heavily on trophy fees (74%) as their primary source of income.

4. INCOME TO WARDS, VILLAGES AND HOUSEHOLDS: 2010 – 2015

Overall Income to CAMPFIRE Wards: 2010 - 2015						
	No Concessions	Area (ha)	Number Wards	Number Villages	Number Households	Gross Income
Total	**26**	**2,288,284**	**62**	**603**	**56,297**	**$5,946,370**
Income (n=6 YEARS)	**$228,706.55**	**$3**	**$95,909.20**	**$9,861.31**	**$105.6**	

Income generated at the District level is then disbursed to Wards. Since 2010, this is estimated to be approximately US$5.9 million. The available data shows that 62 wards representing 603 villages (or 56,297 households) received the equivalent of US$95,909/ward (or US$105/household).

These levels of income are not sufficient to make a significant impact at the individual level, and require that the Districts and Wards channel these revenues into activities that benefit the overall community. This is achieved through supporting several communal projects such as schools, clinics, water provisions etc.

5. DISTRICT EXPENDITURE AND COMMUNITY BENEFITS: 2010 - 2015

	Administration	Law Enforcement	Compensation	Management	Social Services	Other	Total
Total	**$2,486,268**	**$1,778,100**	**$67,600**	**$682,740**	**$1,084,779**	**$779,030**	**$6,878,517**
Average	**$414,378**	**$296,350**	**$11,267**	**$113,790**	**$180,796**	**$129,838**	**$1,146,420**
Overall costs	**$5,014,708**				**$1,084,77**	**$779,039**	
Percentage	**73%**				**16%**	**11%**	

At the District level, 73% of the revenues from hunting are channelled towards administration, law enforcement, compensation and general management while limited funds are used to support social services (16%).

6. WARD EXPENDITURE AND COMMUNITY BENEFITS

	Administration costs					Community Benefits				
	Meetings & Admin	Wages/salaries	Compensation schemes	Management activities	Project Management Costs	Social services	Food security	Direct cash benefits	Other	Total
Total	**$553,260**	**$815,639**	**$56,432**	**$312,178**	**$345,762**	**$2,468,216**	**$223,659**	**$216,077**	**$139,565**	**$5,302,709**
Overall costs	**$2,083,271**					**$2,907,952**			**$139,565**	
Percentage	**39%**					**55%**				

At the Ward level, where communities are directly involved, the tendency is to channel most the income towards community benefits (55%) rather than administration which is seen to be the responsibility of the local government. This means that the bulk of the income from hunting is used to support social services such as schools, clinics, irrigation schemes etc. where the impact at the community level (village, household) is far greater (Figure 6).



Figure 6: Bhemba Clinic in Ward 2 of the Tsholotsho Communal Area (top) and Masera Secondary School (Beitbridge, bottom) that are supported by funds generated through the CAMPFIRE programme

Lessons learnt

1. Quota utilisation of lion (32%) is low in CAMPFIRE areas, equating to 8 lion/year.

2. Trophy fees from key species (elephant, lion etc.) contributed $1,845,231/year to CAMPFIRE revenues:
    a. Elephant (64%) and buffalo (20%) are major contributors
    b. Lion and leopard contribute 7%

3. Income from the sale of safaris generate approximately $2,802,077/year
    a. Hunters from USA contribute 51% and Europe 31% of this income.

4. Income to Districts from a variety of wildlife related revenue streams is approximately $2,510,783/year:
    a. Trophy fees are responsible for 74% of this income, of which lion play a small role.
    b. Fees from photographic tourism are responsible for 5%.

5. Wards receive $5,830,244 (57%) from district trophy fees. These revenues are used to support a variety of social services that benefit a large proportion of the local community.

The cessation of import of lion (and elephant) trophies into the USA has had a significant impact on these revenue streams and consequently on the benefits reaching communities at the local level. These revenues cannot be replaced through alternative revenue streams.

7 Management and Administration of the Safari Hunting Industry in Zimbabwe

7.1 Performance of the industry

To fully account for earnings in the Hunting Sector, the Reserve Bank of Zimbabwe, in collaboration with all the relevant stakeholders, introduced the Tourism Receipts Accounting System (TRAS2) in January 2015. The TRAS2 is a web-based system which links Safari Operators, Zimbabwe Parks and Wildlife Management Authority, Taxidermists, Shipping Agents, International Marketing Agents and Reserve Bank for the purposes of authorizing hunts, capturing hunting data, monitoring hunting quota utilization and tracking hunted trophies.

On an annual basis, Exchange Control Division of the Reserve Bank of Zimbabwe attends the SCI Conventions to achieve the following objectives: -

1. To assess regional price differentials of same hunts at the SCI Convention and the reasons thereof;
2. To present Form TRAS2 systems updates to the users including international marketing agents;
3. To engage international marketing agents of sport-hunting (standardised international marketing agreements, payment arrangements and follow up on overdue export receipts);
4. To obtain relevant insights on governing of the hunting sector; and
5. To come up with an effective mechanism to fully account for export proceeds from the hunting sector.

7.1.1 Global earnings of the industry

The TRAS2 system was introduced in January 2014, and has since recorded a total of $44.6 million ($18.9 million in 2015 compared to $25.9 million in 2014) as shown in Figure 7. The figures are inclusive of daily rates, trophy fees and other incidental revenue. In line with other regional

countries offering safari hunting, the market is dominated by the USA (59%) and Europe (25%) with the remainder of the market taken by the Americas (Canada, Argentina etc.), Asia, Africa, Oceania and Africa (mostly South Africa). Appendix III illustrates the distribution of total hunting revenue by country of destination (Chitauro, 2016).

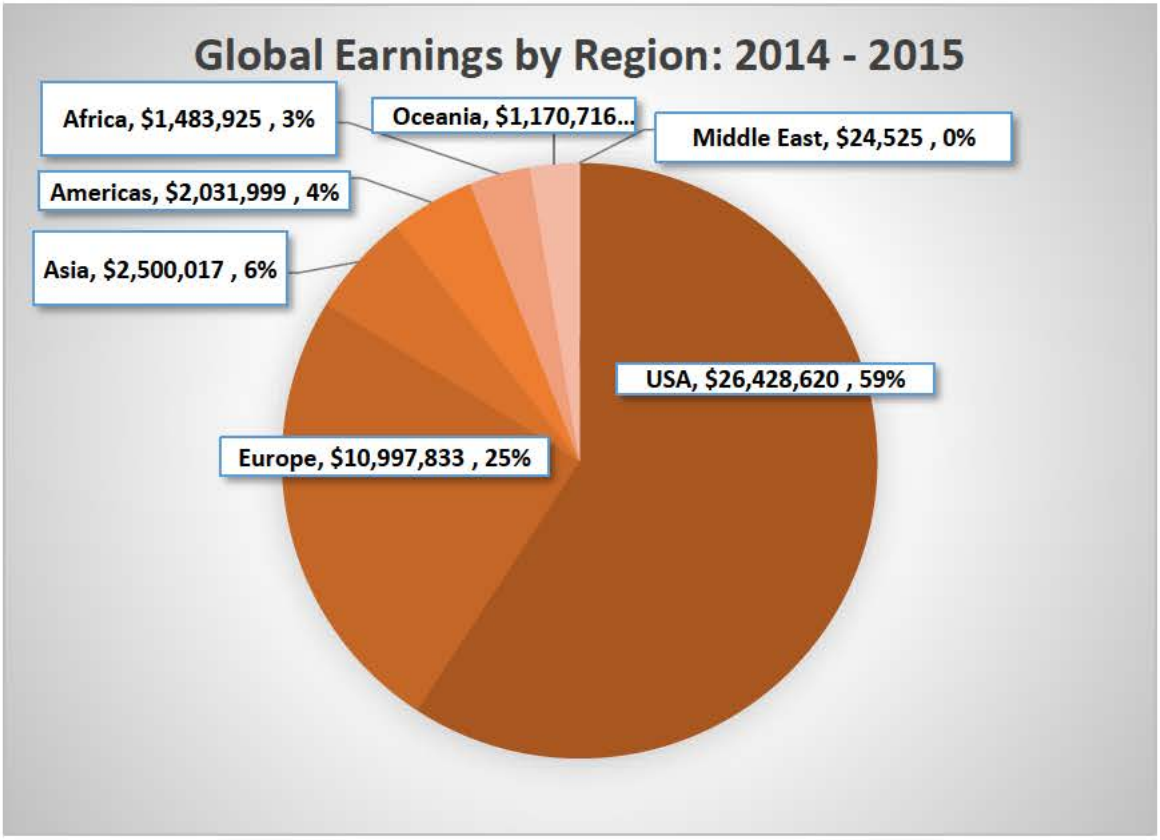


Figure 7: Breakdown of source of hunting income (2014 and 2015) from various regions in the world (adapted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2)

7.1.2 Quota allocation, Utilisation and Total Trophy Fees Earned

The total income from the sale of trophies in 2014 and 2015 is shown in Table 18. The income in 2015 (US$8.2 million) is less than that in 2014 (US$11.1 million) because of the import restrictions of elephant and lion into the USA.

Table 18 also provides data on the quotas allocated in 2015 and the number of level of utilisation. The complete list of species is provided in Appendix III (Chitauro, 2016). These data show that levels of utilisation for all species varies from 10 – 40% for most mammals and far less for birds etc.

Table 18: Summary of the revenue generated from the 11 most common species utilised for hunting, and the percentage utilisation in 2015 (adapted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2)

Species	2014	2015	Total	2015 Quota	Utilised	% Utilised
Buffalo	$2,528,559	$1,962,570	$4,491,129	1,635	482	29%
Elephant (Tusks)	$2,042,610	$1,447,090	$3,489,700	246	64	26%
Elephant (Tuskless)	$1,444,040	$229,860	$1,673,900	462	113	24%

Species	2014	2015	Total	2015 Quota	Utilised	% Utilised
Lion	**$630,950**	**$753,000**	**$1,383,950**	**82**	**49**	**59%**
Leopard	$714,100	$668,490	$1,382,590	530	151	28%
Zebra	$594,239	$555,744	$1,149,983	2,480	600	24%
Sable	$456,615	$309,260	$765,875	718	78	11%
Kudu	$341,092	$357,963	$699,055	2,503	289	12%
Waterbuck	$293,903	$256,133	$550,036	988	156	16%
Hippo	$310,321	$217,470	$527,791	303	83	27%
Impala	$277,198	$242,624	$519,822	8,594	1,261	15%
Other Species	$1,465,560	$1,287,845	$2,753,405			
Grand Total	**$11,099,187**	**$8,288,049**	**$19,387,236**			

7.1.3 Total trophy fees generated by land category

The ZPWMA allocated quotes to all owners and occupiers of land in terms of SI 26. Any person utilising wildlife on these properties is required to submit a TRAS2 form to process any export of trophies and other animal products. Approximately 262 companies/properties submitted returns in 2014 and 2015. From these data, it is possible to determine the income generated from trophy fees and daily rates per company. To protect the privacy of the individual companies, these data have been arranged to show the level of income generated by different land categories from trophy fees (Figure 8),

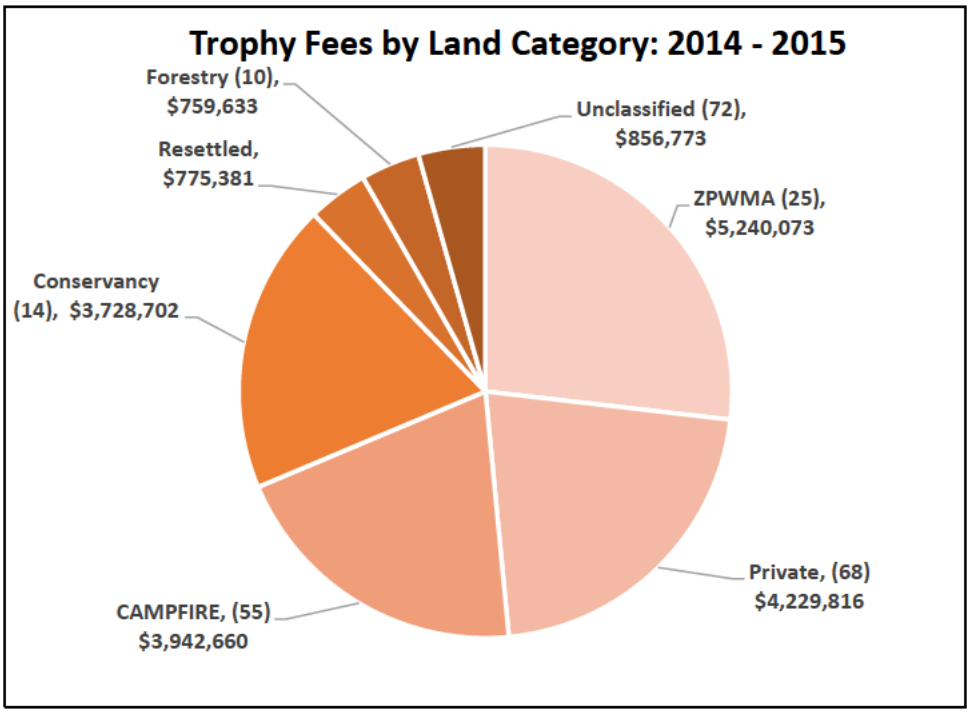


Figure 8: Hunting Trophy Fee Earnings by Land Categories (2014 - 2015). Note that from the description provided in the database, it was not possible to allocate some individual properties to a specific category. These have been recorded as unclassified (adapted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2).

Overall, approximately US$10.7 million was generated in 2014 and US$8.7 million in 2015 from the 62 species on offer. The ZPWMA represented by 25 properties that it either offers on tender to the private sector or operates as hunting areas itself generated the largest income from trophy fee sales

(US$5.2 million). The 14 Conservancies accounted for US$3.7 million while the 68 private properties are recorded as generating US$4.2 million. The CAMPFIRE areas (N=55) generated US$3.9 million.

Together with the income from daily rates (US$13,190,372 in 2014 and US$9,684,396 in 2015 (gross US$22,874,768), extracted from Computerised Exports Payments Exchange Control System, CEPECS - TRAS2), these funds are used to pay for several operational expenses including employment, law enforcement, administration and management.

7.5 Quota Setting Process

The process for quota setting follows procedures agreed to by all stakeholders (ZPWMA, 2014).

- Step 1: Allocate existing quota to each block/hunting area

The starting point for implementation of age-restrictions and adaptive quota management was to allocate existing lion quotas. This quota would then be managed adaptively in line with the age of lions hunted. In future, it is envisaged that fixed quotas for lions would fall away as quotas would be based on the age of lions hunted in the previous year.

- Step 2: Hunters complete and submit return forms and photos after each lion hunt

The data would be compiled into a database by a ZPWMA representative (currently Ms Roseline Mandisodza-Chikerema, Senior Ecologist, ZPWMA). Export permits for trophies will not be issued unless completed hunt return forms (all the required photographs and the first upper premolar) is provided to ZPWMA for aging and monitoring purposes. Furthermore, because the following year's quotas will be based on the ages of the lions hunted in the current year, operators must submit their lion hunt returns and photographs soon after the hunt. At the end of the season, all the teeth would be taken to a dentist to have x-rays conducted to allow for measurement of the size of the pulp cavity.

- Step 3: ZPWMA and Panel of experts assign an age value to each lion trophy

Lion trophies will be aged by ZPWMA, with input from lion scientists and representatives from the hunting industry at a trophy aging session. This is conducted at the end of each hunting season.

- Step 4: Calculate the next years' quotas based on a points system for the ages of lions hunted

A quota setting meeting is held where lion quotas are established for each area based on the age of lions hunted in those areas the year before. This programme commenced in 2014, and so the ages of lions hunted in 2014 will affect the lion quotas in 2015. Table 19 summaries the trend in lion quota allocations since 2002 while Table 12 provides a detailed overview of the lion trophies taken in 2015.

