

# Florida Keys National Wildlife Refuges Complex

## Integrated Pest Management Plan

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U.S. Fish and Wildlife Service  
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Florida Keys National Wildlife Refuges Complex Integrated Pest Management Plan

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## Executive Summary

This Integrated Pest Management Plan (IPMP) includes a variety of methods for managing several invasive exotic animal species. It focuses on exotic species that prey upon or compete with native species, and in particular, negatively impact several Federal and state listed threatened and endangered (listed) species on lands managed by the U.S. Fish and Wildlife Service (USFWS) as part of the Florida Keys National Wildlife Refuges Complex (FKNWRC). An overview of legal authorities, scientific literature, and other sources that justify active management of these species is included. Predation, disease, and sub-lethal (exclusion, competition) effects by non-native species such as free-roaming cats, opossums, armadillos, rats, large-bodied snakes and lizards that have invaded the Florida Keys have impacted or threaten to impact populations of several native species, including listed species, and the ecosystems on which they depend. In some cases recovery of those species will be precluded and long-term persistence is unlikely if actions are not taken. Additionally, a native species, the raccoon, can impact other native species when their abundance is inflated by human-subsidized food sources.

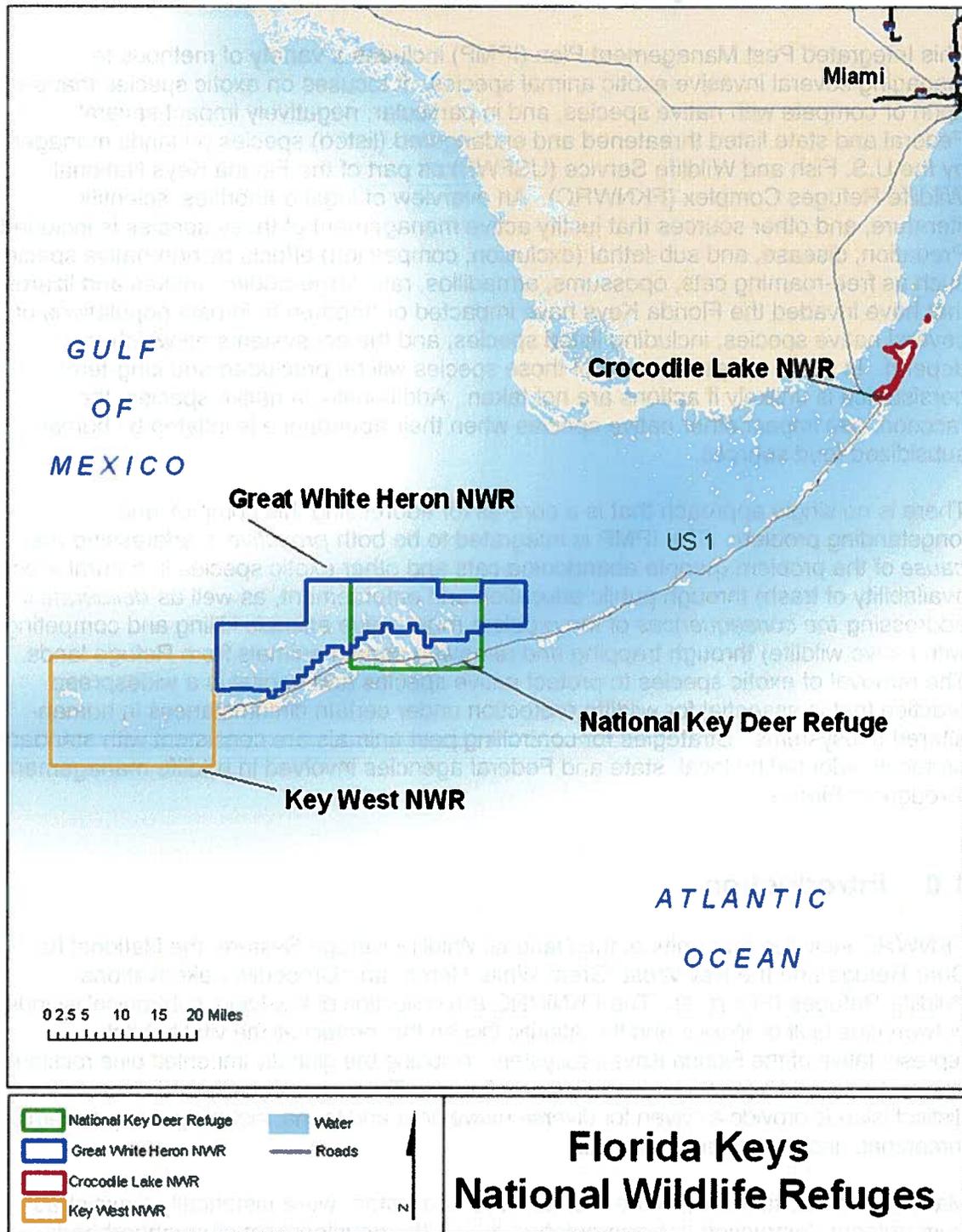
There is no single approach that is a cure-all for addressing this complex and longstanding problem. The IPMP is integrated to be both *proactive* in addressing *the cause* of the problem (people abandoning cats and other exotic species in natural areas; availability of trash) through public education and enforcement, as well as *deliberate* in addressing *the consequences* of the problem (non-native animals killing and competing with native wildlife) through trapping and removing certain animals from Refuge lands. The removal of exotic species to protect native species and habitat is a widespread practice that is essential for wildlife protection under certain circumstances in human-altered ecosystems. Strategies for controlling pest animals are consistent with standard protocols adopted by local, state and Federal agencies involved in wildlife management throughout Florida.

### 1.0 Introduction

FKNWRC includes four units of the National Wildlife Refuge System, the National Key Deer Refuge and the Key West, Great White Heron, and Crocodile Lake National Wildlife Refuges (Figure 1). The FKNWRC is a collection of low-lying, subtropical islands between the Gulf of Mexico and the Atlantic Ocean that protect all the vital habitats representative of the Florida Keys ecosystem, including the globally imperiled pine rockland, tropical hardwood hammock, and mangrove forests. These geologically and climatically distinct islands provide a haven for diverse native flora and fauna, including many endemic threatened and endangered species.

Many native habitat areas in the Florida Keys ecosystem were historically diminished from outright destruction or fragmentation during the development of neighborhoods, roads, canals, and mosquito ditches. The rate of direct habitat loss due to development has declined substantially in the case of roads and buildings, and has essentially ceased in the case of mosquito ditches and canals. In contrast, a secondary effect of development, the proliferation of non-native animal species, has endured as a prominent threat to native wildlife including species listed under the Endangered Species Act (ESA). The importance of reducing predation by exotic species on federally listed species in the

Figure 1. Location of the Florida Keys National Wildlife Refuges.