Table 19: Summary of lion quota allocations and offtake since 2002 (Data provided by ZPWMA)

Year	Lion Allocated Quotas	Female Offtake	Male Offtake	% Utilisation
2002	126	22	49	56%
2003	138	5	11	6%
2004	155	4	9	8%
2005	108	3	20	21%
2006	124	1	17	14%

Year	Lion Allocated Quotas	Female Offtake	Male Offtake	% Utilisation
2007	117	0	9	7%
2008	90	0	17	18%
2009	111	0	9	8%
2010	98	12	30	43%
2011	121	20	38	48%
2012	101	18	27	44%
2013	101	1	34	34%
2014	101	0	37	26%
2015	82	0	49	60%
2016	81	0	33	41%

Table 20: Analysis of lion trophies taken on various properties in 2015

Hunting Area Name	Sex	Killed Wounded	Grid Ref	Date Shot	Trophy Size
Sapi Area	M	KILLED	35l0783	03/06/2015	
Matetsi Safari Area - Unit 3	M	KILLED	307551	05/04/2015	61.31
Antoinette & Antoinette Extension	M	KILLED	187159	02/07/2015	26 7/16"
Tsholotsho District Area 2-South	M	KILLED	S1926181 E02652250	27/10/2015	25 6/8 inches
Hurungwe Safari Area - Rifa	M	KILLED	35K178113	10/05/2015	24.5
Deka Tail	M	KILLED	651 480	10/04/2015	60.38 cm
Hurungwe Safari Area - Nyakasanga	M	KILLED	s15.56.457 e029.15.584	07/06/2015	26
Msaise	M	KILLED	VN204700	14/05/2015	23
Mapari	M	KILLED	VN798124	09/06/2015	23SCI
Ngamo/Sikumi	M	KILLED	456923	09/05/2015	
Deka Safari Area	M	KILLED	278493	26/06/2015	61.5
Mbire (Guruve) South Area 2	M	KILLED	919056	09/08/2015	25.3
Bubye Valley Conservancy	M	KILLED	0194090 7625410	21/02/2015	25"
Bubye Valley Conservancy	M	KILLED	9337	29/03/2015	26"
Bubye Valley Conservancy	M	KILLED	31129	07/04/2015	25
Woodlands Farm	M	KILLED	644972	22/05/2015	25"
Bubye Valley Conservancy	M	KILLED	35K 453 159	10/05/2015	23.625
Bubye Valley Conservancy	M	KILLED	36K 908 852	25/04/2015	25"
Chewore Safari Area - North	M	KILLED	TT015643	05/06/2015	25
Bubye Valley Conservancy	M	KILLED	36K 227 593	12/05/2015	26"
Matetsi Safari Area - Unit 4	M	KILLED	4.05E+12	09/06/2015	24
Matetsi Safari Area - Unit 5	M	KILLED	865505	09/06/2015	25.25
Gunundwe	M	KILLED	822094	11/06/2015	
Bubye Valley Conservancy	M	KILLED	36K 004 971	24/06/2015	25.5625

Hunting Area Name	Sex	Killed Wounded	Grid Ref	Date Shot	Trophy Size
Bubye Valley Conservancy	M	KILLED	942 151	25/06/2015	12
Kusile District Area 1	M	KILLED	S185604.9 E0271547.4	02/07/2015	
Mokore Ranch	M	KILLED	VN110030	15/07/2015	15"
Bubye Valley Conservancy	M	KILLED	36K 229 607	29/07/2015	26"
Bubye Valley Conservancy	M	KILLED	191 623	25/07/2015	27.0625
Nyaminyami District Area 2 (Omay)	M	KILLED	657019PM	18/07/2015	24 1/8"
Matetsi Safari Area - Unit 5	M	KILLED	862 451	15/07/2015	25 8/16 inches
Matendere	M	KILLED	781021	26/07/2015	23.875
Matetsi Safari Area - Unit 1	M	KILLED	740726	13/08/2015	25
Bubye Valley Conservancy	M	KILLED	213 602	15/08/2015	15
Sango	M	KILLED	62691	23/08/2015	23.125
Sango	M	KILLED	320548	27/08/2015	
Dande Safari Area	M	KILLED	945352	13/10/2015	24in
Hurungwe Safari Area - Rifa	M	KILLED	35k062038	30/09/2015	25.25
Bedford	M	KILLED	190429	06/09/2015	
Ngamo/Sikumi	M	KILLED	456919	07/09/2015	
Bubye Valley Conservancy	M	KILLED	206 622	23/09/2015	26"
Hammond	M	KILLED	35k880103	17/10/2015	23.375
Kazuma/Panda Masuei	M	KILLED	s18.44144 & E025.64434	09/10/2015	
Nyaminyami District Area 1 (Omay)	M	KILLED	PM453354	13/11/2015	26"
Chewore Safari Area - South	M	KILLED	ST967260	25/10/2015	
Riverside Ranch	M	KILLED	35k227702	31/10/2015	24.78
Matetsi Safari Area - Unit 6	M	KILLED	18.06.55.68.25.22	03/12/2015	
Chewore Safari Area - South	M	KILLED	QN975310	06/12/2015	
Sapi Area	M	KILLED	Mtawatawa	11/06/2015	24"

7.6 POINTS SYSTEM FOR ADAPTIVELY MANAGING LION QUOTAS IN ZIMBABWE

The points system used to adaptively manage lion quotas has been developed following similar systems that have been implemented in Tanzania and northern Mozambique. The systems that are in place in Tanzania and Niassa differ slightly, but both lion quotas are set per the age of the lions harvested during the previous hunting season (Begg and Begg, 2008; Tanzania Wildlife Division 2013). The Tanzanian system is more punitive with significant quota reductions, trophy confiscation and fines for non-compliance, whereas the Niassa system is more accommodating but nevertheless can result in quota reductions if five-year-old lions are hunted. The latter was aimed at a means of accommodating the difficulty of telling five-year-old lions apart from four year olds.

After reviewing the Tanzanian and Mozambican age restriction systems and debating possible models for application in Zimbabwe, an adaptive quota management system for lion hunting based on the ages of lions hunted was agreed on in July 2013 in Harare, Zimbabwe, during a meeting hosted

by the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) and an independent non-governmental conservation organisation. The approach adopted by Zimbabwe recognises four as opposed to three key age categories (Table 21).

Table 21. Proposed points system for lion age restrictions and quota setting in Zimbabwe

	≥6 years	**No trophy**	**5 years' old**	**4 years' old**	**<4 years**	**Failure to submit hunt return/incomplete hunt returns**
For quotas of 3/more	4	3	3	2	-3	0
For quotas of 2	4	3	3	2	0	0
For quotas of 1	6	3	3	2	0	0
Quota setting process	These points are added up and divided by 3 to yield the quota for next year					

During 2013, operators were requested to submit hunt returns and photos as a trial run to get the system up and running. In 2014 operators were requested to do the same but were informed that the age of the lions hunted in 2014 would determine their lion quotas in 2015. The 2015 lion hunt results would thus also determine the 2016 quota. The key distinction of the Zimbabwean system is that the quota will not be affected if they hunt animals that are five years old. This position was adopted after considering various the population models that suggested that the hunting animals of five years of age or older is predicted to be comparatively safe from a population perspective (Whitman et al. 2007). Moreover, after reviewing aging techniques, the consensus was that professional hunters could be distinguish between lions that are five or above. The system therefore rewards operators with increased quotas if they hunt animals of six years and older, but it does not penalize them if they hunt animals of five years. Neither are they penalised if they do not shoot a lion that they have on quota, however, the quotas will be reduced if they hunt animals younger than five years or if they failed to complete hunt returns.

Lions are aged by triangulating multiple different aging characteristics, including:

- The degree of facial scarring;
- The teeth colour and degree of wear;
- The mane development (particularly regarding the shape around the ear and the mohawk);
- Through post mortem analysis of the width of the pulp cavity of the second premolar (which becomes narrower with age).

7.6.1 Results of the Adaptive Lion Quota Management System: 2013 to 2016

In 2013, only 28% of the lions hunted were 5 years or older, in 2014 that figure had risen to 49% and in 2015 to 77.3% (Figure 5). The proportion of lions hunted that were less than 5 years of age dropped overall between 2013 and 2015 (Figure 9).

In 2015 the Zimbabwe national lion hunting quota was set at 82 lions. Of this 82, only 49 were hunted in 2015, and based on the resultant score from aging the trophies, and the fact that operators chose not to hunt lions of inadequate age (see Figures 9, 10 and 11), the recommended quota for 2016 was set at 81. In 2015 there was a marked increase in the age of lions hunted. Notably, only one lion of <4 years of age was hunted and the large majority of lions were 5 years or older (Figure 9).

As was agreed upon at the 2013 lion management meeting in Harare, the CAMPFIRE areas in which lions occur are currently exempted from the age restrictions. This approach was adopted as a means of ensuring that impoverished communities obtain the opportunity to benefit from the presence of lions, recognising the potential negative impacts the species has on the livelihoods of livestock farmers.

Using these figures and estimating the average value of a lion safari at approximately US$ 80,000 then a 50% offtake would generate approximately US$ 2,800,000 annually. If management costs are approximately $150 km^2, then the lion safaris alone can support 18,600 km^2 of wildlife habitat in Zimbabwe.

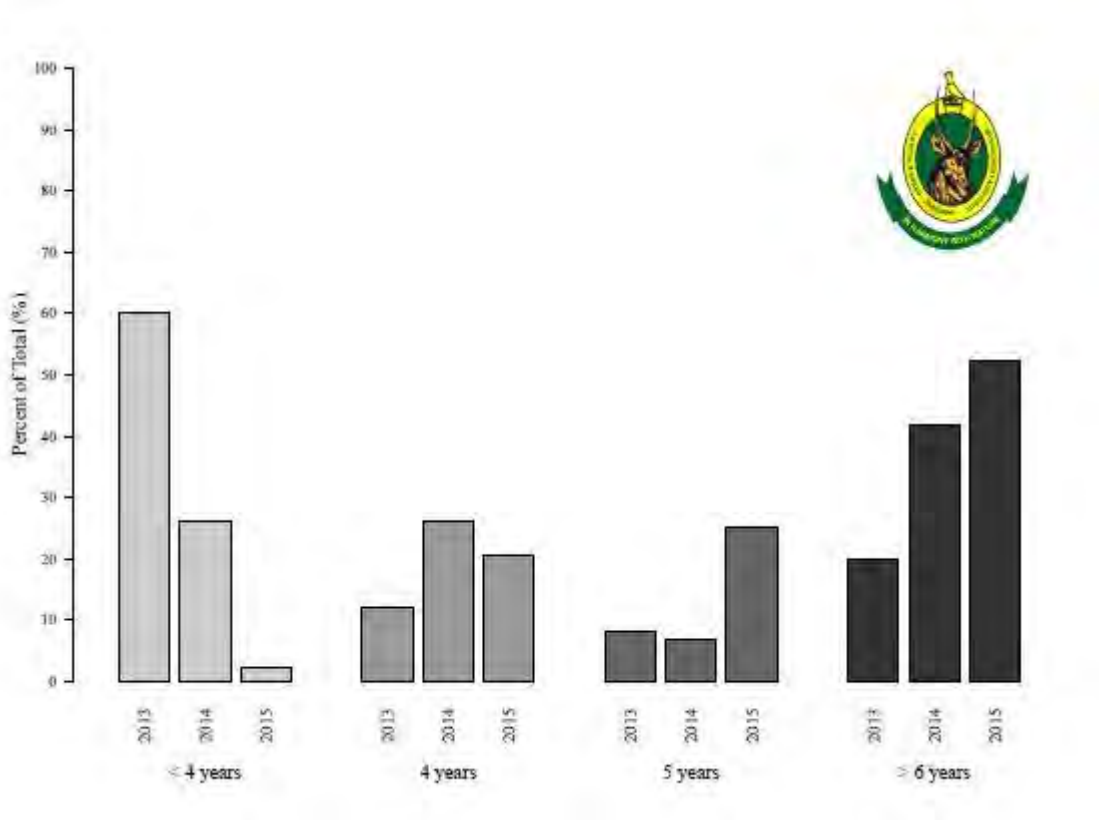


Figure 9: The percentage of lions hunted in each age class in 2013, 2014 and 2015 in Zimbabwe.

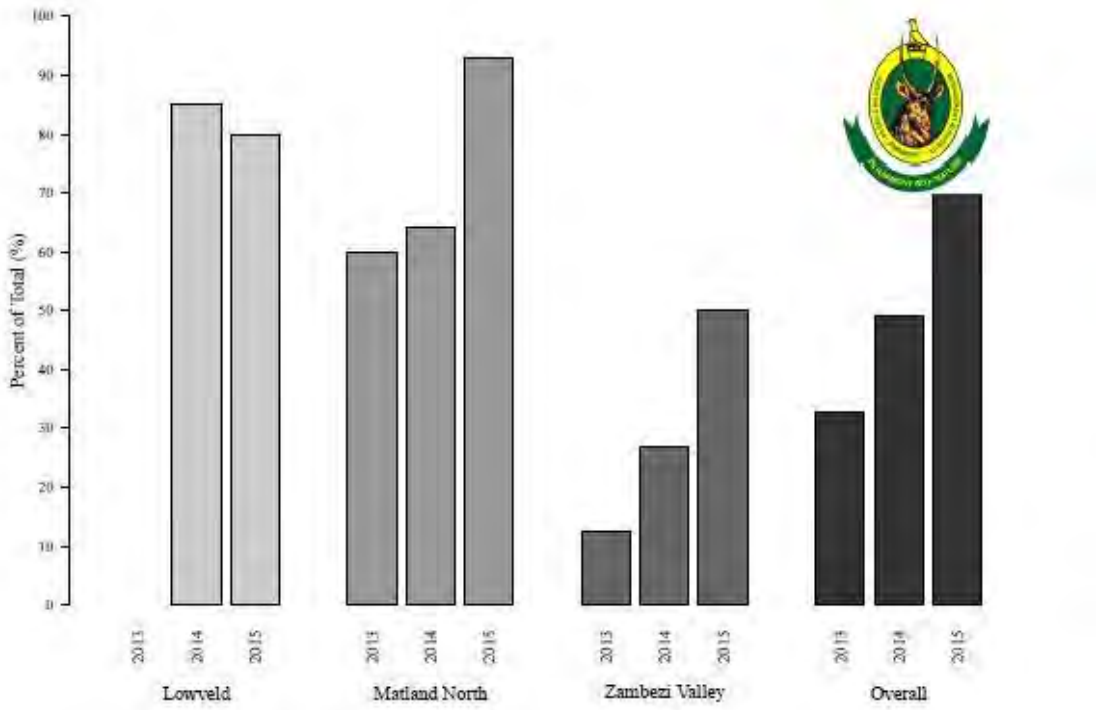


Figure 10: The proportion of lions hunted that were 5 years or older in the three main lion-hunting areas of Zimbabwe.

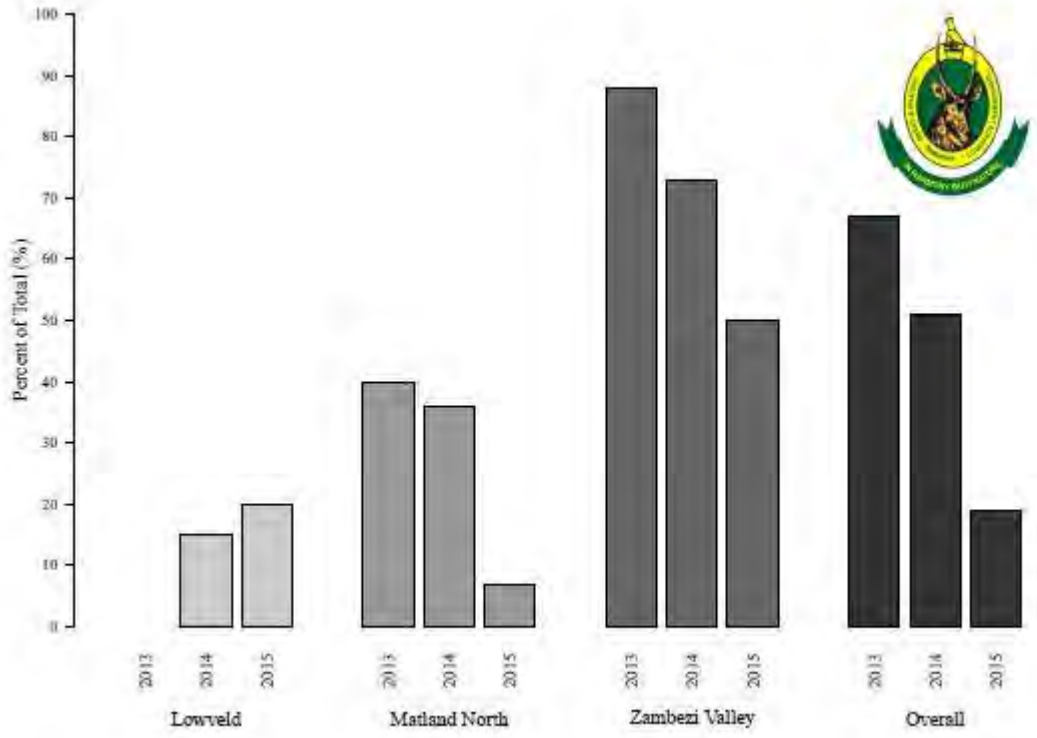


Figure 11: The proportion of lions hunted that were less than 5 years of age in the three main lion-hunting areas of Zimbabwe.

7.6.2 Case study: Safari Hunting surrounding Hwange National Park

The Hwange National Park is surrounded by hunting areas that fall under the Authority, Forestry Land, Private Land and Communal Land. The ZPWMA is responsible for setting and administrating quotas in conjunction with stakeholders for the safari areas, forestry areas, communal lands and private properties.

The Matetsi Safari Area to the north of Hwange National Park was established in the 1970s when several unsuccessful private sector mixed faming properties were expropriated, compensated and the resultant block of land turned over to safari hunting – a largely untried venture at that time on a large scale. An intensive monitoring system was set in place to gauge the effectiveness of the scheme and this continues to this day (Crossmary et al. 2013, Figure 12). The seven concessions (six given over to safari hunting) are leased on five year terms and concessionaires pay a 5 year "right to lease" fee, an annual rental, a fixed quota fee (payable if animals are shot or not) and a supplementary quota fee which allows additional animals to be bought as per need.

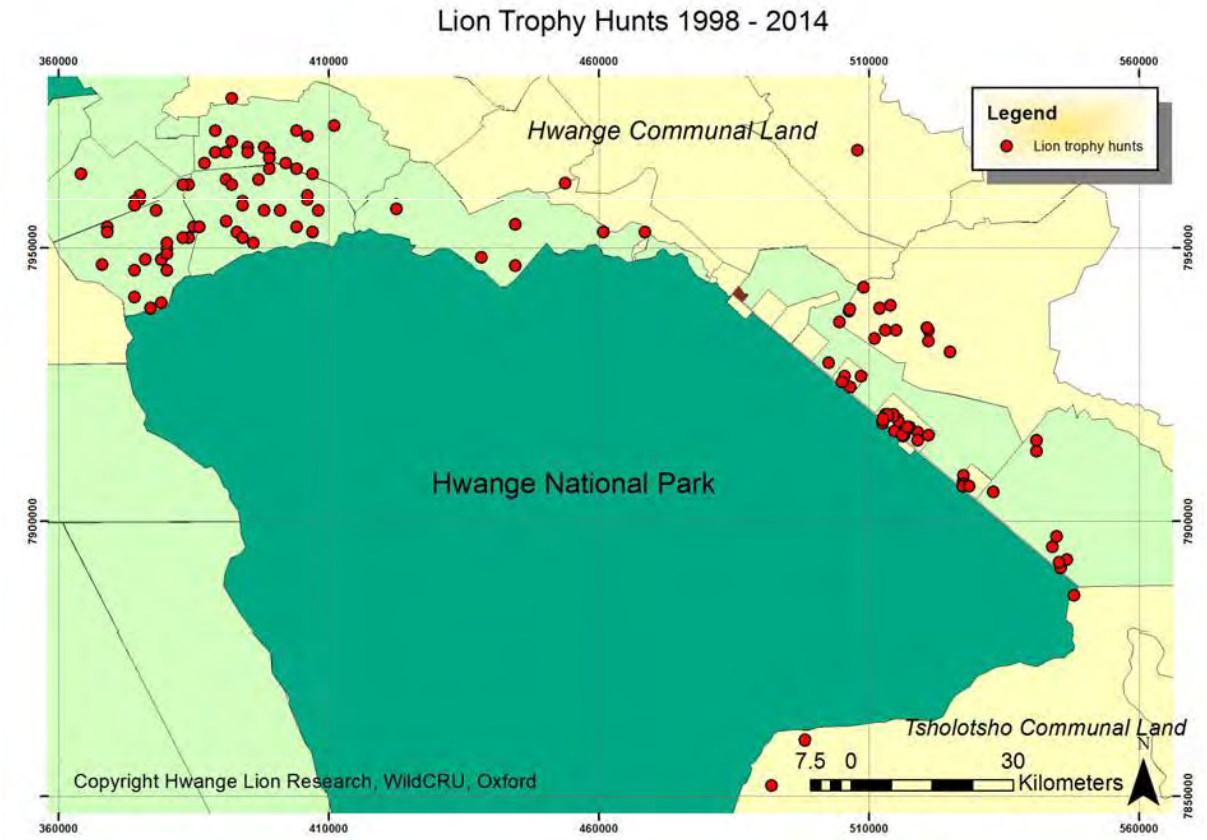


Figure 12: Record of where lion have been hunted on the land surrounding the Hwange National Park since 1998 (data extracted from the Hwange National Park Management Plan).

8 THREATS AND MITIGATION

The consensus of the scientific and animal welfare community is that the populations of lion in Africa has declined by 43% in the last two decades, with the greatest declines having occurred in west Africa. The exception to this are the populations of southern Africa, notably South Africa, Namibia, Botswana and Zimbabwe that are home to 24- 33% of the overall population has increased (Funston et. al. 2016).

Nonetheless, as is the case in other range states, the greatest threats to lion in Zimbabwe are from habitat loss, snaring and retaliatory killings where livestock are involved.

8.1 HUMAN-LION CONFLICT

The main source of illegal killing of lions is a result of Human-Lion conflict. The human population of Zimbabwe has increased since 1960 (estimated at 13 million). There is considerable pressure to convert land to agro-pastoral production, and the pressure is expected to increase. It is not unexpected therefore that the incidence of Human-Lion conflict will increase. ZPWMA records show that 200 attacks occurred on humans and 150+ on livestock (cattle, goats, sheep, dogs etc.) were killed in 2015 (see Table 13 above).

Retaliation for these livestock losses is usually done poisoning or hunting. The exact number of lions killed in this way is difficult to assess, but may number over 50/year. These indiscriminate killings pose the most significant threat to the species, and is of major concern to the management authorities. For example, the Area Manager for Hwange National Parks reported that 6 lions were killed on the Hwange National Parks boundary in 2016, and the Authority responded to several problem animal attacks on livestock.

In accordance with the Parks and Wildlife Act of 2001 when a lion attacks a human or kills livestock, it shall be eliminated. However, despite the numerous incidents reported across the country, less than 10 lions are killed through official "problem animal control" (PAC).

8.2 HABITAT LOSS

Zimbabwe supports substantial populations of lions outside of its protected areas and extensive conservancies. Moreover, despite its expanding human population, many of the protected areas are still intact however, the threat to lions from habitat loss exists in the Sebungwe and the South East Low Veld where the fragmented nature of the protected areas is compounded by an increasing human and livestock populations surrounding these areas. In these areas, habitat loss, reduction in prey populations and killing of problem lions are the major threats to long term lion survival.

Due to the large size of the protected area system in the Zambezi Valley and North West Matabeleland, threats are limited to lion range which extends into adjacent settled areas. The huge natural prey base in these protected areas, reduced killing of problem animals associated with lions preying on livestock in adjacent settled areas.

The potential and real loss of habitat and the fragmentation of range and conflicts with people in the absence of effective incentive mechanisms to maintain such habitat is probably the second greatest threat to lions after retaliatory killings. Increasing livestock numbers is reducing the available habitat in buffer areas adjacent to the protected areas, and increasing the incidents of human-lion conflicts. Lions are being more and more regarded as a liability and economic cost to rural communities. Reversing this trend is difficult under normal circumstances, and this has been made that much more difficult with the cessation of lion hunting. Integrating income from lions into rural economies, and demonstrating that lions contribute to the welfare and development of people is regarded as one strategy to mitigate against this. The involvement and empowerment of rural people in natural resource management through the CAMPFIRE programme that strives to provide economic and financial incentives through sustainable use, is one of the main driving forces behind changes in attitudes towards wildlife in communities where lion-livestock conflicts occur.

8.3 ILLEGAL TRADE IN LION PRODUCTS

Very few lions are poached in Zimbabwe (not to be confused with retaliatory killings). Records, mainly from anti-poaching reports, are for impoundment of body derivatives such as skins, teeth/claws, body

fats and bones. These may be sought after for local traditional medicinal use. Poaching mainly occurs along the boundaries of the protected areas where lions are incidentally snared as non-target prey.

The illegal trade in lions and their products (i.e. bone trade) is very insignificant. There are no records of people found in possession of illegally acquired lion specimens in Zimbabwe, and anyone found in possession of illegally acquired lion specimens is required to pay a fine US$5000 or faces a mandatory jail sentence. On conviction for lion poaching, courts may ask the accused to pay a compensation fee of US$20 000.

8.4 BUSHMEAT POACHING

Poaching for bushmeat is an important livelihood component of rural communities in Zimbabwe and a vast literature exists on this subject (see Lindsey et. al. 2015a and 2015b). Poverty stands as the major driver of illegal hunting, and the livelihoods of illegal hunters have been augmented considerably through revenue generated from bushmeat sales. Illegal hunters use bushmeat both for supplementing household protein and for economic gain.

Poaching for bushmeat does not seem to have impacted directly the overall lion's status in Zimbabwe, but more research is needed to fully understand its impact on lion. However, lions are often inadvertently caught in snares set for animals targeted by bushmeat poachers. Where possible, lions caught in snares are captured and treated (Figure 13).





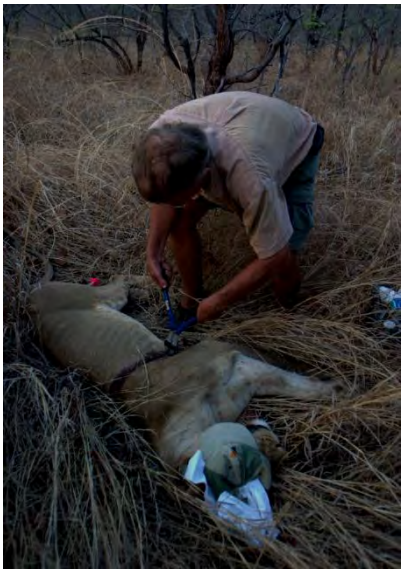




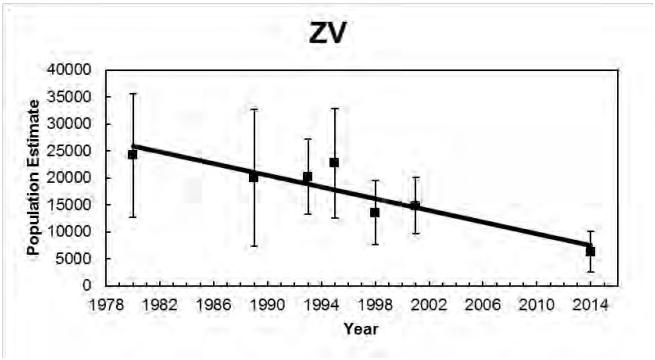
Figure 13: Young lioness being treated by the Victoria Falls Conservation Trust after a snare was removed from around the chest (Source: S. Edwards)

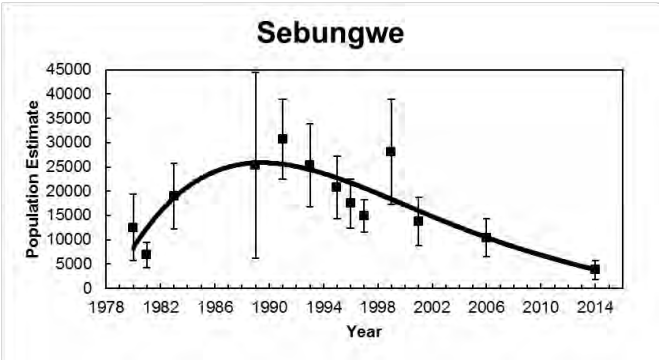
8.5 PREY ABUNDANCE

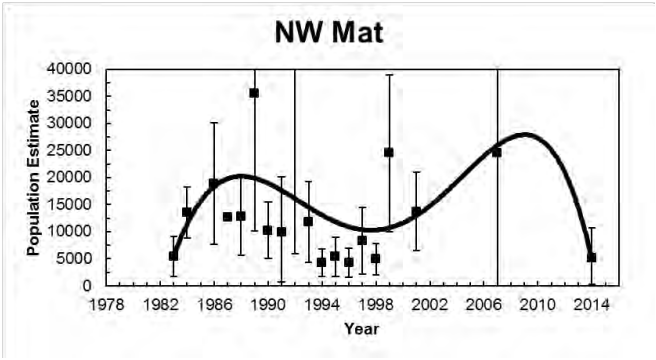
The extent to which bushmeat poaching outside of the Parks Estate is depleting lion's prey is not known. Prey abundance is still high in all protected areas where lions occur, and as abundance of prey species is highly correlated with lion density (Hayward et al 2007), data on the main prey species for lion, extracted from the 2014 aerial surveys of elephants and other large herbivores (Dunham et. al., 2015, 2015a, b, c, d) are shown in below (ZV = Zambezi Valley, NW Mat = North West Matabeleland).

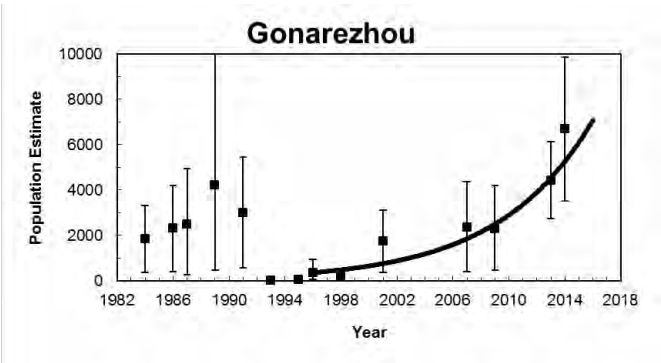
The overall long term trends show that most population status of most prey species has declined in recent years. There are many possible explanations for these declines, but probably the most critical factor has been droughts, especially that experienced in 2005.

Buffalo

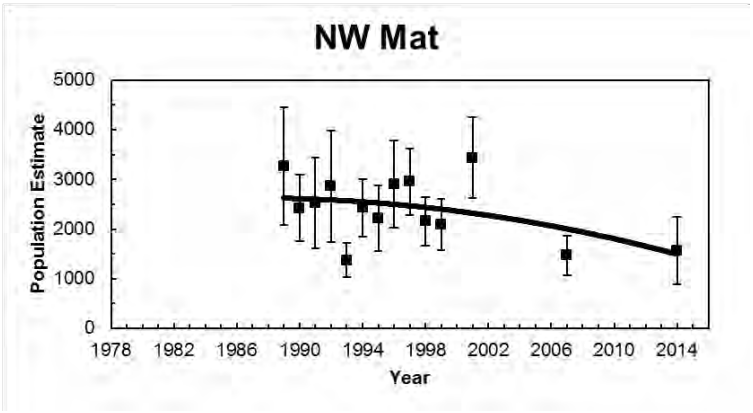

ZV
Population Estimate
40000
35000
30000
25000
20000
15000
10000
5000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

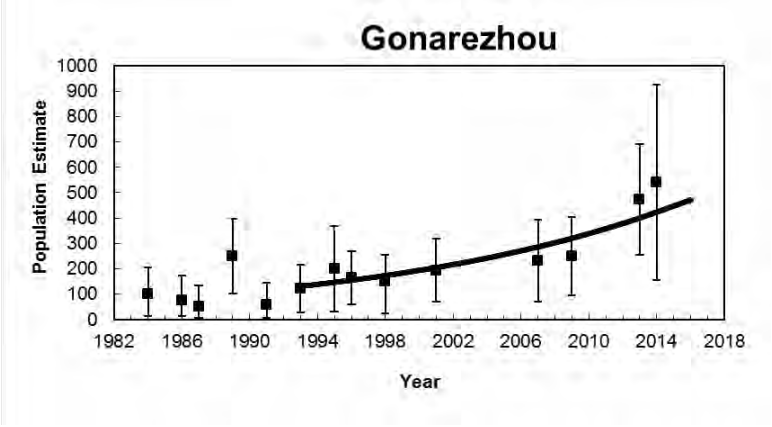

Sebungwe
Population Estimate
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


NW Mat
Population Estimate
40000
35000
30000
25000
20000
15000
10000
5000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

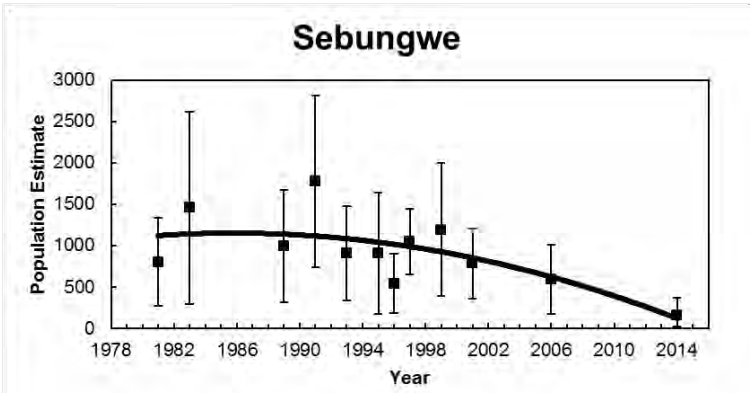

Gonarezhou
Population Estimate
10000
8000
6000
4000
2000
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