Florida Keys has been well documented and prescribed in scientific literature (see Section 3.0), assessments, and plans, including the South Florida Multi-Species Recovery Plan (USFWS 1999; Appendix I), subsequent Five Year Reviews for listed species (<http://ecos.fws.gov/ecos/indexPublic.do>), the USFWS's Biological Opinion for the Federal Emergency Management Agency's administration of flood insurance in the Florida Keys (USFWS 2010), and the FKNWRC's Comprehensive Conservation Plans (CCPs).

The USFWS developed CCPs for the Crocodile Lake NWR (2006) and the Lower Keys Refuges (2009) to guide management and conservation strategies for these refuges over a 15 year planning horizon. The CCPs address issues that threaten the long-term conservation of imperiled species and their habitats, including habitat loss and fragmentation, invasive species, sea-level rise, altered fire regimes, changing public uses and demands, and inadequacy of resources for management and protection. The CCPs lay out broad goals, objectives and strategies to protect and maintain diverse habitats and eliminate adverse human impacts to the extent possible, so that ecosystems, species diversity, and imperiled species are protected or restored. Some species require additional attention and direct intervention to increase their population abundance and distribution and improve their long-term viability. This IPMP is a step-down plan that tiers off the CCPs to specifically address the relevant management objectives and strategies for minimizing current and foreseeable threats from exotic animals.

## 2.0 Legal Authorities and Policy Directives

Administration of the Florida Keys National Wildlife Refuges Complex is guided by the purposes for which each refuge was established, the mission and goals of the Refuge System, congressional legislation, executive orders, and international treaties. Policies for management options of refuges are further refined by administrative guidelines established by the Secretary of the Interior and by policy directives established by the Director of the U.S. Fish and Wildlife Service. Below is a summary of select authorities and directives that are relevant to this IPMP, as well as state and local mandates with which this IPMP seeks consistency.

**U.S. Fish and Wildlife Service (USFWS):** The USFWS is the primary Federal agency charged with protecting the nation's native fish and wildlife resources, including migratory birds and candidate, threatened and endangered species, for the enjoyment of current and future generations of Americans. The USFWS has the responsibility for conserving, protecting and enhancing fish, wildlife, plants and their habitats. The USFWS administers the National Wildlife Refuge System, and has the lead responsibility in implementing the Endangered Species Act and Migratory Bird Treaty Act.

**Endangered Species Act (ESA):** The ESA (87 Stat. 884, as amended; 16 U.S.C. § 1531 et seq.) affords Federal legal protections to species of plants and animals classified as endangered or threatened. Section 7 of the ESA mandates that Federal agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act to ensure that "any action authorized, funded or carried out by such an agency. . . is not likely to jeopardize the continued existence of any endangered or threatened species. . . Each agency shall use the best scientific and commercial data available" [Sec. 7(a)(2)]. Section 9 makes it

illegal for any "person" to "take" any species listed as endangered or threatened, and defines "take" as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Harm may include significant habitat modification where it actually kills or injures a listed species through impairment of essential behavior (e.g., nesting or reproduction). Section 10 requires private landowners, corporations, State or local governments, or other non-Federal landowners who wish to conduct activities on their land that might "take" threatened and endangered wildlife to first obtain an Incidental Take Permit (ITP; see discussion below for Monroe County). Activities that are considered take under ESA include altering an animal's behavior such as occurs when people intentionally feed or touch Key deer, and if they place food and water out for free-roaming cats that may unintentionally attract Key deer. The USFWS traditionally implements outreach and education efforts to inform the public and companies about activities they are practicing that may unintentionally result in the take of species protected by the ESA. Enforcement actions can ultimately be pursued when such acts knowingly or intentionally continue.

**Migratory Bird Treaty Act (MBTA):** The MBTA (40 Stat.755; 16 U.S.C. § 703-712) implements the U.S. commitment to four separate international conventions with Russia, Japan, Great Britain (for Canada), and Mexico that recognize migratory birds as international resources warranting coordinated Federal trust protections across nations. The MBTA affords protection to over 1,000 species of native birds occurring in the U.S. and its territories (50 Code of Federal Regulations (C.F.R.) § 10.13). Prohibited activities include unauthorized taking, killing, possession, transportation or importation of these species, or their parts, nests or eggs. Under the MBTA, "take" is defined as pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt these activities, by any means or any manner (16 U.S.C. § 703; 50 C.F.R. § 10.12). The USFWS traditionally implements outreach and education efforts to inform the public and companies about activities they are practicing that may unintentionally result in the take of migratory birds. Enforcement actions can ultimately be pursued when such acts knowingly or intentionally continue.

**National Wildlife Refuge System:** The mission of the National Wildlife Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997 (NWRSIA), is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. The Improvement Act establishes wildlife conservation as the primary mission of the Refuge System.

The term "pest" is defined as living organisms, including both invasive and native species, that may interfere with achieving management objective(s) on or off Refuge lands, or that jeopardize human health or safety. The policy of the USFWS is to engage in pest management on National Wildlife Refuges to prevent substantial damage to refuge resources and to ensure balanced wildlife and fish populations consistent with the optimum management of refuge habitat. Refuge policy promotes an integrated approach using appropriate combinations of animal control techniques, including but not limited to: biological control, habitat management, live trapping and transfer, public harvest (prohibited in Monroe County), non-lethal repellants, physical barriers (e.g. exclusion fencing), and lethal reduction (16 U.S.C. 668dd-668ee, National Wildlife Refuge System Administration Act of 1966, as amended; 601 FW 3, Biological Integrity, Diversity and Environmental Health; 569 FW 1 Integrated Pest Management; 50 C.F.R. 27.52

Introduction of Plants and Animals; 50 C.F.R. 28.42 Impounding of Domestic Animals; 50 C.F.R. 28.43 Destruction of Dogs and Cats; 50 C.F.R. 30.11-12, Feral Animal Management; 50 C.F.R. 31.1-2, Surplus Wildlife Management; 50 C.F.R. 31.14, Terms and Conditions of Wildlife Reduction and Disposal).

**Invasive Species Executive Order 13112:** This order directs Federal agencies to prevent the introduction of invasive species, to detect and to respond rapidly to control populations of such species in a cost effective and environmentally sound manner, accurately monitor invasive species, provide for restoration of native species and habitat conditions, conduct research to prevent introductions and to control invasive species, and promote public education on invasive species and the means to address them.

**Florida State Law:** The State of Florida's statute and administrative code also provide various authorities for protecting native wildlife, prohibiting relocation of wild animals to public lands, controlling the release of non-native species, and prohibiting cruelty to animals and abandonment of domestic animals into the wild (FFWCC 2003). The USFWS may enforce State laws under the Assimilated Crimes Act (18 U.S. Code Sect. 13).

**Monroe County:** The Monroe County (MOCO) 2010 Comprehensive Plan includes several goals and objectives that address the special environmental protection needs of the Florida Keys, particularly Big Pine and No Name Keys. For example, Objective 207.3 states "Monroe County shall protect native wildlife species, especially State- and federally-designated species, from disturbance and predation by free-roaming domestic pets, particularly cats and dogs."

Furthermore, in compliance with Section 10 of the ESA, Monroe County (in partnership with the Florida Department of Transportation and Florida Department of Community Affairs) developed a Habitat Conservation Plan (HCP) for Big Pine and No Name Keys (MOCO 2006). The HCP outlines a conservation strategy to protect the habitat of the Key deer, Lower Keys marsh rabbit, and eastern indigo snake while allowing limited residential, commercial, recreational, and municipal development on Big Pine and No Name Keys. In addition to protecting high quality habitat, the HCP directs development toward areas that have already been impacted and away from endangered species habitat. The USFWS issued an Incidental Take Permit (ITP) associated with this HCP in June 2006. With respect to animal control, the ITP includes measures to ensure that take of covered species is minimized and mitigated, including the requirements that Monroe County must "implement an animal control education program to educate the public regarding the potential negative effect of domestic predators on the Key deer and Lower Keys marsh rabbit..." and "annually review and evaluate the need and feasibility of additional regulatory measures to control the spread of domestic predators." This IPMP seeks to complement these requirements by collaborating with the Monroe County's growth management and contracted animal control services programs in areas where Refuge lands are intermixed with private residential and commercial properties.

### **3.0 Management Plan - Pest Species Accounts, Justification for Action, and Control Methods**

This IPMP includes a range of non-lethal and lethal control methods that would be available for implementation on the FKNWRC, depending on the abundance, distribution, and extent of impacts by pest species that interfere with achieving management objectives of the FKNWRC, as described below. The IPMP will be implemented using an adaptive management approach. Adaptive management is an iterative process of selecting best available management strategies, implementing actions, monitoring and evaluating results, conducting research as needed, determining if objectives have been met, considering other environmental, social, and economic factors that may change over time, and refining strategies as necessary.

Refuge lands, particularly in the National Key Deer Refuge, include a mosaic of public lands intermixed with private residential and commercial areas. To successfully remove substantial threats to wildlife resources posed by exotic species will require a collaborative public and private effort with Monroe County, Florida Fish and Wildlife Conservation Commission, county-contracted animal control service providers, researchers, animal advocacy groups, wildlife rescuers, environmental organizations, private landowners, and responsible pet owners. The on-refuge control methods outlined herein will largely be implemented by refuge personnel. Contractors and collaborators may assist where practical and appropriate. We do not expect to achieve complete eradication of any existing pest species, especially since sources of exotic species invasions (escapes, releases, free-roaming pets, immigration from adjacent areas, continued reproduction of pest species, etc.) will likely endure for some time. However, a concerted and sustained effort to control and reduce the number of pest animals on Refuge lands will be needed have substantial benefits for listed and other native species that inhabit the FKNWRC.

#### **3.1 Non-Native Vertebrate Species**

##### **3.1.1 Free-roaming Cats**

###### Species Account

The cat (*Felis catus*) is a small, domesticated, carnivorous mammal that is valued by humans for its companionship and for its ability to hunt household pests. House cats are considered pets or companion animals, and spend all or most of their time indoors, depend on their owners for food, and are comfortable around people. House cats are therefore not considered to be free-roaming. Outdoor cats may also be considered pets or companion animals but are allowed by their owners to spend most of their time outside, have a home to go to for food and shelter, and are comfortable around people. Such outdoor cats are considered free-roaming and may kill wildlife out of instinct or invoke avoidance behaviors from prey species; Stray cats were either indoor or outdoor cats at one point in their life but their owners abandoned them and now they are *free-roaming*, feeding where they can on either wildlife or food left out by strangers. Feral cats are also *free-roaming* cats that are born to stray cats or other feral cats, and they feed on wildlife or on food left out by humans.

### Justification for Management Action

Domestic cats prey on a wide array of native fauna over much of the globe (Liberg 1984; Coleman and Temple 1989; Dickman 1996a, 1996b; Fitzgerald and Turner 2000; Woods et al. 2003; Bonnaud et al. 2011; Medina et al. 2011). Domestic cats are recognized by the International Union for the Conservation of Nature as one of the world's worst invasive species (Lowe et al. 2000). Island fauna and ground-dwelling species, including many endemic forms and rare species listed by the International Union for the Conservation of Nature or the USFWS, often suffer great losses where they co-occur with cats. Medina et al. (2011) document 175 threatened taxa (listed by the IUCN) impacted by cats on about 120 islands. As in the Florida Keys, native fauna on islands and island-like habitat patches throughout the world are heavily impacted by cat predation, which often causes or contributes to population declines or extinctions (Iverson 1978, Apps 1983, Moors 1985, Kirkpatrick and Rauzon 1986; Konecny 1987; Cruz and Cruz 1987, Churcher and Lawton 1987, Towns et al. 1990, Mellink 1992, Smith et al. 1993, Dickman 1996, 1996b, Alterio and Moller 1997, Nogales et al. 1998, Donlan et al. 2000, Veitch 2001, Burbidge and Manly 2002, Tershy et al. 2002, Blackburn et al. 2004, Nogales et al. 2004, Sax and Gaines 2008, Faulquier et al. 2009; van Heezik et al. 2010; Bonnaud et al. 2010, 2011; Medina et al. 2011). Impacts to species on land-bridge islands and oceanic islands were not significantly different, and impacts to endemic species are disproportionately high (Medina et al. 2011). Medina et al. (2011) estimated that "feral cats on islands have contributed to 33 (13.9%) of the 238 global bird, mammal, and reptile extinctions (including species extinct in the wild but extant in captivity) recorded by the IUCN Red List". The Bonnaud et al. (2011) analysis "suggests that cats can negatively impact a large percentage of the native vertebrates on any island."

Free-roaming cats are also significant predators of rabbits in diverse environments throughout the world (McMurry and Sperry 1941; Eberhard 1954; Coman and Brunner 1972; Apps 1983; Liberg 1984; Warner 1985; Coleman and Temple 1989, 1993; Molsher et al. 1999; Fitzgerald and Turner 2000; Calver et al. 2007). Although small mammals often comprise the majority of prey items observed in cat diets, free-roaming cats are estimated to kill hundreds of millions of birds every year in the U.S. alone (American Bird Conservancy 2010, Dauphiné and Cooper 2009). They represent a major source of bird mortality and degradation of avian communities (Soulé et al. 1988, Gill 1995, Hawkins 1998, Crooks & Soulé 1999, Lepczyk et al. 2003, Hawkins et al. 2004, Erickson et al. 2005, Woods et al. 2003).