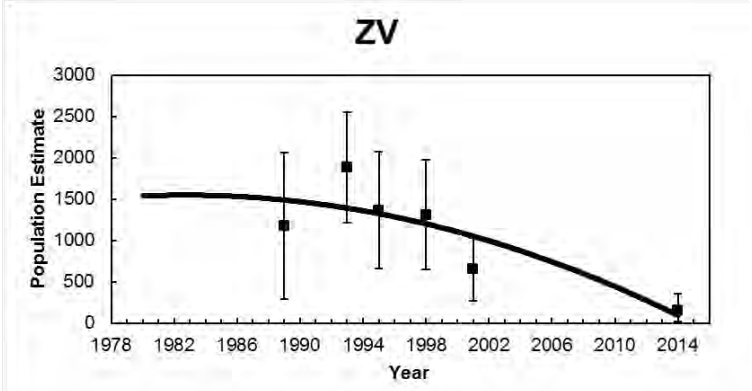
Giraffe

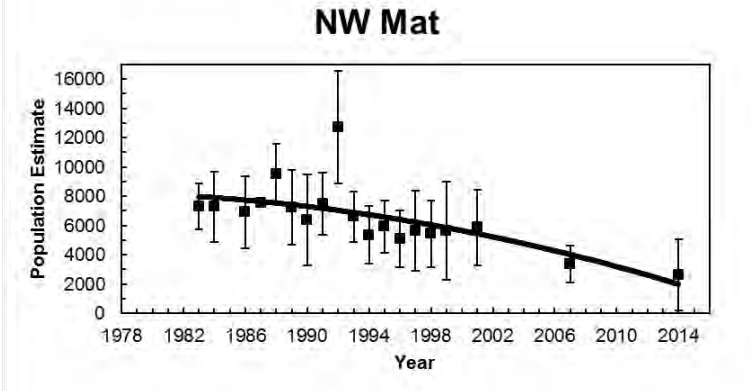

NW Mat
Population Estimate
5000
4000
3000
2000
1000
0
1978
1982
1986
1990
1994
1998
2002
2006
2010
2014
Year

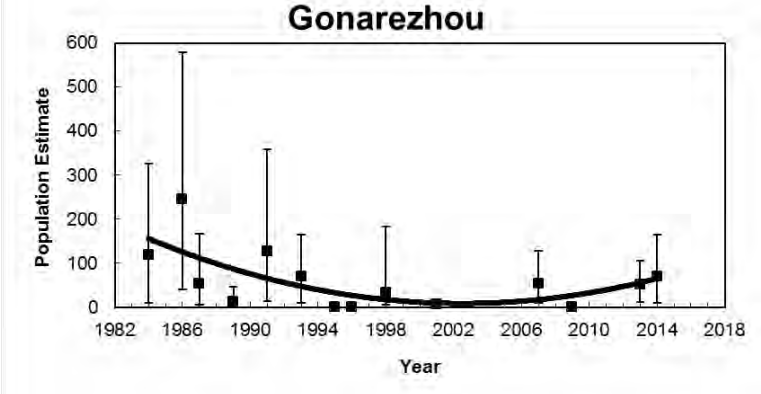

Gonarezhou
Population Estimate
1000
900
800
700
600
500
400
300
200
100
0
1982
1986
1990
1994
1998
2002
2006
2010
2014
2018
Year

Sable

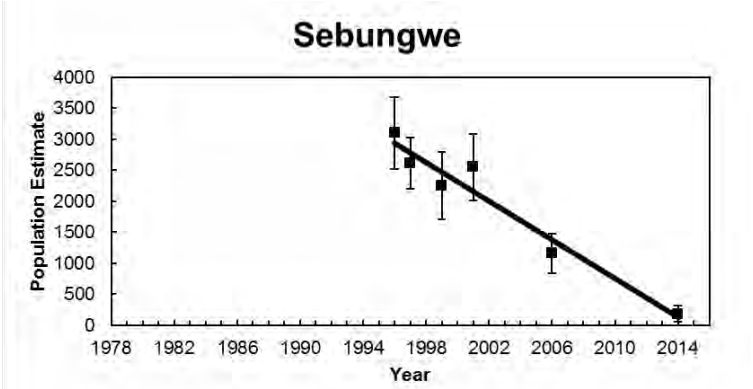

Sebungwe
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

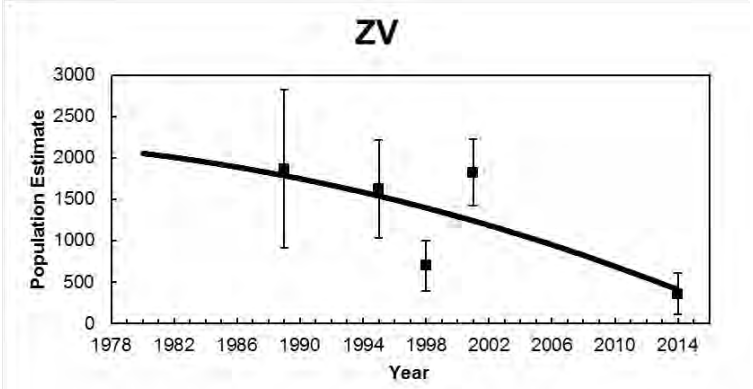

ZV
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

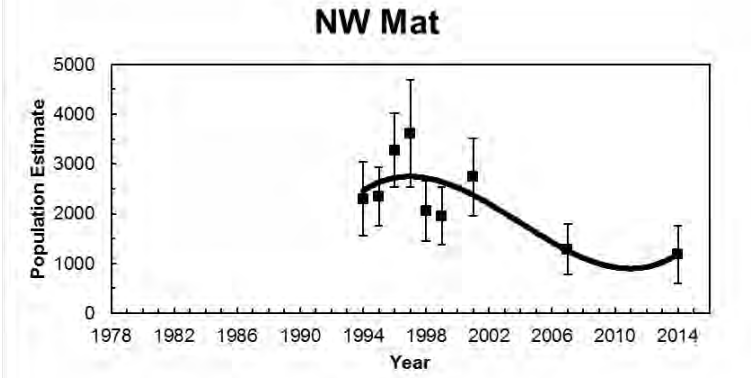

NW Mat
Population Estimate
16000
14000
12000
10000
8000
6000
4000
2000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

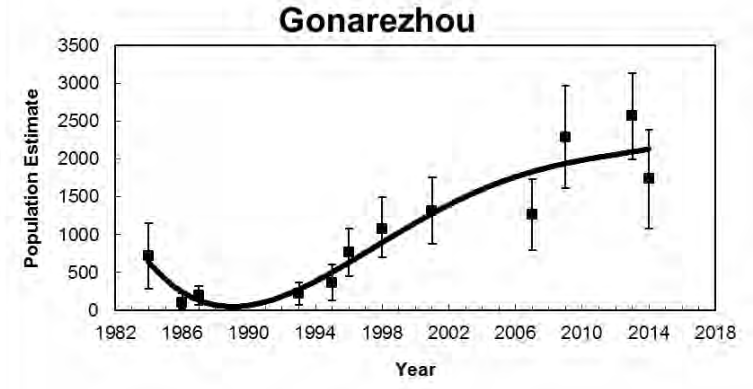

Gonarezhou
Population Estimate
600
500
400
300
200
100
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

Kudu

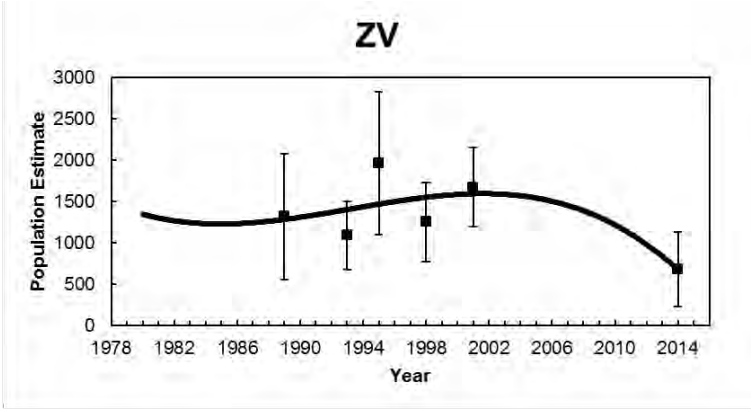

Sebungwe
Population Estimate
4000
3500
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

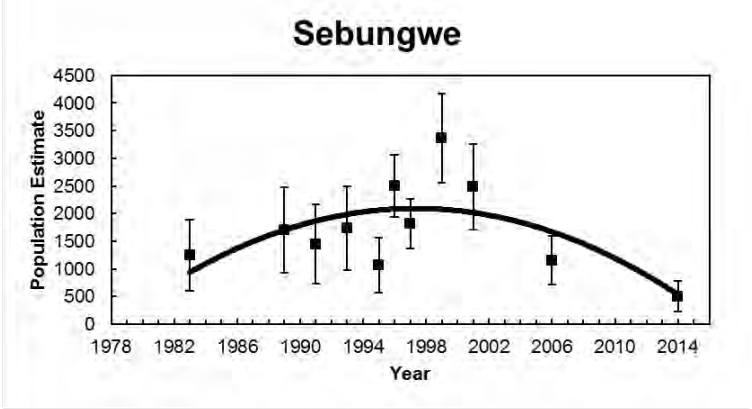

ZV
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

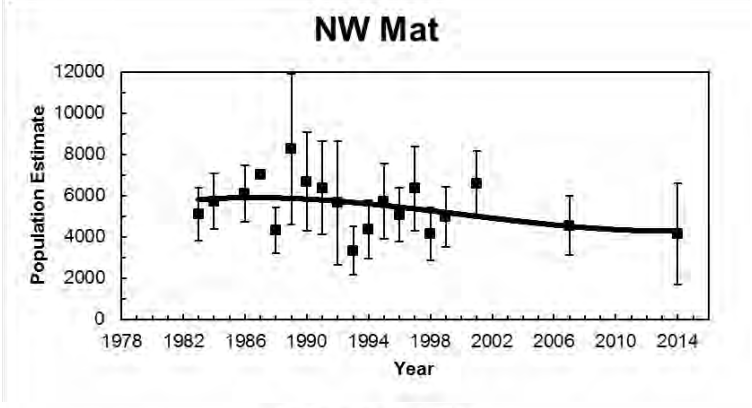

NW Mat
Population Estimate
5000
4000
3000
2000
1000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

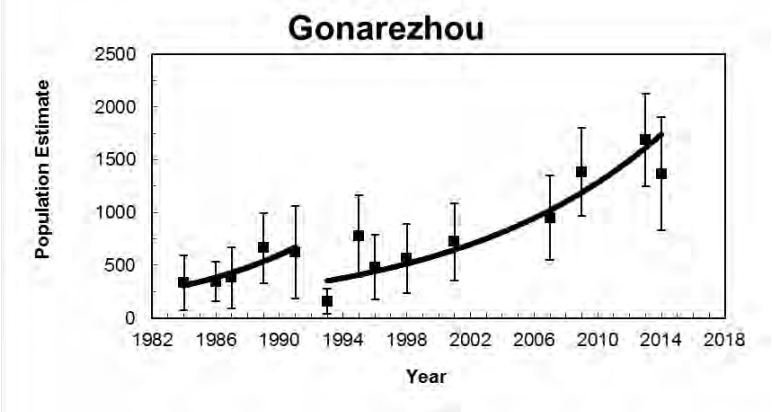

Gonarezhou
Population Estimate
3500
3000
2500
2000
1500
1000
500
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

Zebra

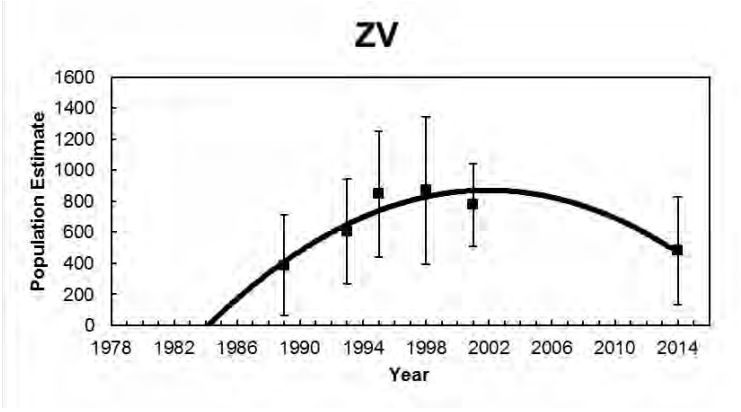

ZV
Population Estimate
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

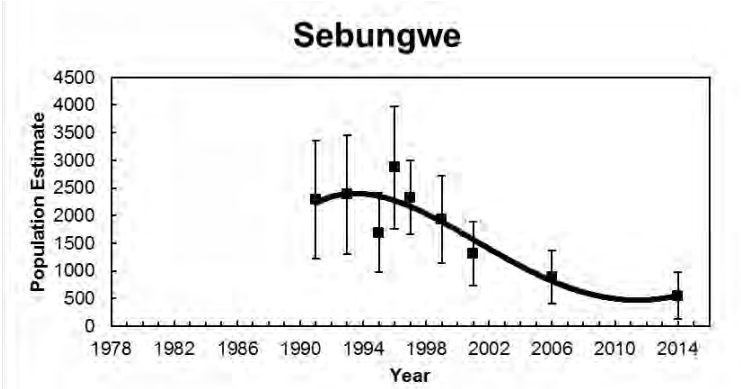

Sebungwe
Population Estimate
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

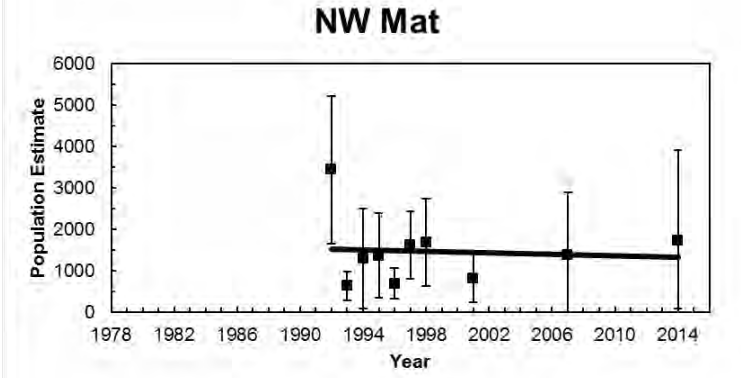

NW Mat
Population Estimate
12000
10000
8000
6000
4000
2000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

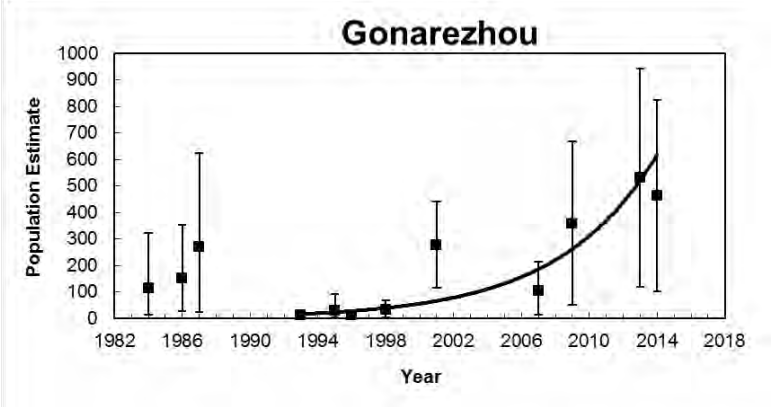

Gonarezhou
Population Estimate
2500
2000
1500
1000
500
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

Waterbuck


ZV
Population Estimate
1600
1400
1200
1000
800
600
400
200
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


Sebungwe
Population Estimate
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


NW Mat
Population Estimate
6000
5000
4000
3000
2000
1000
0
1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year


Gonarezhou
Population Estimate
1000
900
800
700
600
500
400
300
200
100
0
1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
Year

9 ASSESSMENT OF THE ENHANCEMENT AND NON-DETRIMENT FINDINGS

The assessment of the enhancement and non-detrimental findings for lion in Zimbabwe is presented here using the "IUCN SSC GUIDING PRINCIPLES ON TROPHY HUNTING AS A TOOL FOR CREATING CONSERVATION INCENTIVES. VER. 1.0. IUCN SSC (2012)" as a guide. Zimbabwe recognises the importance of these principles to guide and manage trophy hunting as a legal, regulated conservation activity which provides a critical tool to secure a sound social, economic and ecological conservation scenario.

Biological Sustainability: Trophy hunting can serve as a conservation tool when it:

	Principle	**Remarks**
1	***Does not contribute to long-term population declines of the hunted species or of other species sharing its habitat, noting that a sustainably harvested population may be smaller than an unharvested one***	Considering the latest available estimate of lion population size in Zimbabwe (1,800 – 2,000), trophy hunting harvests a yearly mean of 2.7% of adult male lions. This figure has decreased since the establishment of age restriction rules on lion hunting. This low offtake is sustainable and generates significant financial and other benefits to ZPWMA, Communities and Private Sector.
2	***Does not substantially alter processes of natural selection and ecosystem function; that is, it maintains "wild populations of indigenous species with adaptive gene pools." This generally requires that hunting offtake produces only minor alterations to naturally occurring demographic structure. It also requires avoidance of breeding or culling to deliberately enhance population-genetic characteristics of species subject to hunting that are inconsistent with natural selection***	Safari hunting in does not substantially alter natural selection or ecosystem processes. The limited quota, as further limited by age restrictions, ensures that hunting offtakes do not negatively affect natural processes. This age-based policy was adopted in part to mitigate any social or population impacts from limited safari hunting. (Whitman et al. 2004).
3	***Does not inadvertently facilitate poaching or illegal trade of wildlife***	Safari hunting in Zimbabwe does not facilitate poaching or illegal trade. Poaching and illegal trade in lion products is currently very low suggesting that the existence of licensed, regulated hunting is helping control poaching and not facilitating it. Hunting operators are in the frontlines against poaching, and are obligated through their concession lease agreements to assistance with anti-poaching. Operators spend significant resources on this, and work in close cooperation with the ZPWMA to combat all forms of illegal wildlife trade. Even where anti-poaching is not a legal prerequisite, operators fund their own anti-poaching teams and support government rangers and community scouts e.g. in Sengwa and Dande Safari Area

	Principle	Remarks
4	***Does not artificially and/or substantially manipulate ecosystems or their component elements in ways that are incompatible with the objective of supporting the full range of native biodiversity***	Hunting in Zimbabwe has created financial incentives for the development and retention of wildlife across Safari Areas, Forestry Areas, Communal CAMPFIRE Areas and private Conservancies thereby supporting biodiversity over 145,000km^2 where hunting is a primary land use. Hunting areas on private and communal land outside of the protected areas also serve as buffer zones for many national parks and safari areas which would be converted to other land uses if these were abandoned.

Net Conservation Benefit: Trophy hunting can serve as a conservation tool when it

	Principle	Remarks
1	***Is linked to identifiable and specific parcels of land where habitat for wildlife is a priority (albeit not necessarily the sole priority or only legitimate use); and on which the "costs of management and conservation of biological diversity [are] internalized within the area of management and reflected in the distribution of the benefits from the use"***	Zimbabwe has identified Safari Areas within the Parks Estates where maintaining habitats and wildlife populations is the priority. These gazetted protected areas cover approximately 17,000km^2 where, without safari hunting, it would be difficult to secure and maintain natural ecosystems and prey bases for lions. In addition to these areas, lion occur on 66% (approximately 11,000km^2) of the land set aside as Conservancies. The operational and law enforcement costs incurred by hunting companies on a yearly basis ranges from US$300,000 to US$500,000 per hunting concession, which includes the expense of camps, salaries, anti-poaching, fuel, community assistance, etc. Many of the government's costs of maintaining Safari Areas are transferred to the private sector through the obligations of their concession agreements. Revenues from hunting in communal CAMPFIRE areas are used to support a range of social services (e.g. schools, clinics, irrigation schemes etc.) while operators cover the costs of anti-poaching, maintenance and development, and contributions to communities living nearby (e.g. through boreholes, grinding mills etc.).

		In private hunting areas and conservancies, the costs and benefits of wildlife in the area are internalized and distributed within the area of management. Critically, most of the Conservancies have elected to manage and conserve endangered species, such as black rhino, and offset the costs of this by conducting sustainable hunting of lion and other key trophy species.
2	***Produces income, employment, and/or other benefits that generate incentives for reduction in pressures on populations of target species, and/or help justify retention, enhancement, or rehabilitation of habitats in which native biodiversity is prioritized. Benefits may create incentives for residents to co-exist with such problematic species as large carnivores, herbivores competing for grazing, or animals considered to be dangerous or a threat to the welfare of humans and their personal property***	Hunting produces direct and indirect income, employment, and other benefits that generate incentives that reduce the threats to wildlife populations. Approximately US$44 million accrued to the country from the revenues of trophy hunting over the last two years. This could have been 5% higher if it were not for restrictions on the export of elephant and lion trophies. This revenue pays for the daily wildlife conservation work in all sectors of the wildlife industry, including research projects, surveys, anti-poaching, and other services. Of this amount, approximately 20% is paid directly to the ZPWMA which is then used to support its management activities, including anti-poaching budgets. Local communities benefit from hunting income through leasing the right to hunt and the sale of trophy fees in CAMPFIRE areas as well as from voluntary contributions and meat. Over the last 6 years, payments from hunting operations generated approximately US$16 million. The nature of the hunting industry does not require large numbers of people to be employed. Nonetheless, the average hunting company employs approximately 80 people on a permanent basis and 20 on a seasonal basis. This equates to approximately 3,000 people who would not otherwise secure any form of employment because of the lack of opportunities in the remote areas where hunting takes place.
3	***Is part of a legally recognized governance system that supports conservation adequately and of a system of implementation and enforcement capable of achieving these governance objectives***	All wildlife species in Zimbabwe, including the African lion, are protected under the Parks and Wildlife Act of 1996 (Chapter 20:14) as amended by Act Number 19 of 2001 which came into operation on the 1st of June 2002 through a Statutory Instrument 144C of 2002. The Act that was originally passed by Parliament in 1975 was a unique move in Africa, if not globally, that promoted the rapid development of the country's wild life industry and lead to the partial

		extension of the principle to the Communal Lands through the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in the 1980s. The Act provided a legal basis for the devolution of Authority through granting Appropriate Authority Status to the communal areas to manage the wildlife resources for their own benefit. The Act was subsequently revised in 1996 and 2001 with the latest revision paving the way for the establishment of the current Parks and Wildlife Management Authority to replace the former Department of National Parks and Wild Life Management. Following the introduction of the Parks and Wild Life (General) (Amendment) Regulations, 1998 (No.2), i.e. Statutory Instrument 26 of 1998, the administration of the wildlife industry experienced increasing centralisation of controls on wildlife management and utilisation on alienated and communal land. The Parks and Wildlife Management Authority is mandated by the Parks and Wildlife Act [Chapter 20:14], with the responsibility of conserving Zimbabwe's wildlife heritage through effective, efficient and sustainable protection and utilisation of natural resources for the benefit of present and future generations. The Authority was established to allow it to retain the revenue that it generates to fund its operations and thereby reducing its dependence on Treasury. This entailed introducing a commercial dispensation and putting in place effective revenue generation and financial management systems. The ZPWMA has the mandate to manage the entire wildlife population of Zimbabwe, whether on state, private and communal land.

Socio-Economic-Cultural Benefit

	Principle	10 Remarks
1 1	***Respects local cultural values and practices (where "local" is defined as sharing living space with the focal wildlife species), and is accepted by (and preferably, co-managed and actively supported by) most members of the local community on whose land it occurs***	Zimbabwe has promoted the CAMPFIRE programme that requires safari operators to work closely with the Wards and villages in the concession areas how to use the contributions from hunting to implement community and infrastructure development and projects. There are currently 33 CAMPFIRE programmes in Zimbabwe but only 13 of these are dependent on income from hunting that is used to invest in conservation work and community development services.
2	**Involves and benefits local residents in an equitable manner, and in ways that meet their priorities**	The CAMPFIRE programme is the foundation upon which the community based conservation system in Zimbabwe is based, and is seen as one of the key components of rural development. The CAMPFIRE programme is critical in areas that are adjacent to the national parks and safari areas since they provide a means to support wildlife and critical habitats outside of the protected areas.
3	***Adopts business practices that promote long-term economic sustainability***	All Rural District Councils and Wards that support CAMPFIRE Programmes have established committees that have the authority to negotiate and enter into contracts with the private sector for both consumptive and non-consumptive agreements. Over the last 6 years, the six key CAMPFIRE districts have generated approximately $2,802,077/year. Hunters from USA contribute 51% and Europe 31% of this income. Income to Districts from a variety of wildlife related revenue streams is approximately $2,510,783/year, and 74% of this income is used to support general administrative and management costs, including law enforcement. At the Ward level,55% the income received (approximately $2.9 million/year) is used to support a variety of social services that benefit a large proportion of the local community.

Adaptive Management: Planning, Monitoring, and Reporting

	Principle	Remarks
1	***Is premised on appropriate resource assessments and/or monitoring of hunting indices, upon which specific quotas and hunting plans can be established through a collaborative process. Optimally, such a process should (where relevant) include local communities and draw on local/indigenous knowledge. Such resource assessments***	Zimbabwe implements an adaptive quota setting quota system that uses inputs from monitoring data and input from a variety of stakeholders including ZPWMA field and research staff, local communities, hunting operators, and independent biologists. Quotas are set based on population estimates or trend

	(examples might include counts or indices of population performance such as sighting frequencies, spoor counts) or hunting indices (examples might include trophy size, animal age, hunting success rates and catch per hunting effort) are objective, well documented, and use the best science and technology feasible and appropriate given the circumstances and available resources	analyses, monitoring data, hunt return data, research work and indices as may be reflected in various reports by field personnel. For lions, specifically, the ZPWMA together with the Safari Operators Association (SOAZ), the Zimbabwe Professional Hunters Association (ZPHGA) and invited independent scientists (such as Panthera) review the returns from the current hunting season and assign points as per the lion aging criteria. The overall quotas allocated and actual offtake have been reduced in recent years as a precautionary measure, including implementing moratoriums in some regions where lion densities have declined. These measures, i.e., age, population trends, maximum overall numbers and levels of utilisation has resulted in lower quotas thus underlining Zimbabwe's commitment to sustainable hunting.
2	***Involves adaptive management of hunting quotas and plans in line with results of resource assessments and/or monitoring of indices, ensuring quotas are adjusted in line with changes in the resource base (caused by ecological changes, weather patterns, or anthropogenic impacts, including hunting offtake)***	Quotas are set adaptively in line with the results of monitoring trends and on regulatory compliance. If an underage lion is harvested, the quota for that area is removed in the next season to allow the population to age and to penalize the non-compliance. In this way, Zimbabwe ensures responsible and sustainable offtakes that have limited impact on the lion population.
3	***Is based on laws, regulations, and quotas (preferably established with local input) that are transparent and clear, and are periodically reviewed and updated***	Safari hunting in Zimbabwe is regulated through the National Parks and Wildlife Act and supporting Regulations that specify when, where and how animals are hunted. Both the professional hunters and the hunting client are licensed in terms of these regulations, and all returns are lodged electronically and tracked through the Reserve Bank TRAS-2 system. As described above, quotas are established in a transparent and participatory way.
4	***Monitors hunting activities to verify that quotas and sex/age restrictions of harvested animals are being met***	The monitoring of the lion hunting is carried out through the implementation of a specific database and a specific safari return form. All hunting permits issued by (and compulsorily returned to) the ZPWMA are registered on a specific database that has been developed under the auspices of the Exchange Control Division of the Reserve Bank that records all parameters related to hunting safaris, including records of lion hunting. The database is accessible to the ZPWMA who can extract reports on all lion hunting activities for all areas in the country.

		Since 2013, all professional hunters conducting lion hunting safaris are required to fill in the return form for both successful and unsuccessful safaris that captures a broad range of general information on the safari (client name, duration, date, payments etc. For the successful lion hunting safaris, additional information related to hunting effort and success, trophy skull measures (total length and width) and specified photographs are taken of the physical features (mane etc.) and upper and lower jaws. These return forms and trophy photographs are compulsory. No CITES export permit can be issued without compliance. All data forms are reviewed by the ZPWMA together with a committee appointed by the SOAZ and ZPHGA to ensure the offtakes and subsequent exports are not detrimental to the survival of the species. Zimbabwe also requires that a ZPWMA ranger accompany all lion safaris both on state land and private land.
5	***Produces reliable and periodic documentation of its biological sustainability and conservation benefits (if this is not already produced by existing reporting mechanisms).***	The Exchange Control Division of the Reserve Bank publishes a detailed report that summarises all data related to sport hunting. This includes country of origin of clients, gross income from daily rates and trophy fees (by company), average trophy and safari values, and the contribution of key species to the overall income generated through hunting. The ZPWMA also produces annual reports that highlight the performance of the hunting industry, listing the challenges that it faces. It also submits periodic reports to CITES.

Accountable and Effective Governance

	Principle	**Remarks**
1	***Is subject to a governance structure that clearly allocates management responsibilities***	The governance structure is described in the Parks and Wildlife Act and its subsidiary regulations that clearly provides for institutional arrangements and administration defining the management responsibilities within the relevant Government Authority.
2	***Accounts for revenues in a transparent manner and distributes net revenues to conservation and community beneficiaries according to properly agreed decisions;***	The equitable distribution of costs and benefits take into consideration the role of stakeholders in relation to the land category. Benefit sharing to communities under the CAMPFIRE programme is determined through an approved ratio that

		channels 55% of all income from hunting to the Ward level. This institution is monitored at the local level by the Rural District Councils that guide Ward Wildlife Committees with respect to community projects and services. At national level this is monitored by Ministry of Rural Development, Preservation and Promotion of Culture and Heritage Safari operators contribute substantially and voluntarily, over and above the prescribed fixed contribution, especially where this involves anti-poaching efforts and community developments. They provide funding, equipment and the technical expertise for repairs, transportation, and other social services (schools, boreholes). In addition, hunting companies collaborate with both ZPWMA and District anti-poaching teams to remove snares, participate in serious wildlife crime investigations and arrest poachers.
3	***Takes all necessary steps to eliminate corruption;***	Anti-corruption efforts in Zimbabwe are governed by the following legislation: • The Prevention of Corruption Act (1983); • Public Service Act (1995); • The Ombudsperson Amendment Act (1997); • Anti-Corruption Commission Bill (2004); • The Criminal law (Codification and Reform) Act (2004); • Bank Use Promotion and Suppression of Money Laundering Act (2004); • Criminal Procedure and Evidence Amendment Act (2004); and • Criminal Law (Codification and Reform) Act of 2006 The Zimbabwean Anti-Corruption Commission (ACC) was established after the passing of the Anti-Corruption Commission Bill in June 2004. The Commission is a signatory to the Southern Africa Development Community (SADC) Protocol as well as the African Union (AU) and United Nations Convention on Anti-Corruption.
4	***Ensures compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.***	The CITES Management Authority of Zimbabwe, the ZPWMA, ensures compliance of safari hunting to CITES guidelines and provisions.

11 REFERENCES

Bauer, H. Chardonnet, P. and Kristin Nowel, l. 2005. Status and distribution of the lion (*Panthera leo*) in East and Southern Africa. Background paper for the East and Southern African Lion Workshop, Johannesburg, 2006. IUCN, Pretoria.

Bauer, H. and Van der Merwe, S. 2004. Inventory of free-ranging lions *Panthera leo* in Africa. 26–31 pp. Available at: WOS:000220283600007.

Bauer, H., Chapron, G., Nowell, K., Henscheld, P., Funston,P.,Hunter, L.T.B., Macdonald, D.W. and Packer, C. 2015. Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas. www.pnas.org/cgi/doi/10.1073/pnas.1500664112

Begg, C. and Begg, K. 2008. Trophy monitoring of lion and leopard trophies in Niassa National Reserve, Mozambique: 2007 hunting season. Ratel Trust and SRN, Mozambique.

Chitauro. 2016. Status of the hunting sector in Zimbabwe. Internal report prepared by the Director of Exchange Control om behalf of the Reserve Bank of Zimbabwe. Unpublished.

Creel, S. and Creel, N.M. 1997. Lion density and population structure in the Selous Game Reserve: evaluation of hunting quotas and offtake. Afr. J. Ecol. Volume 35, pages 83 - 93

Crosmary, W.G., Loveridge, A.J., Ndaimani, H., Lebel, S., Booth, V., Côté, D. and Fritz, H. 2013. Trophy hunting in Africa: long-term trends in antelope horn size. Animal Conservation •• (2013) ••–•• © 2013 The Zoological Society of London.

Davidson, Z. and Loveridge, A. 2005. Population Estimation by Spoor Counts with Calibration Using Known Lion Density. Status report of the Gwaai ICA; Wildlife Conservation Research Unit, Oxford University.