Free-roaming cats not only threaten wildlife through direct predation or competition, but also serve as vectors for a number of diseases including rabies, cat scratch fever; hookworms, roundworms and toxoplasmosis (see Center for Disease Control, [www.cdc.gov/healthypets/animals/cats.htm](http://www.cdc.gov/healthypets/animals/cats.htm)). Some of these diseases can be transmitted to other native wildlife, domestic animals, and humans (Dubey 2002, Jessup et al. 1993, Jessup 2004, Miller et al. 2002). Dense populations of feral cats can also lead to increased prevalence of ectoparasites (e.g., fleas, ticks, mites); in addition to being nuisances, these

parasites may transmit bacteria of the genera *Bartonella*, *Rickettsia*, and *Coxiella* from cats to humans, causing diseases such as endocarditis, bactremia, and Rocky Mountain spotted fever (Case et al. 2006). Additionally, the agent of Johne's disease or paratuberculosis, a contagious progressive wasting disease found in the federally endangered Florida Key deer (*Odocoileus virginianus clavium*), has been detected in feral cats in addition to opossum (*Didelphis virginiana*), armadillo (*Dasybus novemcinctus*), and raccoons (*Procyon lotor*) (Corn et al. 2005, Palmer et al. 2005).

In the FKNWRC, free-roaming cats are known to prey upon a number of federally listed species such as the Lower Keys marsh rabbit (*Sylvilagus palustris hefneri*), Key Largo woodrat (*Neotoma floridana smalli*), and Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*), and likely, the silver rice rat (*Oryzomys palustris natator*) (Brown 1978, Howe 1988, Goodyear 1992, Forsys 1995, Forsys et al. 1996, USFWS 1999, Perry 2006, Barbour and Humphrey 1982, Faulhaber 2003, Winchester et al. 2008, Alligood and Savage 2011). Lower Keys marsh rabbit records illustrate ongoing population decline (Lazell 1989, Forsys and Humphrey 1999, USFWS 1999, USFWS 2007, Faulhaber et al. 2007). Forsys and Humphrey (1999) estimated that free-roaming cat predation accounted for 53% of Lower Keys marsh rabbit mortality during radio telemetry studies, and was the largest impediment to population recovery. Based on population viability analyses (PVAs), reducing predation by free-roaming cats would increase the viability of Lower Keys marsh rabbit and lessen the likelihood of extinction (Forsys and Humphrey 1999; LaFever et al. 2008). Forsys and Humphrey (1999) concluded that "Cats represent a deterministic threat, and until that threat is removed, no other management techniques (e.g., translocation, habitat restoration) will be successful." Forsys et al. (1996) reported that cats occurred in 14 of 19 Lower Keys marsh rabbit subpopulations (habitat patches) newly located during the course of their investigation. Recent motion-triggered camera trap images confirm that free-roaming cats occur in habitat patches occupied by Lower Keys marsh rabbits at the National Key Deer Refuge (NKDR) and Key Largo woodrats and Key Largo cottonmouse at the Crocodile Lake NWR (USFWS, unpublished data). Cats rapidly preyed upon at least 77% of Key Largo woodrats subject to a recent re-introduction attempt (Alligood and Savage 2011).

Impacts of cats on resident and migratory songbirds, other ground-dwelling birds, and reptiles are well documented and widespread. In the Florida Keys, cats are known to prey on numerous species of native reptiles and birds, including the white-crowned pigeon (*Patagioenas leucocephala*; Maya Totman, Florida Keys Wildlife Rescue, pers. comm.), a state-designated threatened species which exists nowhere else in North America except for extreme southern Florida. Most of U.S. population nests on mangrove islands, and forages on other islands of the Florida Keys, such as Big Pine Key and other main-line islands, where they are susceptible to predation. Other at-risk birds include the federally designated (threatened) piping plover (*Charadrius melodus*; Winter and Wallace 2006, FFWCC 2003), which has wintering grounds and designated critical habitat in the FKNWRC (USFWS 1999). At-risk reptiles include the Florida brownsnake (*Storeria victa*), Key ringneck snake (*Diadophis punctatus acricus*), Peninsula ribbon snake (*Thamnophis sauritus sackenii*), and rim rock crowned snake (*Tantilla oolitica*), which are state-designated threatened species, and the Florida

Keys mole skink (*Eumeces egregius egregius*) and red rat snake (*Elaphe guttata*), which are species of special concern. It is likely that cats could kill young individuals of the federally designated (threatened) Eastern indigo snake (*Drymarchon corais couperi*) as well.

### Control Methods

1. The USFWS will remove free-roaming cats found on Refuge lands through live trapping. Traps will be set to reduce exposure of trapped animals to adverse diurnal weather conditions (e.g. solar heat, humidity). A variety of baits, visual attractants, and trap design modifications may be used to target free-roaming cats while trying to avoid attracting non-target species to the greatest extent possible. All non-target native species will be immediately released alive at the trap site (see following sections for disposition of other non-native species).
2. Cats trapped on Refuge lands will be transferred and surrendered to a Monroe County-contracted animal control shelter facility or its representative as quickly as possible to minimize stress on the animals. The animal control service provider will have the authority to determine appropriate placement options for trapped cats based on their health and disposition according to county ordinances and standard protocol and will contact owners of collared cats. Under no circumstances will cats be allowed to be re-released on or near Refuge lands in the FKNWRC. If any shelter declines to accept any cat trapped, or is deemed otherwise unacceptable, the USFWS reserves the right to transfer the animals to other willing shelters in Monroe County, mainland Florida, or beyond.
3. Owners of repeatedly captured cats, if found by law enforcement to have retrieved their cat from the shelter and intentionally allowed it to continue free-roaming on Refuge lands, will be subject to potential enforcement action under applicable law. Refuge regulations allow for fines of up to \$250 per incident and mandatory court appearance (50 CFR Wildlife and Fisheries, Part 27 Prohibited Activities). Penalties for enforcement under the ESA can be substantially greater. State and county regulations may also apply.
4. Cat feeding stations on Refuge lands will be identified, immediately removed, and monitored for future unauthorized activity. Persons found by law enforcement to be responsible for such activity may be subject to potential enforcement action under applicable law.
5. Actively promote outreach programs, such as, the Our Animal Family campaign ([www.ouranimalfamily.org](http://www.ouranimalfamily.org)) that is coordinated by Friends and Volunteers of Refuges (FAVOR) and their partners. This innovative partnership and educational effort promotes the humane treatment of all animals, including native wildlife and domestic pets, and seeks to reduce human-induced pressures on endangered species. The USFWS will assist in developing brochures and conducting neighborhood canvassing to distribute educational materials. The Our Animal Family campaign can also be used to spread the word about pertinent ordinances, legislation, free spay/neuter clinics, and other activities or issues that may arise in the future.