Davidson, Z. and Romanach, S. 2007. Estimations of lion and hyena density in the Savé Valley Conservancy using two different census techniques: spoor transects and call-up stations. Report for SVC, WildCRU and University of Zimbabwe, TREP.

du Preez, B., Groom, R., Mufute, O., Mandisodza-Chikerema, R. and Booth, V. 2016. Sport-Hunting and Lion *Panthera leo* Conservation in Zimbabwe. Report prepared by the Bubiana Valley Conservation Research.

Dunham, K.M. Mackie, C.S. and Nyaguse, G. 2015a. Aerial Survey of Elephants and other Large Herbivores in the Zambezi Valley (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 118 pp.

Dunham, K.M., Mackie, C.S., Nyaguse, G. and Zhuwau, C. 2015b. Aerial Survey of Elephants and other Large Herbivores in north-west Matabeleland (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 126 pp.

Dunham, K.M., Mackie, C.S., Nyaguse, G. and Zhuwau, C. 2015c. Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 111 pp.

Dunham, K.M. & van der Westhuizen, H.F. 2015d Aerial Survey of Elephants and other Large Herbivores in Gonarezhou National Park and Save Valley Conservancy (Zimbabwe): 2014. Great Elephant Census, Vulcan Inc., Seattle, WA, USA. 115 pp.

Funston, P.J., Herrmann, E., Babupi, P., Kruiper, A., Jaggers, H., Masule, K. and Kruiper, K. 2001. Spoor frequency estimates as a method of determining lion and other large mammal densities in the Kgalagadi Transfrontier Park. (Book chapter).

Funston, P., Henschel, P., Hunter, L., Lindsey, P., Nowak, K., Vallianos, C. and Wood, K. 2016. Beyond Cecil: Africa's Lions in Crisis. Panthera and WildAid, New York and San Francisco.

Groom, R. 2008. Carnivore densities in the Savé Valley Conservancy; Results of the 2008 spoor survey. Report for Savé Valley Conservancy Technical Advisory Committee.

Groom, R. J. 2009. Carnivore Densities in Gonarezhou National Park: Results of the May/June 2009 Spoor Survey. Lowveld Wild Dog Project.

Groom, R.J. 2010. The abundance and conservation status of lions (*Panthera leo*) and spotted hyenas (*Crocuta crocuta*) in Gonarezhou National Park, Zimbabwe. Results of the 2010 call-up survey. African Wildlife Conservation Fund, unpublished report.

Groom, R.J., Funston, P.J. and Mandisodza, R. 2014. Surveys of lions *Panthera leo* in protected areas in Zimbabwe yield disturbing results: what is driving the population collapse? Oryx http://journals.cambridge.org.

Groom, R. J. and Watermeyer, J. 2015. Carnivore Densities in Gonarezhou National Park. Results of the 2015 Spoor Survey. Gonarezhou Predator Project

Groom, R. J. and Watermeyer, J. 2015a. Carnivore Densities in the Savé Valley Conservancy. Results of the 2015 Spoor Survey & Wild Dog Monitoring Project. African Wildlife Conservation Fund

Hayward, M. W., O'Brien, J., and Kerley, G.I.H., 2007. Carrying capacity of large African predators: predictions and tests. Biological Conservation, 139(1), 219-229.

IUCN/SSC. 2012. IUCN/SSC Guiding principles on trophy hunting as a tool for creating conservation incentives. Ver. 1.0. IUCN, Gland. http://cmsdata.iucn.org/downloads/iucn_ssc_guiding_principles_on_trophy_hunting_ver1_09aug2012.pdf

Loveridge, A.J. Searle, A.W., Murindagomo, F., Macdonald, F.W. 2007. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. Biological Conservation 134: 548 – 558

Lindsey, P. A., Balme, G., Becker, M., Begg, C., Bento, C., Bocchino, C., Dickman, A., Diggle, R. W., Eves, H., Henschel, P., Lewis, D., Marnewick, K., Mattheus, J., McNutt, J. W., McRobb, R., Midlane, N., Milanzi, J., Morley, R., Murphree, M., Opyene, V., Phadima, J., Purchase, G., Rentsch, D., Roche, C., Shaw, J., van der Westhuizen, H., van Vliet, N. and Zisadza-Gandiwa, P. 2015a. The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. FAO/Panthera/Zoological Society of London/WCS Report, Harare. 79 pages.

Lindsey, P., Taylor, W.A., Nyirenda, V., Barnes, L., 2015b. Bushmeat, wildlife-based economies, food security and conservation: Insights into the ecological and social impacts of the bushmeat trade in African savannahs. FAO/Panthera/Zoological Society of London/SULi Report, Harare. 58 pages.

Miller, J.R.B., Balme, G., Lindsey, P.A., Loveridge, A.J., Becker, M.S., Begg, C. Brink, H., Dolrenry, S., Hunt, J.E., Janssoni, I., Macdonald, D.W., Mandisodza-Chikerema, R.L., Cotterill, O.L., Packer, C., Rosengren, D., Stratford, K., Trinkel, M., White, P.A., Winterbach, C., Winterbach, H.E.K. and Funston, P.J. 2016. Aging traits and sustainable trophy hunting of African lions. Biological Conservation 201 (2016) 160–168.

Mills, M.G.L. , Biggs, H.C. and White, I.J. 1995. The relationship between rainfall, lion predation and population trends in African herbivores. Wildl. Res. 22: 75–88

Stander, P.E. (1998) Spoor counts as indices of large carnivore populations: the relationship between spoor frequency, sampling effort and true density. Journal of Applied Ecology, 35, 378-385

Seymour-Smith, J. L. and Loveridge, A. J. 2015. Mana Pools National Park Predator Survey July – October 2015.

Whitman, K.L., Starfield, A.M., Quadling, H. and Packer, C. 2007. Modeling the effects of trophy selection and environmental disturbance on a simulated population of African lions. Conservation biology: The Journal of the Society for Conservation Biology, 21(3): 591–601.

ZPWMA, 2006. Conservation Strategy and Action Plan for the Lion (*Panthera leo*) in Zimbabwe. Zimbabwe Parks and Wildlife Management Authority, Ministry of Environment and Tourism, Harare, Zimbabwe. 19 pages.

ZPWMA, 2014. Age Restrictions on Lion Trophies and the Adaptive Management of Lion Quotas in Zimbabwe.

ZPWMA, 2016. Hwange National Park Management Plan 2016 – 2016. Prepared by African Wildlife Foundation on behalf of the Zimbabwe Parks and Wild Life Management Authority, Harare.

12 APPENDICES

12.1 ANNEX I: SUMMARY OF NATIONAL PARKS ESTATE, FORESTRY, COMMUNAL AND PRIVATE LAND WHERE LION ARE KNOWN TO OCCUR

1. National Parks Estate

Type of Land	Name of Park	District	Area (hectares)	Presence of lion
NP	Chizarira	Binga	191,000	Yes
NP	Gonarezhou	Chiredzi	505,000	Yes
NP	Matusadonha	Nyaminyami	140,700	Yes
NP	Chimanimani	Chimanimani	17,110	No
NP	Mana Pools	Hurungwe	219,600	Yes
NP	Kazuma Pan	Hwange	31,300	Yes
NP	Hwange	Hwange	1,465,100	Yes
NP	Victoria Falls "A"	Hwange	1,904	No
NP	Victoria Falls "B"	Hwange	436	No
NP	Zambezi	Hwange	56,010	Yes
NP	Rhodes Nyanga	Nyanga	47,150	Migratory
NP	Rhodes Matopos	Matobo	42,400	No
Total Area National Parks (ha)			**2,717,710**	
Botanical Gardens	Pioneer Reserve	Beitbridge	38	No
Botanical Gardens	Tolo River Reserve	Beitbridge	44	No
Botanical Gardens	South Camp Reserve	Beitbridge	26	No
Botanical Gardens	Chisekera Hot Springs	Chiredzi	95	No
Botanical Gardens	Mawari Raphia Palm	Mt. Darwin	34	No
Botanical Gardens	Tingwa Raphia Pan	Mt. Darwin	290	No
Botanical Gardens	Haroni Forest	Chimanimani	20	No
Botanical Gardens	Rusitu Forest	Chimanimani	150	No
Botanical Gardens	Sebakwe Acacia Karoo	Kwekwe	60	No
Botanical Gardens	Sebakwe Great Dyke	Kwekwe	165	No
Botanical Gardens	Sebakwe Mountain Acacia	Kwekwe	53	No
Botanical Gardens	Mazowe "A"	Harare	43	No
Botanical Gardens	Mazowe "B"	Harare	3	No
Botanical Gardens	Bunga Forest	Mutare	495	No
Botanical Gardens	National Botanic Garden	Harare	67	No

Type of Land	Name of Park	District	Area (hectares)	Presence of lion
Botanical Gardens	Vumba Botanic Garden	Mutare	200	No
Botanical Gardens	Ewanrigg Botanic Garden	Goromonzi	286	No
Total Area of Botanical Gardens and Botanical Reserves:			**2,069**	
Sanctuary	Maninii Pan	Chiredzi	300	No
Sanctuary	Melsetter Eland	Chimanimani	1,800	No
Sanctuary	Mbaze Pan	Nkayi	40	No
Sanctuary	Nyamanyetsi (Nyamanechi)	Guruve	2,840	No
Sanctuary	Mushandike	Masvingo	12,900	No
Sanctuary	Rhodes - Bulawayo	Matobo	1,100	No
Total Area Sanctuaries			**18,980**	
Safari Area	Tuli	Beitbridge and Gwanda	41,600	Yes
Safari Area	Chete	Binga	108,100	Yes
Safari Area	Chipinga (Chipinge)	Chipinge	26,100	No
Safari Area	Malapati (Malipati)	Chiredzi	15,400	Yes
Safari Area	Chinsa	Gokwe	171,300	Yes
Safari Area	Hartley (Chegutu)	Chegutu	44,500	No
Safari Area	Charara	Kariba and Hurungwe	169,200	Yes
Safari Area	Hurungwe	Hurungwe	289,400	Yes
Safari Area	Doma	Makonde	94,500	Yes
Safari Area	Umfurudzi	Shamva	76,000	No
Safari Area	Dande	Guruve	52,300	Yes
Safari Area	Chelvore (Chewore)	Hurungwe	339,000	Yes
Safari Area	Sapi	Hurungwe	118,000	Yes
Safari Area	Deka	Hwange	51,000	Yes
Safari Area	Matetsi	Hwange	295,500	Yes
Total Area of Safari Areas:			**1,891,900**	
Recreational	Chibwatata	Binga	6	No
Recreational	Kavira	Binga	50	No
Recreational	Lake Kariba	Binga, Nyaminyami and Hwange	287,200	Yes

Type of Land	Name of Park	District	Area (hectares)	Presence of lion
Recreational	Ngezi	Kadoma	5,800	No
Recreational	Umfuli (Mfurudzi	Chegutu	12,700	No
Recreational	Lake Robertson (Manyame Lake)	Chegutu, Makonde and Harare	11,200	No
Recreational	Lake Cunningham	Insiza	4,172	No
Recreational	Chinhoyi Caves	Makonde	120	No
Recreational	Manjirenji	Zaka	3,400	No
Recreational	Bangala	Zaka and Masvingo	2,700	No
Recreational	Sebakwe	Kwekwe	2,600	No
Recreational	Robert McIlwaine (Chivero)	Harare	6,180	No
Recreational	Umzingwane	Umzingwane	1,233	No
Recreational	Kyle (Mutirikwi)	Masvingo	16,900	No
Recreational	Lake Matopos	Matobo	2,900	No
Total Area of Recreational Parks, Lakes and Dams			**357,161**	

Total Area National Parks (ha)	2,717,710
Total Area of Botanical Gardens and Botanical Reserves:	2,069
Total Area Sanctuaries	18,980
Total Area of Safari Areas:	1,891,900
Total Area of Recreational Parks, Lakes and Dams	357,161
Total Ha	**4,987,820**

2. Forestry Land

Land	Name	District	Area (ha)	Presence of lion
Forestry Areas	Fuller	Hwange	23,300	Yes
Forestry Areas	Panda Masuie	Hwange	33,500	Yes
Forestry Areas	Kazuma	Hwange	24,000	Yes
Forestry Areas	Mvutu	Hwange	2,100	No
Forestry Areas	Sikumi	Hwange	54,400	Yes
Forestry Areas	Gwayi	Lupane	144,265	Yes
Forestry Areas	Lake Alice	Lupane	39,000	No
Forestry Areas	Ngamo	Lupane	102,900	Yes

Land	Name	District	Area (ha)	Presence of lion
Forestry Areas	Chisengu	Lupane	4,006	No
Forestry Areas	Glencoe	Lupane	2,050	No
Forestry Areas	Lionhills	Lupane	2,747	No
Forestry Areas	Martin (i)		400	No
Forestry Areas	Martin (ii)		4,400	No
Forestry Areas	Mudima		6,355	No
Forestry Areas	Nyambewa		5,484	No
Forestry Areas	Tandai		5,450	No
Forestry Areas	Tarka		4,343	No
Forestry Areas	Gwampa	Nkayi	47,000	No
Forestry Areas	Chesa	Nkayi	14,250	No
Forestry Areas	Inseze	Nkayi	35,200	No
Forestry Areas	Inseze Extension	Nkayi	8,400	No
Forestry Areas	Umgusa	Nkayi	32,200	No
Forestry Areas	Umzibani	Nkayi	2,471	No
Forestry Areas	Kavira	Binga	28,200	Yes
Forestry Areas	Mzolo	Binga	67,200	No
Forestry Areas	Sijarira	Binga	25,600	Yes
Forestry Areas	Bembesi	Binga	55,100	No
Forestry Areas	Molo	Binga	2,900	No
Forestry Areas	Mtao	Chirumanzu	8,170	No
Forestry Areas	Chirindu	Chirumanzu	950	No
Forestry Areas	Gungunyana	Chirumanzu	1,650	No
Forestry Areas	Mafungabusi	Chirumanzu	82,100	No
Forestry Areas	Mudzongwe	Chirumanzu	1,420	No
Forestry Areas	Ungwe	Chirumanzu	567	No
Forestry Areas	Nyangu	Chirumanzu	16,600	No
Forestry Areas	York	Chirumanzu	1,455	No
Forestry Areas	Banti	Mutare	2,219	No
Forestry Areas	Stapleford	Mutare	24,600	No
Rhodes Estate	Erin	Nyanga	10,700	No
Rhodes Estate	Sauerdale North	Nyanga	214	No

Land	Name	District	Area (ha)	Presence of lion
Total Forest Areas (ha)			**927,866**	

3. CAMPFIRE Districts

District	Natural Region	Total Area (km^2)	Area of CF Wards (km^2)	Number of Wards	CF Wards	District Pop (persons)	Presence of lion
Beitbridge	5	12,935	4,595	21	6	80,946	Migratory
Binga	3,4&5	12,308	7,930	27	21	87,802	Migratory
Bubi	4	5,547	88	12	2	36,614	Migratory
Bulilimamangwe	4&5	12,574	1,530	33	10	156,641	Migratory
Chaminuka	2a,2b,3,4&5	2,752	380	26	2	94,047	No
Chimanimani	1,2a,3,4&5	3,419		28		110,836	No
Chipinge(Gazaland)	1,2a,3,4&5	5,223	408	33	2	336,893	Migratory
Chiredzi(Gaza Khomanani)	5	17,748	3,633	32	9	183,228	Yes
Chiweshe(Mazowe)	2a	4,482	375	29	5	198,319	No
Gokwe North	3,4&5	7,359	2,523	25	4	164,558	Migratory
Gokwe South	3&4	11,138	1,308	28	6	238,581	Migratory
Goromonzi	2a	2,504		26		147,126	**No**
Mbire (Guruve)	2a,3&4	7,810	4,215	28	14	135,637	Yes
Gwanda	4&5	10,792	2,283	23	6	112,984	No
Hurungwe	2a,3,4&5	19,895	2,793	40	9	246,902	Yes
Hwange	4&5	29,934	4,021	27	15	71,707	Yes
Hwedza	2b&3	998				69,981	No
Kusile(Lupane)	3&4	7,780	2,885	24	11	94,469	Migratory
Marondera	2a&2b	3,554		24		104,601	No
Matobo	4&5	7,278	1,233	26	4	89,281	No
Mudzi	4	4,222	1,009	18	2	109423	No
Mutoko	2b,3&4	4,052		29		122,941	No
Muzarabani	2a,3&4	4,322	2,540	17	9	69,851	Migratory
Mwenezi	4&5	12,933		31		101,354	Migratory
Nkayi	4	5,333	2,628	23	6	113,302	Migratory
Nyaminyami(Kariba)	4&5	6,327	3,532	16	11	27,717	Yes
Nyanga	1,2b,3&4	5,738	253	37	1	128,439	Migratory
Pfura(Mt. Darwin)	2a,2b,3&4	1,771				164,362	No
Rushinga	3&4	2,408		17		75,332	No
Tsholotsho	4	7,823	5,354	20	8	111,828	Yes
UMP Zvataida	2b,3&4	2,682	619	15	2	86,302	No
Umzingwane	4	1,074				62,954	No

District	Natural Region	Total Area (km²)	Area of CF Wards (km²)	Number of Wards	CF Wards	District Pop (persons)	Presence of lion
Zivagwe	4	2,363				65,752	No
TOTAL/AVERAGE		247,078	56,135	735	165	4,000,710	

4. Conservancies

	Name of Conservancy	District	Area (hectares)	Presence of lion
Conservancies	Malilangwe	Chiredzi	40,000	Yes
Conservancies	Save	Chiredzi	344,200	Yes
Conservancies	Chiredzi River	Chiredzi	28,500	No
Conservancies	Bubye Valley	Matabeland South	374,000	Yes
Conservancies	Bubiana	Matabeland South	130,000	No
Conservancies	Gwayi	Hwange	150,897	Migratory
Conservancies	Midlands Black Rhino	Midlands	85,000	No
Other	Matetsi Farms	Hwange	155,627	Migratory
Total Area of Conservancies			**1,308,224**	

12.2 ANNEX II: SUMMARY OF PRIMARY LEGISLATION AND REGULATIONS

12.2.1 The Policy for Wild Life of 1992

This policy provides for Government to maintain a protected area network known as the Parks and Wild Life Estate for the conservation of the nation's wild resources and biological diversity. According to the policy, government will use the Estate to promote a rurally based wild life industry and will harmonise the management of the Estate with the efforts of neighbouring communities that are developing wild life as a sustainable form of land use. The policy vests executive responsibility for the Parks and Wildlife Estate in the Department of National Parks and Wild Life Management (DNPWLM). It provides for the following categories of protected area: National Park; Safari Area; Sanctuary; Recreational Park, Botanic Reserve and Botanic Garden.

- The objectives of the Parks and Wild Life estate will be to:
- Preserve representative samples of Zimbabwe's aquatic and terrestrial flora and fauna and their physical environments;
- Protect areas of scenic beauty and special interest;
- Preserve rare, endangered and endemic species;
- Conserve water catchments;
- Provide opportunities for public education and the advancement of scientific knowledge;

and, without prejudice to any of the above:

- Encourage public use related to the enjoyment and appreciation of these areas; and
- Generate economic activity within the Estate and surrounding areas to enhance rural development.

The policy commits the DNPWLM to an adaptive management strategy in which research and monitoring are incorporated as integral components of management. It states that where sport

hunting is an objective in a protected area, quotas will be set to the maximum sustainable level at which trophy quality can be maintained and the hunting can be marketed. In terms of the policy the emphasis of tourism in parks should be low density and high quality tourism. An EIA must be carried out for major developments such as construction of roads, powerlines, buildings or dams.

With respect to Wildlife Conservation, the Policy states that the Government of Zimbabwe aims to encourage the conservation of wild animals and their habitats outside the Parks and Wild Life Estate recognising that this is only likely to be successful if wild life can be used profitably and the primary benefits accrue to people with wild life on their land. "*Recognising that much of Zimbabwe does not consist of good arable land, Government regards wild life management in all its diverse forms as a legitimate land use which may be the most appropriate or highest-valued form of development in many areas*". The policy also states that Government will take the necessary legal and enforcement measures to prevent the illegal use of wildlife.

Addressing community rights to natural resources the Policy states that government intends to "*transform land use in remote communal areas through its Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), under which rural peoples have the authority to manage their wild life and other natural resources and benefit directly from so doing*". Further government will "*ensure that wildlife is not undervalued to the people living with it by permitting them to use it sustainably for their own gain as they are able to do with other natural resources and agricultural products*".

The policy states that the mechanism for communities to gain rights over wild life will be through the granting of Appropriate Authority to Rural District Councils (under the Parks and Wildlife Management Act of 1975). For this authority to be granted, the Minister will require:

1. An acceptable management plan from councils in which objectives for wild life are stated and preliminary intentions for achieving these objectives are outlined;
2. An acceptable institutional plan which outlines clearly the methods by which councils intend a) to involve wild life producer communities in district level management and b) to devolve the decision-taking process in local wild life management and the distribution of wild life benefits to producer communities;
3. The department to assist councils in managing their wild life and to coordinate the activities of NGOs who are assisting councils;
4. The approval by the department of all annual quotas of wild life killed or sold in communal lands during the interim period while councils develop their management capacity;
5. The presentation of annual reports from Councils to the Director and to their constituents detailing the year's performance in wild life management in their district.

The policy provides for the Minister to withdraw Appropriate Authority from a council not conforming to conditions and objectives under which it was granted.

12.2.2 Wildlife Based Land Reform Policy

In 2004 there was a move to revise the Policy for Wildlife to cater for the Land Reform programme. The revised policy, known as the Wildlife-Based Land Reform Policy, has not however been formally accepted by Government. Nonetheless, it is important to summarise what was envisioned at that time since this has influenced the way the management of wildlife outside of the Parks Estate has unfolded.

The vision of this reformed policy is to ensure profitable, equitable and sustainable use of wildlife resources, particularly in areas where agricultural potential is limited. It states that "*the policy has*

been developed in the context of Zimbabwe's Land Reform Programme and is underpinned by recognition that wildlife is a viable land-use option, that it can facilitate attainment of equity objectives and that it is feasible. This policy is complemented by existing natural resources legislation and the state protected area system."

The policy also states that the key issues that were taken into consideration were:

- The State will continue to make provision for wildlife management outside the protected area system, including setting aside certain core zones for wildlife production. Wildlife should be the only permitted primary land use option in these areas.
- Outside core zones, wildlife production, amongst other land use options, will be encouraged. The most profitable and ecologically sustainable land use option must be allowed to evolve in response to changing economic influences, notwithstanding the need to ensure food security in these areas.
- The scale of wildlife operations must be allowed to vary from intensive to extensive, depending on agro-ecological settings.
- All beneficiaries of wildlife operations, whether individually or jointly, must equitably share the costs of production.
- Wildlife management responsibility and authority must be devolved to the most appropriate level for efficient resource management and production incentives must be maximized for landholders.
- Security of tenure over resources is key to successful wildlife-based land reform. These core areas should be identified.

The aims of the Wildlife-Based Land Reform Policy are listed as:

1. To facilitate the indigenisation of the wildlife sector and to ensure more equitable access by most Zimbabweans to land and wildlife resources and to the business opportunities that stem from these resources.
2. To maintain a proportion of land outside state protected areas under wildlife production.
3. To enhance diversity of land uses through wildlife production.
4. To promote secure and equitable tenure.
5. To develop and implement appropriate institutional arrangements for wildlife-based land reform.

The policy recognized that wildlife production can be at different scales, which are dependent on several factors that include the type of wildlife, management regime and ecological conditions. Three categories are highlighted in the policy:

1. Intensive production systems with captive or semi-captive species such as crocodiles and ostriches (1 – 100 hectares).
2. Semi-intensive to semi-extensive production systems with free-ranging "plains game" populations (1,000 to 10,000 hectares).
3. Extensive production systems incorporating "big game" populations (over 10,000 hectares).

The Wildlife Based Land Reform Policy promotes two land redistribution models:

1. A state leasehold approach which is based on the reallocation of leasehold leases.
    a. This approach entails the acquisition of the entire land-holding with compensation for infrastructure, wildlife, etc.,

   b. The land will be reallocated to lessees under terms and conditions that will ensure sustainable wildlife management, on-going investment and capacity-building in that area.
2. A corporate equity model that involves transfer of shares within a land-owning company.
   a. The transfer of shares will be in accordance with the Indigenisation goals and sound business principles;
   b. Proposals from stakeholders must outline realistic ways in which new entrants can increase their shareholdings well beyond an initial level, over a reasonable time scale.
   c. The proposals must make provision for immediate allocation of shareholdings to new participants.

The Policy document also acknowledges that the two approaches can be applied in combination and shall be considered on a case by case basis, and that the State may from time to time consider other approaches that meet the objectives of the Wildlife Based Land Reform Policy.

12.2.3 Parks and Wild Life Act Chapter 20:14 of 1996 as amended in 2001:

This is the pivotal Act with respect to wildlife management in Zimbabwe. The Act includes the following sections:

1. Parks and Wildlife Board
2. Parks and Wildlife Estate and Parks and Wildlife Land
3. National Parks
4. Botanical Reserves and Botanical Gardens
5. Sanctuaries
6. Safari Areas
7. Recreational Parks
8. Specially Protected Animals
9. Specially Protected Indigenous Plants
10. Indigenous plants
11. Hunting, removal, viewing and sale of animal products
12. Protection of animals and Indigenous plants on alienated land
13. Fish Conservation
14. Evidence, prevention and detection of offences and additional penalties and forfeitures
15. Inspectors, Officers, employees and advisory committees
16. General

The Act also defines the different types of land (Alienated land):

a. “Private Land” means land the ownership of which is vested in any person other than the President.
b. “State Land” means land vested in the President other than Communal Land or trust land vested in the President.
c. “Trust land” means any land, other than Communal land held in trust by the President or a statutory body or by a person, whether solely or jointly with others, by virtue of his being the holder of some office in a statutory body.

The Parks and Wildlife Act of 1975 (as amended) states that the purposes of National Parks are:

1. To preserve and protect the natural landscape and scenery.
2. To preserve and protect wild life and plants and the natural ecological stability of wild life and plant communities for the enjoyment, education and inspiration of the public.

Establishment of Protected Areas: The Act enables the President to declare National Parks on State land or Trust Land if the trustees give their consent (Section 22). The Act enables the Minister acting on the authorisation of the President to acquire land for the Parks and Wild Life Estate either compulsorily or by agreement in terms of the procedures contained in the Communal Land Act and the Land Acquisition Act. The Act gives the Minister the power to manage National Parks, control entry and authorise or restrict certain activities and carry out various conservation measures. The Act provides for the provision of facilities and services for tourists in National Parks or to lease out such facilities or services. The Act allows the Minister to issue a permit for hunting in National Parks.

The Act makes provision for the establishment of Botanical Reserves and Botanical Gardens (Section 26) on State Land or Trust Land for the preservation and protection of rare or endangered indigenous plants or representative plant communities for the enjoyment, education and benefit of the public.

A third category of protected area is a Sanctuary which may be established by the President on State Land or Trust Land (Section 31) to afford special protection to all animals or a particular species of animal in the sanctuary for the enjoyment and benefit of the public. The Minister may provide tourism facilities and services in a Sanctuary or lease facilities or services. The Minister may also issue permits for hunting or the removal of game from a sanctuary for certain purposes.

In terms of the Act the President may establish Safari Areas on State Land or Trust Land as part of the Parks and Wild Life Estate (Section 36) for the preservation and protection of the natural habitat and the wild life in these areas in order that facilities and opportunities may be afforded to the public for camping, hunting, fishing, photography, viewing of animals, bird watching and similar activities. The Minister may lease sites in safari areas for various purposes and may grant hunting or other rights. Hunting or removal of wildlife in a safari area may only take place with a permit.

The fifth category of protected area provided for by the Act is a Recreational Park (Section 41), which may be established by the President for the purpose of preserving and protecting the natural features for the enjoyment, benefit and recreation of the public. The Minister may designate areas within Recreational Parks which can be alienated or leased for the provision of tourism facilities and services.

Prospecting and mining are prohibited in National Parks, Botanical Reserves, Botanical Gardens, Sanctuaries or Recreational Parks without a permit issued by the Minister and with the consent of the Minister of Mines (Section 119). The Environmental Management Act of 2002 also makes provision for land to be acquired by the State for conservation purposes. According to Section 109 the President may acquire land or set land aside for the improvement or proper management of the environment. In the absence of an agreement with the land owner the President may acquire the land in accordance with the procedures under the Land Acquisition Act. The President may set aside any area of Communal Land for the conservation or improvement of natural resources or for the protection of irrigation works or sources of water supplies provided that no such area shall be set aside until the Minister responsible for the administration of the Communal Land Act is satisfied that suitable provision has been made elsewhere for the inhabitants who will be affected by the setting aside of the area (Section 110).

Specially Protected Animals and Plants: The Act makes provision for the Minister to declare certain animals as specially protected (Section 44). In terms of the Act, no-one may hunt, have in their possession, or sell a live specially protected animal or the meat or trophy from such an animal without a permit. The trophy of any specially protected animal must be surrendered to the state if not obtained by a permit. The Act specifies the purposes for which the Minister may issue a permit for use of

specially protected animals (Section 46), but provides the Minister with some flexibility as he/she may issue a permit for any purpose which in the opinion of the Minister is in the interests of the conservation of animals.

The Act also makes provision for the declaration of specially protected indigenous plants (Section 49). No person may pick a specially protected plant without a permit, although the owners or occupiers of land or a person acting under their authority may pick a specially protected plant for cultivation, forestry, building construction or the construction of roads and other infrastructure. No person may sell a specially protected plant without a permit unless the person is a recognised dealer in specially protected indigenous plants or a member of a recognised horticultural society and the purchase is from a member of the same or other recognised society. The Act specifies the purposes for which the Minister may issues permits for the picking or sale of specially protected indigenous plants. The Act also stipulates that no person may pick or sell indigenous plants without a permit (Section 55) provided that the appropriate authority for any land may pick or sell or authorise others to pick or sell indigenous plants (Section 56). If the Minister deems it necessary for the conservation of an indigenous plant, the Minister may prohibit the picking or selling of that plant (Section 57).

Hunting and removal of animals: The Act prohibits hunting, removal of an animal or any part of an animal or the sale of an animal without a permit unless by an appropriate authority for the land (Section 59), which is the owner of freehold land, a Rural District Council on communal land, the Forestry Commission on state forests and the DNPWLM on the parks and Wildlife Estate. The appropriate authority for the land may issue permits to others to use the wild life (except for specially protected species). If the Minister deems it necessary for the conservation of a animal, he/she may prohibit the hunting or removal of such animals in a specific area (Section 60) and may serve a notice to prohibit a specific person from hunting, conducting photographic tourism, or being in the possession of a weapon used for hunting save for self-defence. The Minister does not have to give reasons for such prohibitions. The Act enables the killing of an animal without a permit for self-defence (Section 61).

The Act prohibits anyone from conducting of hunting or photographic safaris within the parks and wild life estate or on forest land without holding a professional hunter's licence or a professional guide's licence (Section 65). No person may manufacture an article from a trophy, process a trophy or sell or otherwise dispose of a trophy or an article manufactured from a trophy from an animal that has been hunted in contravention of the Act (Section 73).

If the Minister believes it in the interests of conservation, he/she may declare any animal that is not a specially protected animal as a protected animal and any indigenous plant that is not a specially protected plant as a protected plant (Section 77) on alienated land within the area of an environment committee established in terms of the Environmental Management Act of 2002 and the Rural District Councils Act of 1988. No person may, without a permit, hunt an animal or pick an indigenous plant that has been declared protected. The Minister may also restrict the extent of hunting animals or picking of indigenous plants on alienated (private freehold) land in the area of an environment committee if the Minister believes that the hunting of animals or picking of plants is unsustainable. The Minister may authorise an environment committee to reduce the numbers of problems animals on any alienated land within its area if the number of such animals is sufficient to cause excessive damage or nuisance. Section 79 gives environment committees the power to restrict hunting on alienated land if it believes that hunting is unsustainable.

The Minister may declare any person to be the appropriate authority for any waters (Section 83) and may declare controlled fishing waters (Section 84) for which the Minister may make regulations for

the control, regulation, restriction of prohibition of fishing. Unless the Minister designates areas of water where a permit is not required, no-one except the appropriate authority for that water may fish in any water without a permit. Section 87 regulates the means of fishing by prohibiting the use of explosives, firearms and poisons. Section 88 controls the introduction into any water of fish and plants that are not native to that water. No-one except the appropriate authority for a water may fish commercially and sell the fish without a permit (Section 90). The minister may ban fishing by specific persons in any area in the interests of conservation (Section 96).

Enforcement: The Act provides for the powers of conservation officials, and police officers in relation to enforcing the Act. It provides for penalties for various offences and for the Minister to make regulations on a wide range of issues and activities. The Act provides for the highest penalties to be awarded for the unlawful killing of a rhinoceros or other specially protected game specified by the Minister in an
official notice and for the unlawful possession or trade in rhino horn, ivory or the trophy of any other specially protected animal specified by the Minister in an official notice (Section 128).