6. Collaborate with Monroe County to assist the enforcing of existing ordinances and supporting new codes that serve to reduce the prevalence of free-ranging domestic pets, including free-roaming cats, dogs, large-bodied snakes and lizards and other pest species. The USFWS supports local ordinances which require micro-chips, tattoos, or identification tags for all cats owned, sold, adopted, licensed or taken to a vet in order to promote responsible pet ownership. This would also allow for free-roaming pet cats trapped on Refuge lands to be easily identified and returned to owners, and for homeless cats to clearly be identified as such.

7. Conduct further research and continue monitoring as needed to determine abundance and distribution of free-roaming cats throughout the FKNWRC, optimize management actions, document effectiveness of management actions in reducing free-roaming cat numbers on Refuge lands, and determine the impacts on the ecosystem and native species to aid in the adaptive management process.

### **3.1.2 Opossum, Armadillo, and Rats**

#### **Species Accounts**

The black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), Gambian pouch rat (*Cricetomys gambianus*), and nine-banded armadillo did not historically occur in Florida, but were introduced by humans. Black rats have been widely distributed in the Florida Keys for centuries, likely introduced through European shipwrecks and cargo. (DePourtales 1877). Gambian pouch rats released on Grassy Key (located approximately 40 miles from Refuge lands) by a breeder several years ago quickly multiplied and spread. Most have since been removed, and they are now controlled in low numbers by State and USDA wildlife agents, although there have been unsubstantiated sightings elsewhere. Armadillos are a more recent invader of the Florida Keys, as evidenced by road-killed animals (USFWS, unpublished data).

The Virginia opossum is native to peninsular Florida and the Upper Florida Keys (including Crocodile Lake National Wildlife Refuge), but did not occur naturally in the Lower Florida Keys (Lazell 1989). They were initially represented by rare sightings, most likely from occasional human facilitated transportation events that hadn't resulted in the establishment of a widespread population (Deisler 1987, Lazell 1989). For unknown reasons they expanded more rapidly in recent years, as evidenced by road-killed animals and camera trap images collected in the Refuge on Big Pine Key in 2010, and are now established as an invasive exotic in the Lower Florida Keys (USFWS 2009c; USFWS, unpublished data).

#### **Justification for Management Action**

The black rat is widespread in the Lower Keys, and may impact native wildlife through direct competition, predation, or the spread of disease. The black rat has been implicated as a threat to the native silver rice rat (Goodyear 1992). Other insular native rice rat populations have been affected by introductions of non-native rat species from the genus *Rattus* as well (Goodyear 1992, Dowler et al. 2000). *Rattus* may prey upon other native fauna including tree snails, and

pose a threat to the federally listed Stock Island tree snail (*Orthalacus reses reses*) and other State-listed tree snails in the Florida Keys (*Drymaeus multilineatus* and *Liguus* spp.) (Deisler 1987, Tuskes 1981, Forys et al. 1996, Voss 1996, USFWS 1999).

Published research indicates that the diet of armadillos generally consists of insects (including butterflies), gastropods, arthropods, and small vertebrates (i.e., salamanders, lizards, etc.), and bird eggs (Davis and Schmidly 1994, Sikes et al. 1990).

Opossums frequently exhibit opportunistic foraging and diverse, omnivorous diets that includes native terrestrial vertebrates (McManus 1974, Kincaid and Cameron 1982, Wolfe 1982, Jennings et al. 2006). Their diet also encompasses terrestrial snails in various portions of North America (Sandidge 1953, Hopkins and Forbes 1980), including both *Orthalicus* and *Liguus* snails in the Florida Keys (Voss 1976, Deisler 1987). Deisler (1987) noted in the 1980s that the opossum "is more numerous in the mainland range of *Orthalicus* than in the Keys," but added that they have been reported from Key Largo, Key Vaca, Big Pine Key, and Key West. As stated above, they have since been observed and reported with increasing prevalence in the Lower Keys including Big Pine Key, where they now appear to be widespread and relatively abundant, and therefore pose a likely threat to the Federal and State listed tree snails in the Florida Keys.

#### Control Methods

1. USFWS will attempt to prevent further expansion of local abundance of these species onto Refuge lands by trapping pest species. Any opossum, armadillo, or rat caught in the live traps on Refuge lands (excluding opossums on Crocodile Lake NWR where they are considered to be native) will be removed. Removal could include transfer to a wildlife park or zoo, a state-certified wildlife rehabilitator, or euthanized in accordance with the American Veterinary Medical Association (AVMA) guidelines for euthanasia. All native species caught unintentionally will be immediately set free at the trap site.
2. Noticeable population increases based on research including, but not limited to, camera trap data, reports, road kills, or other specific or auxiliary data may initiate intensified and targeted control and eradication efforts.
3. USFWS will advocate for, and work with Monroe County, neighborhood associations, civic organizations, commercial businesses, homeowners, and the Our Animal Family campaign, to reduce trash related food subsidies to wildlife. Examples include workshops to build and distribute wildlife-proof garbage cans, advocating for more secure garbage receptacles, and discouraging outdoor pet feeding stations and feeding or watering wildlife.

### **3.1.3 Green Iguana**

#### **Species Account**

The green iguana (*Iguana iguana*) was first reported to inhabit southern Florida by King and Krakauer (1966), and its range has been increasing over the last 35 years (Townsend et al. 2003). Green iguana populations in south Florida may grow slowly for long periods, only to irrupt (Meshaka et al. 2004) and reach extraordinarily high densities (Kyrsko et al. 2007, Smith et al. 2007, Sementelli et al. 2008, Meshaka et al. 2009). Female iguanas may exhibit interannual nest site fidelity (Kyrsko 2007). Where nesting habitat is limited, iguanas may nest communally and be highly concentrated (Bock and Rand 1968, Bock and Rand 1989). Gravid females trapped in the Marquesas Keys in 2011 contained a large number of eggs (range 42-61 eggs; USFWS unpublished data), which compares with the largest green iguana clutch on record of 71 eggs (Rodda 2003). Raccoons and hawks occasionally prey upon eggs and smaller size classes of green iguanas in the Florida Keys; however, because the iguana lacks strong top-down control by predators here, the iguana population may grow unchecked until limited by food.

#### **Justification for Management Action**

The green iguana is primarily a vegetarian, but the species has been documented consuming tree snails, which are species of special concern in Florida (Townsend et al. 2005). Consequently, green iguanas are a potential threat to the federally listed Stock Island tree snail which has established populations on Refuge lands in the FKNWRC on north Key Largo and No Name Key.

The green iguana's consumption of certain native plant species may also result in impacts to native flora and associated fauna. At Bahia Honda State Park, green iguanas impacted grey nickerbean (*Caesalpinia bonduc*) plants which is a host plant of the Miami blue butterfly (*Cyclargus thomasi bethunebakeri*), a State and federally listed endangered species (Emmel and Daniels 2009). Larvae of this highly imperiled insect were likely consumed opportunistically with the tender new shoots on which iguanas feed, and the Miami blue was apparently extirpated shortly thereafter (USFWS 2009b). Nectar plants of adult butterflies are also consumed to some degree. The presence of green iguanas have recently been confirmed on several remote islands of the Key West NWR, which supports the only known surviving populations of Miami blue butterfly (Cannon et al. 2007). While this reptile's consumption of blackbead (*Pithecellobium keyense*) (the Miami blue's sole host plant in the KWNWR) is possible, the full extent of its impacts to the butterfly in this case is conjectural pending further study. Additionally, hurricanes that substantially alter vegetation may trigger food shifts in different size classes of iguanas such that remaining vegetation becomes highly vulnerable to herbivory, which may have contributed to the extirpation of Miami blues at Bahia Honda (USFWS 2009b). Accordingly, monitoring of the situation is warranted, particularly in light of the reptile's spread to KWNWR and the recent high frequency of tropical storm and hurricane activity in the Atlantic.

### Control Methods

1. The USFWS may engage in intensive trapping of green iguanas in specific locations on Refuge lands if monitoring shows that iguanas are negatively impacting native tree snails, important plant species used by native butterfly fauna, or any other listed species or assemblage of native fauna. Such efforts may become necessary on remote islands of the KWNWR, which are occupied by endangered Miami blue butterflies that rely exclusively on the blackbead as the host plant. Trapping effort would focus on the capture of gravid females during the egg-laying period using a variety of trap types, including standard live traps and artificial iguana nest box traps. Trapped iguanas will be lethally dispatched in accordance with AVMA and other available guidelines for humane euthanasia of reptiles. Concurrently, as many iguana nests as feasible will be dug up and the eggs will be destroyed.

### **3.1.4 Large-Bodied Snakes and Lizards**

#### Species Accounts

Exotic large-bodied snakes such as the Burmese python (*Python molurus bivittatus*) and common boa (*Boa constrictor*) have established breeding populations in south Florida (Meshaka 2000, Snow 2007b, Harvey et al. 2008). There are at least three large, carnivorous lizard species of concern which have been found in the Florida Keys, the Nile monitor (*Varanus niloticus*), black spiny-tailed iguana (*Ctenosaura similis*), and the giant black and white tegu (*Tupinambus merianae*). The abundance of black spiny-tailed iguanas on Big Pine and No Name Keys suggests that it is breeding in the wild. The tegu has recently become established in south Florida and has been documented crossing through underpasses along US-1 between the mainland and Key Largo (U.S. Geological Survey, unpublished data).

#### Justification for Management Action

Exotics reptiles have impacted island ecosystems worldwide, preying on and competing with native wildlife, altering and degrading habitat, and creating the potential to introduce foreign disease into native wildlife populations (Platenburg 2007, Harvey et al. 2008). As both predators and competitors, large-bodied exotic snakes pose a major threat to endangered wildlife in the FKNWRC; Their rapid and widespread invasion in south Florida has been facilitated by aspects of their natural history such as diverse habitat use, broad dietary preferences, long lifespan, high reproductive output, and ability to move long distances; consequently, all of these advantages may allow pythons to compete with native snakes such as the federally listed Eastern indigo snake (*Drymarchon couperi*) for food, habitat, and space (Reed 2005).

Several pythons have been found on Key Largo in and adjacent to Crocodile Lake NWR where they preyed upon Key Largo woodrats (Greene et al. 2007). Over a dozen large bodied exotic snakes have been found in, or areas adjacent to, the National Key Deer Refuge (USFWS unpublished data). A large boa

captured on No Name Key in 2008 was found to have eaten one or more unidentified mammals (USFWS, unpublished data). Dietary analysis of pythons and boas at Everglades National Park showed that they consumed more than ten native mammal species. These included marsh rabbits, white-tailed deer, and rice rats (Snow et al. 2007a), all of which have related subspecies (that are listed under the ESA) in the FKNWRC.

The Nile Monitor, black spiny-tailed iguana, and giant black and white tegu are aggressive reptilian predators. These species prey on small animals, including insects, crabs, rodents, fish, nestling birds, bird eggs, and hatchling sea turtles (Montanucci 1968, Alvarez del Toro 1982, Fitch and Hackforth-Jones 1983, Lee 2000, Krysko et al. 2003, Krysko et al. 2009). Recent studies have shown that both green iguanas and spiny-tailed iguanas feed on carcasses of Key deer (Anderson and Enge, in press), and therefore may provide competition for native scavengers. Because of the possible ecological impacts of these exotic predators on the native flora and fauna of the Florida Keys, population monitoring, rapid detection and immediate eradication efforts are warranted (Krysko et al. 2003, Enge et al. 2004).

### Control Methods

1. Presence of exotic large-bodied snakes and lizards on Refuge lands will be detected through camera traps, reports, incidental sightings, and the community-based interagency "Python Patrol". The Python Patrol is a network of trained responders that are deployed when reptile sightings are called into a dedicated 24-hour hotline at 1-888-I've Got 1 (1-888-483-4681). Exotic reptiles will be turned over to other appropriate agencies such as the FFWC or USGS or may be lethally dispatched in accordance with AVMA and other available guidelines for humane euthanasia of reptiles. Prevention of the establishment of any breeding populations of any exotic reptile species not already established will be the intent of these actions in order to protect vulnerable native species.
2. Dietary studies will be conducted whenever possible through necropsy to determine diet preferences and consumption rates of non-native reptile species and document impacts on native species accordingly.
3. Early detection will continue to be the best policy to prevent further establishment of invasive exotic reptiles on Refuge lands in the FKNWRC. As workloads and necessity permits, the USFWS may conduct sweeping surveys and targeted eradications of exotic reptiles on Refuge lands with proximity to known problem areas or with potential for new invasions.

## **3.2 Non-Native Invertebrate Species**

### **3.2.1 Fire Ants**

#### Species Account

Imported red fire ants (*Solenopsis invicta*) have invaded disturbed areas, and to a lesser degree natural areas of the Florida Keys. Invasions by non-native ants can have dramatic consequences on natural communities (Allen et al. 2004).

#### Justification for Management Action

Fire ants are a possible nest predator for the endangered Lower Keys marsh rabbit, Key Largo woodrat, and Key Largo cottonmouse (USFWS 1999). Fire ants are known to prey on the Stock Island tree snail, and reportedly contributed to its extirpation from its original range (Forys et al. 2001a). They are also a threat to the federally endangered Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*) and may impact a wide variety of invertebrate fauna including many rare butterflies (Tuskes 1981, Forys et al. 2001a, Forys et al. 2001b, Forys et al. 2002). Other non-native ant species, such as the Mexican twig ant (*Pseudomyrmex gracilis*), have also been implicated in the decline of rare butterfly species. Fire ant colonies also pose a safety threat to humans and domestic pets due to their aggressive attacks and stinging bites when their nests are disturbed.