The Environmental Management Act of 2002 provides the Minister responsible for the Environment to regulate the use of wetlands. In terms of Section 113 of the Act the Minister may declare any wetland to be an ecologically sensitive area and may impose limitations on development in or around such area. Further, no person may without authorisation in terms of the Act:

a. reclaim or drain any wetland;
b. disturb any wetland by drilling or tunnelling in a manner that has or is likely to have an adverse impact on any wetland or adversely affect any animal or plant life therein;
c. introduce any exotic animal or plant species into the wetland. Section 114 enables the Minister to serve an order on the owner, occupier or user of land under which they must take measures, construct such works or refrain from specific activities in order to protect the environment.

Biological Diversity: Further the Act enables the Minister to take such measures as may be necessary for the conservation of biological diversity and the implementation of Zimbabwe's obligations under the United Nations Convention on Biological Diversity adopted in 1992 and may, in so doing (Section 116):

a. identify the components of the biological diversity of Zimbabwe;
b. determine the components of biological diversity which are threatened with extinction;
c. prepare and maintain an inventory of the biological diversity of Zimbabwe;
d. determine actual and potential threats to the biological diversity and devise such measures as are necessary for preventing, removing or mitigating the effect of those threats;
e. devise measures for better protection and conservation of rare and endemic species of wild fauna and flora;
f. develop national strategies, plans and programmes for the conservation of the biological diversity of Zimbabwe;
g. promote the integration of conservation and sustainable use of biological diversity into relevant sectoral policies, plans and programmes;
h. require in writing any developer, including the government, to integrate the conservation and sustainable utilisation of the biological diversity in any project the implementation of which has or is likely to have detrimental effects to the biological diversity of Zimbabwe;
i. protect indigenous property rights of local communities in respect of biological diversity with scientific knowledge;

j. support the integration of traditional knowledge on conservation of biological diversity with scientific knowledge;
k. prohibit or restrict access by any person to or the exportation of any component of the biological diversity of Zimbabwe.

The Minister may also take such action or measures as may be necessary for the conservation of the biological diversity of a specific locality and may:

a. promote such land use methods as are compatible with the conservation of the biological diversity of that locality;
b. select and manage environmental protection areas for the conservation of the various terrestrial and aquatic ecological systems;
c. establish and manage buffer zones near environmental protection areas;
d. prohibit or control the importation of and introduction into the wild of exotic animal and plant species;
e. identify, promote and integrate traditional knowledge into the conservation and sustainable utilisation of the biological diversity of that locality; and
f. determine special measures for the protection of species, ecosystems and habitats faced with extinction.

Community rights to natural resources: The Act provides for land holders to acquire rights over wildlife through the granting of "appropriate authority" status. Thus, the owners of private freehold land are deemed to be the appropriate authority over wildlife on their land (Section 2). Communities acquire rights over wildlife through Rural District Councils (RDCs). A 1982 amendment to the Act provides for the Minister to appoint an RDC as the appropriate authority for wild life on the communal land within the jurisdiction of the RDC (Section 108). The Act states that no person may hunt any animal on any land or remove any animal or part of an animal except in term of a permit issued by the appropriate authority for that land [Section 59(2)]. The appropriate authority may hunt any animal on the land, remove any animal or part of an animal from the land and may issue permits to others to hunt or remove animals from the land. RDCs are then expected to apply the guidelines contained in the 1992 Wildlife Policy to devolve the decision-taking process in local wild life management and the distribution of wild life benefits to producer communities (i.e. smaller and more localised groups of people with wildlife on their land). Further policy guidelines state that RDCs
are expected to distribute a percentage of income derived from wildlife use to producer communities and to allow these communities to be responsible for several wildlife management activities. Because of the existing administrative system of local government, producer communities had to be represented by Ward Development Committees (WADCOs) and Village Development Committees (VIDCOs) which are advisory bodies to Councils.

In this way, various legal entities are granted authority over wildlife outside the Parks Estate. These authorities include private land-owners (where the land is held under an agreement of purchase or lease), forest land (such as Forestry Commission estates). For Communal Land, the Rural District Councils (RDC) may be appointed the Appropriate Authority. The Minister of Environment grants this authority, with input from the Zimbabwe Parks and Wildlife Management Authority. If appropriate authority is not granted, the authority remains vested in Central Government. This Appropriate Authority clause in the Act, paved the way for the implementation of the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE)[3].

Statutory Instruments: There are several statutory instruments (SI) that regulate the wildlife sector:

[3] Note that the CAMPFIRE programme is about to undergo a comprehensive review that will impact on future policies.

- SI 362 of 1990: This legislation provides in sections 66-75 for the Regulation of Manufacture, Processing and Dealing in trophies.
- SI 76 of 1998: Parks and Wild Life (Import and Export) (Wild Life) Regulations specifically deals with Import and Export of wildlife products. This legislation was enacted to ensure compliance with CITES requirements for export and import of wild flora and fauna. These provide for the following:
    - Section 3 deals with the Control of Import and Export of wild life and trophies and lays down a general prohibition on the import into or export from Zimbabwe of any "wild life" or trophy of "wild life" except in accordance with either a certificate issued in terms of section 5 by the Director or Director of Customs, or an open general permit:
    - Section 5 deals with Permits and Certificates and is consistent with CITES legislation.
    - Section 15 deals with Offences and Penalties. Any person who contravenes any of the provisions of subsection 1 shall be guilty of an offence, and liable to a fine or imprisonment. To effectively ensure compliance, the Zimbabwe Parks and Wildlife Management Authority deployed a permanent team of officers based at all ports of exit and entry to assist border control officials in monitoring and inspection of all wildlife exports.
- SI 26 of 1998: The regulation provides for the monitoring of all hunting activities in the country to ensure compliance by all Safari Operators and international clients and to ensure that the TR2 Form. (Tourism Hunting Return Form) is duly completed.
- Trapping of Animals (Control) Act Chapter 20:21: The Act provides for the control, restriction and regulation of the construction, possession and use of certain traps for the purpose of trapping animals; to control the sale and disposal of certain animals, to include lions and to provide for matters incidental to or connected with the foregoing.
- SI 92 of 1992: Parks and Wild Life (Payment for Hunting of Animals and Fish) Notice, 2009: This instrument provides for compensation values of various wildlife forms to include animals and fish. It acts as an additional deterrent measure in matters where poaching cases are being dealt with in accordance with the law. The compensation value for illegal hunting of lion is USD 5 000, 00.
- SI 93 of 2009: Parks and Wild Life (Payment for Trapping of Wild Animals) Notice, 2009. This instrument provides for the payment of compensation to the state or game owners in the event that one is convicted for illegally trapping wild animals on various land categories. The compensation value for illegal hunting of lion is USD 5 000, 00.
- SI 40 Of 1994: Parks and Wildlife (Appropriate Authorities for Communal Land) Notice, 1994. This SI facilitates the granting of Appropriate Authority status to various Rural District Councils. This legislation devolved authority to Rural District Councils and gave rights to local communities to sustainable utilize wildlife and other natural resources in their areas of jurisdiction.

12.2.4 The Rural District Councils Act Chapter [29:13] 2002

The Rural District Councils Act is important in the wildlife sector as it provides for a legal entity (in Communal Lands) responsible for wildlife resources. Since the land in Communal areas is not privately owned by the communities and given that most of the communities do not constitute a legal entity, the Appropriate Authority status is conferred to the Rural District Councils (RDCs). Thus the RDCs act as custodians of the wildlife resources on behalf of the communities.

Efforts are now underway in some areas to form Community Development Trusts. There is scope for these Community Development Trusts to be used as vehicles to further devolve authority from the District level to the sub-district level, which will provide more income at a community level and therefore increase conservation support from the community as they will have a true vested interest.

The feasibility of granting Appropriate Authority to these Trusts in Zimbabwe needs to be assessed and piloted. The major challenge with these Trusts is that of financial sustainability as they do not have adequate funds to cater for their activities. Capacity-building of all Trust members is also a key requirement to ensure institutional sustainability.

In the Rural District Councils Act, there are three key terms that will be described further: Ward, Ward Development Committee and Communal Land. According to the Act, a "Ward" (an administrative unit) means a ward into which a council area is divided or re-divided. Several villages make up a ward. In the Act, a "Ward Development Committee" means a village development committee established in terms of Section 58 of the Act. A Ward Committee is made up of members who are elected from the community to represent the community in discussions/meetings with the Rural District Council. The Act further defines three different types of Wards. These are, Commercial Ward, Communal Ward and Resettlement Ward. The Commercial Ward is a large-scale commercial ward or a small-scale commercial ward. A Communal Ward is a ward consisting wholly or mainly of Communal Land. A Resettlement Ward is a ward consisting wholly or mainly of Communal Land (as in the case of the Communal Ward). It is important to establish whether in practice, the RDCs make
this distinction of the wards or whether they are all considered simply just as wards.

The "Communal Land" is defined as any land that is Communal Land in terms of the Communal Land Act [Chapter 20:04]; and any other land that was within the area of a district council on the 19th August 1988.

12.2.5 The Forest Act of 1948

This Act establishes the Forestry Commission and places demarcated forests under its control. The commission is responsible for the control, management and exploitation of state forests including the leasing of timber harvesting rights. The Act also gives the Minister the power to regulate the commercial use of timber from indigenous trees on other land.

As the appropriate authority for the Forest Areas, the Commission is also responsible for the management and conservation

12.3 Annex III: Analysis of Total Revenue by Country of Destination

Destination	2014	2015	Total
United States	$14,485,835	$11,942,785	$26,428,620
Russian Federation	$1,444,729	$861,925	$2,306,654
China	$1,416,196	$441,759	$1,857,955
Germany	$1,100,534	$698,450	$1,798,984
Canada	$620,852	$474,935	$1,095,787
South Africa	$513,070	$576,035	$1,089,105
France	$825,975	$158,291	$984,266
Australia	$671,527	$259,136	$930,663
Spain	$488,616	$321,064	$809,680
Austria	$519,322	$201,073	$720,395
India	$302,653	$241,741	$544,394
United Kingdom	$357,317	$183,888	$541,205
Italy	$181,956	$343,197	$525,153
Hungary	$418,824	$104,262	$523,086
Mexico	$252,263	$266,543	$518,806

Destination	2014	2015	Total
Norway	$300,645	$119,831	$420,476
Denmark	$132,690	$194,435	$327,125
Switzerland	$171,991	$123,828	$295,819
Sweden	$196,575	$80,014	$276,589
Ukraine	$80,432	$163,604	$244,036
Czech Republic	$104,450	$137,456	$241,906
Neatherlands	$89,042	$105,227	$194,269
Nigeria	$171,830	$0	$171,830
Bulgaria	$21,865	$123,469	$145,334
Argentina	$106,529	$24,888	$131,417
Finland	$65,768	$63,223	$128,991
Brazil	$56,785	$59,886	$116,671
Honduras	$104,683	$0	$104,683
Poland	$38,911	$62,015	$100,926
New Zealand	$17,880	$81,127	$99,007
Mauritius	$56,225	$36,945	$93,170
Chile	$91,374	$0	$91,374
Belgium	$9,340	$80,355	$89,695
Portugal	$78,470	$0	$78,470
Columbia	$77,944	$0	$77,944
Slovakia	$69,420	$0	$69,420
Botswana	$59,401	$0	$59,401
Pakistan	$54,208	$0	$54,208
Namibia	$20,298	$18,862	$39,160
Latvia	$37,611	$0	$37,611
Estonia	$12,078	$23,586	$35,664
Slovenia	$20,620	$11,200	$31,820
Kenya	$14,302	$16,957	$31,259
Dominican Republic	$30,463	$0	$30,463
Belarus	$0	$29,430	$29,430
Kazakhstan	$0	$28,460	$28,460
Romania	$0	$20,112	$20,112
United Arab Emirates	$19,629	$0	$19,629
Lao Peoples Democratic Republic	$15,000	$0	$15,000
Bolivia	$0	$11,553	$11,553
Lithuania	$9,164	$0	$9,164
Costa Rica	$5,900	$0	$5,900
Qatar	$4,896	$0	$4,896
Grand Total	**$25,946,088**	**$18,691,547**	**$44,637,635**

12.4 ANNEX IV: ANALYSIS OF TOTAL REVENUE BY SPECIES

Species	$2,014	$2,015	Total	2015 Quota	Utilised	% Utilised
Buffalo	$2,528,559	$1,962,570	$4,491,129	1,635	482	29%
Elephant (Tusks)	$2,042,610	$1,447,090	$3,489,700	246	64	26%
Elephant (Tuskless)	$1,444,040	$229,860	$1,673,900	462	113	24%
Lion	$630,950	$753,000	$1,383,950	82	49	59%
Leopard	$714,100	$668,490	$1,382,590	530	151	28%
Zebra	$594,239	$555,744	$1,149,983	2,480	600	24%
Sable	$456,615	$309,260	$765,875	718	78	11%
Kudu	$341,092	$357,963	$699,055	2,503	289	12%
Waterbuck	$293,903	$256,133	$550,036	988	156	16%
Hippo	$310,321	$217,470	$527,791	303	83	27%
Impala	$277,198	$242,624	$519,822	8,594	1,261	15%
Crocodile	$284,650	$202,705	$487,355	211	70	33%
Eland	$179,470	$187,990	$367,460	1,659	132	8%
Wildebeest	$180,665	$170,350	$351,015	2,189	220	10%
Giraffe	$158,385	$157,410	$315,795	880	135	15%
Nyala	$130,840	$117,175	$248,015	174	38	22%
Bushbuck	$116,011	$94,936	$210,947	1,082	125	12%
Warthog	$98,975	$89,820	$188,795	3,060	208	7%
Hyeana	$75,648	$54,503	$130,151	1,702	118	7%
Klipspringer	$44,130	$40,441	$84,571	823	59	7%
Bush Pig	$18,226	$30,370	$48,596	1,972	69	3%
Tsessebe	$19,800	$19,500	$39,300	186	15	8%
Baboon	$24,909	$13,664	$38,573	8,017	264	3%
Reedbuck	$23,265	$12,731	$35,996	371	20	5%
Steenbok	$13,790	$15,070	$28,860	927	31	3%
Jackal	$9,656	$15,889	$25,545	2,179	105	5%
Civet	$8,850	$11,368	$20,218	1,034	29	3%
Grysbok	$9,435	$8,585	$18,020	632	31	5%
Eland	$16,750	$0	$16,750	1,659	132	8%
Genet	$6,020	$14,183	$20,203	1,136	38	3%
Duiker, Grey	$2,774	$12,523	$15,297	2,005	53	3%
Duiker, Blue	$7,991	$0	$7,991	-	-	-
Honey Badger	$3,681	$3,625	$7,306	622	15	2%
Wild Cat	$3,160	$4,180	$7,340	812	19	2%
Guinea Fowl	$5,496	$968	$6,464	29,174	121	0%
Porcupine	$4,123	$1,473	$5,596	857	9	1%
Serval	$2,670	$2,410	$5,080	536	6	1%
Egyptian Goose	$3,025	$60	$3,085	4	-	0%
Cheetah	$2,560	$0	$2,560	42	-	0%
Ant Bear	$900	$1,651	$2,551	39	6	15%
Francolin	$1,166	$609	$1,775	22,449	109	0.5%

Species	$2,014	$2,015	Total	2015 Quota	Utilised	% Utilised
Dove	$1,321	$418	$1,739	34,485	63	0.2%
Monkey, Vervet	$885	$800	$1,685	3,677	15	0.4%
Ostrich	$1,200	$0	$1,200	14	-	0%
Mongoose	$508	$690	$1,198	279	3	1%
Sandgrouse	$456	$688	$1,144	8,088	78	1%
Oribi	$500	$500	$1,000	82	2	2%
Duiker, Red	$950	$0	$950	-	-	-
Caracal	$900	$0	$900	351	-	0%
Bushbaby	$850	$0	$850	-	-	-
Bontebok	$700	$0	$700	-	-	-
Waterfowl	$0	$400	$400	40	2	5%
Springhare	$60	$120	$180	-	-	-
Gemsbok	$105	$0	$105	6	-	0%
Hyrax	$75	$20	$95	371	1	0.3%
Duck	$29	$20	$49	10,779	13	0.1%
Aardwolf	$0	$0	$0	-	-	-
Blesbok	$0	$0	$0	40		0%
Rabbit	$0	$0	$0	252	-	0%
Hare	$0	$0	$0	138	3	2%
Lichtenstein's Hartebeest	$0	$0	$0	5	-	0%
Red Hartebeest	$0	$0	$0	7	-	0%
Grand Total	**$11,099,187**	**$8,288,049**	**$19,387,236**			