#### Control Methods

1. Known exotic ant colonies on Refuge lands will be treated with a USFWS-approved insecticide to prevent, to the extent possible, the impacts of the imported red fire ant upon native wildlife in areas where unintended damage to non-target species can be avoided.
2. Early detection will continue to be the best policy to prevent further establishment of invasive non-native ant species on Refuge lands in the FKNWRC. As workloads and necessity permits, the USFWS may conduct sweeping surveys and targeted eradications of non-native ant species on Refuge lands.

## **3.3 Native Vertebrates Species**

### **3.3.1 Raccoon**

#### Species Account

Raccoons are found statewide in Florida, especially in urban and coastal areas, in high densities. Two subspecies in the Florida Keys are recognized, the Key Vaca raccoon (*Procyon lotor auspicatus*) and Key West raccoon (*P. l. incautus*). Raccoons are omnivorous, consuming fruits, plant material, turtle and bird eggs, crustaceans, small animals, garbage, and possibly tree snails (Carrillo et al.

2001, Gehrt 2003, Lotze and Anderson 1979).

In a pristine environment, native prey species co-evolve with native predators and adapt to natural rates of predation. However, with extensive fragmentation of habitats from human development, and increased access to human sources of food and shelter, raccoon populations may inflate beyond the environment's natural carrying capacity. Raccoons are efficient and opportunistic mesopredators that have relatively few enemies, are extremely adaptable, and have relatively high populations throughout much of their range. Reports of nuisance raccoons in the Lower Florida Keys were first noted by the early 1980s, and raccoons now occur in high densities, locally if not rangewide (USFWS, unpublished data, Faulhaber 2003).

#### Justification for Management Action

Under certain circumstances, local raccoon populations can increase to the extent that they have a significant impact on other native wildlife such as nesting sea turtles and shorebirds, warranting active control measures (Prange et al. 2003, 2004; Engeman et al. 2005; Rosatte et al. 2006). There has been some indication that high densities of raccoons may negatively impact Lower Keys marsh rabbit populations (USFWS 2007, Schmidt et al. 2010). Neonatal and juvenile rabbits in natural settings may be susceptible to raccoon predation (USFWS 2007). Raccoons are known to kill adult Lower Keys marsh rabbits when the rabbit's movements are restricted (Forys et al. 1996, Faulhaber 2003). Raccoons prey upon both *Orthalicus* and *Liguus* snails (Voss 1976, Deisler 1987), posing a threat to the Federal and State-listed tree snails in the Florida Keys. Raccoons are also known to excavate nests and destroy the eggs of the American crocodile (*Crocodylus acutus*), which is federally listed as threatened, on Crocodile Lake NWR (USFWS, unpublished data).

Raccoons are indigenous to the Florida Keys and provide functions in the natural ecosystem. Rapid removal of raccoons from the local ecosystem has the potential to yield unintended ecological consequences (Ratnaswamy and Warren 1998; Barton and Roth 2006, 2008). Removal of an apex predator from the ecosystem can in turn increase the abundance of other predators on vulnerable prey species (e.g. removal of raccoon's leads to an increase in the crab population which could lead to an increase in turtle egg depredation). Whereas reduction of human-generated food sources that may contribute to inflated raccoon populations is warranted, further research and evaluation of potential impacts on protected species would be required for evaluating whether additional strategies beyond those outlined below for managing native raccoon abundance in the FKNWRC.

#### Control Methods

1. The FKNWRC will strive to reduce raccoon numbers indirectly by working with Monroe County, neighborhood associations, civic organizations, commercial businesses, homeowners and others to distribute wildlife-proof garbage cans and trash dumpsters to homes and businesses located near Refuge lands, and to discourage outdoor pet feeding stations and intentional feeding or watering of wildlife.

2. With partners and efforts such as the Our Animal Family campaign, the FKNWRC will develop brochures and conduct neighborhood canvassing to distribute educational materials on the legal and biological ramifications of intentional and unintentional outdoor feeding and watering of animals, including the dangers and nuisance posed to themselves, their pets, their neighbors, and local wildlife such as raccoons.

3. Raccoons trapped in live traps targeted for cats or other non-native species will be released alive at the trap site. Incidentally-caught raccoons may be either marked (e.g. ear tag, ear clip, radio collar or other identification) or left unmarked, depending on current or future research needs. Raccoons that exhibit severe disease or other serious health issues will receive appropriate evaluation, which may include care and treatment or euthanasia by a State-certified wildlife rehabilitator, veterinarian, or county-contracted animal control services provider.

4. The FKNWRC will continue to seek funding opportunities and engage universities and research partners to conduct field studies on the ecology, distribution, abundance, density, food habits, and genetic diversity of raccoons, and to better understand any relationships between raccoons and potential prey species. We anticipate that this will inform or provide a foundation for monitoring, which will be essential for measuring the effectiveness of management strategies over time and which will be implemented as applicable and feasible to evaluate if the raccoon populations respond to management strategies of reducing human-subsidized sources of food and shelter. Motion-triggered cameras and/or radio telemetry methods may be used to enumerate and track raccoons.

5. If field studies and monitoring indicate that raccoon populations are having a substantial negative impact on an endangered species, the FKNWRC will re-evaluate the need to implement direct control (such as removal) of raccoons from sensitive habitats. Removal could include transfer to a wildlife park or zoo, a state-certified wildlife rehabilitator, or euthanasia. Under no circumstances will raccoons be translocated to other natural areas due to concerns for resident animals. If substantial impacts to endangered species are observed and direct control considered, a planning process with public input will be conducted.

#### **4.0 Public Involvement**

The USFWS has conducted periodic pest control on Refuge lands in the FKNWRC over the past several decades. Those activities were either conducted by refuge personnel or implemented through contracts with the U.S. Department of Agriculture's Division of Wildlife Services, pursuant to their Environmental Assessment and Finding of No Significant Impact on the Management of Predation Losses to Federally Listed Species in the State of Florida (2004). Due to increasing need for improving and sustaining pest management practices, USFWS conducted extensive public scoping and developed this Integrated Pest Management Plan to address site-specific conditions and constraints unique to the FKNWRC and Monroe County, Florida. In the National Key Deer Refuge in particular, a comprehensive and coordinated effort will be needed among the USFWS,

state, county, animal advocate groups, and private property owners due to the intermixture of public and private lands.

#### 4.1 Public Scoping

The need for an integrated pest management plan was driven by public controversy arising out of the USFWS's initial efforts in 2007 to control free-roaming cats and raccoons to protect the endangered Lower Keys marsh rabbit on National Key Deer Refuge. During 2008, four public scoping meetings were held in Big Pine Key, Florida on April 3, April 24, May 8, and November 25, with participants representing the state, county, animal advocate groups, environmental organizations, and local citizens. Meetings of the self-titled Marsh Rabbit Stakeholder Group were professionally facilitated by the Florida Conflict Resolution Consortium Consensus Center (Florida State University, Tallahassee), which serves as an independent public resource for facilitating consensus solutions and supporting collaborative action throughout Florida.

The Marsh Rabbit Stakeholder Group drafted strategies for protecting the endangered Lower Keys marsh rabbit from predators while assuring the humane treatment of feral and free-roaming cats and dogs and other domestic and wild animals. A questionnaire was developed and distributed on-line by the stakeholder group to solicit input on the draft strategies; and 106 people subsequently responded. The strategies were rated by respondents using this scale: 5 – Wholeheartedly support, 4 – Support with minor concerns, 3 – Neutral, 2 – Concerned but can live with it, 1 – Opposed. The average rating is shown below for each general strategy statement, listed in order from high (5) to low (1) support. The results should not be interpreted as a statistically-rigorous opinion survey of any groups participating; however they reflect a general sense of priority for the strategies.

| <b>Proposed general strategy for Lower Keys marsh rabbit predator control</b>  | <b>Score</b> |
|--|--------------|
| Educate children, residents, businesses, groups, and community leaders about the importance of spaying, neutering and not abandoning pets, not feeding wildlife and using animal-proof trash containers.   | 4.95         |
| Remove free-roaming cats and dogs from marsh rabbit habitat if education and regulations are not sufficient to reduce predation using trapping and handling guidelines that assure humane treatment and easy return of pets that are captured.   | 4.52         |
| When education and voluntary action is not enough, establish and enforce regulations on Big Pine and No Name Keys that may include: enforcing existing pet license and abandonment laws, requiring microchips for pets, and prohibiting free-roaming cats within 500 meters of marsh rabbit habitat. | 4.45         |
| Fund strategy implementation by public agencies and private groups using license and microchip fees, fines, program budgets, donations and grants.   | 4.42         |
| Reduce the intentional and incidental feeding of raccoons and other wildlife through education, law enforcement and secure trash containers. Do not remove raccoons unless research proves significant predation and then only in specific predation locations.                                      | 4.13         |
| Provide an animal shelter on Big Pine Key, a network of volunteers to foster adoptable feral cats, and arrangements with feral cat sanctuaries so it is not necessary to kill captured cats.   | 3.58         |

The final outcome of the stakeholder process was a commitment to a common goal of “no homeless pets” through a collaborative public and private effort including education,

enforcement, and trapping and removing free-roaming cats from Refuge lands as well as applying proper waste management practices to control native raccoon populations (Taylor 2008). Two initiatives - Our Animal Family and Key Lime Kitties – have subsequently been launched to engage the local communities in achieving the common goal through public education and individual stewardship (see sample materials in Appendix V).

Strategies for controlling other pest species addressed in this IPMP are consistent with ongoing efforts and protocols adopted by local, state, and Federal government agencies and non-government entities involved in exotic species management in the Florida Keys.

#### **4.2 Draft Integrated Predator Management Plan Environmental Assessment**

On January 3, 2011, the USFWS issued a Draft Integrated Predator Management Plan Environmental Assessment (EA) addressing pest species management strategies for Refuge lands in the FKNWRC. News releases about the availability of the draft for review were widely distributed through a variety of local, state and national news sources in addition to notifications sent out to an extensive contact list of interested parties via email. The draft was also posted on the National Key Deer Refuge website. The USFWS accepted comments for a 30-day period through February 3, 2011. During this 30 day period, the USFWS received approximately 9,614 comments with over 99% coming in the form of internet-generated letters with standard content (commonly known as web-based alerts). Unique (original) comments were received from several individuals, local and national animal advocacy groups, local and national environmental groups, zoological associations, and other governmental agencies (Table 1). Copies of all public comments received electronically or hard copy are kept on file at the FKNWRC headquarters office on Big Pine Key, Florida.

**Table 1.** Organizations and agencies that provided written comments on the Draft IPMP and EA.

|   |
|---|
| Alley Cat Allies  |
| American Bird Conservancy <i>co-signed by</i> National Wildlife Federation, Defenders of Wildlife, Sierra Club, Avian Research and Conservation Institute, Cornell Laboratory of Ornithology, Center for Biological Diversity, Urban Wildlands Group, University of New Mexico Center for Wildlife Law, Endangered Habitats League, High Desert Ecological Research Institute, Biodiversity Conservation Alliance, University of Georgia Warnell School of Forestry and Natural Resources, North Carolina Museum of Natural Sciences, three state ornithological societies and eight Audubon chapters |
| Ark Angels Wildlife Rescue  |
| Association of Zoos and Aquariums   |
| Audubon of Florida  |
| Best Friends Animal Society   |
| Brevard Zoo   |
| Disney Animal Programs and Environmental Initiatives  |
| Forgotten Felines   |
| Florida Fish and Wildlife Conservation Commission   |
| Humane Society of the United States   |
| Key Deer Protection Alliance  |
| Raccoon Rescue  |
| The Wildlife Society  |
| U.S. Department of Agriculture Wildlife Services  |

U.S. Fish and Wildlife Service Ecological Services' New Jersey Field Office

U.S. National Park Service Biological Resource Management Division

The final plan was retitled Integrated Pest Management Plan to conform to the USFWS policy on integrated pest management. Editorial comments on text or grammar were incorporated in this Final IPMP where applicable. The USFWS's response to comments is in Appendix II, with specific examples and quotes included to illustrate common themes. The Finding Of No Significant Impact and Final Environmental Assessment are in Appendix III.

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## Appendix I

### Excerpts of Recovery Actions for Listed Species from the South Florida Multi-Species Recovery Plan (USFWS 1999)

#### Lower Keys Marsh Rabbit

**S2.5.1. Control or eliminate free-roaming cat populations near rabbit habitat.** Free-roaming cats are abundant in the Lower Keys and are a major threat to juvenile and adult marsh rabbit survival. Establish a program throughout the Lower Keys to control free roaming cats. Establish a program to license domestic cats, implement leash laws, eliminate cat-feeding stations, implement spay and neuter program, increase awareness through educational material, test diseases, and remove nuisance feral cats.

**S2.5.1.1. Continue coordination efforts with NAS, Key West to eliminate free roaming cats from that Federal facility.**

**S2.5.1.2. Reduce impacts by free roaming cats. Develop deed restrictions to prohibit free roaming cats in rabbit sensitive areas.** Develop and enforce deed restrictions that minimize the effects of free-roaming cats on Lower Keys marsh rabbits.

**S2.5.2. Control raccoon predation. Raccoon populations are unnaturally high in some areas of the Lower Keys.** Raccoons are capable of killing both adult and juvenile rabbits. Eliminate supplemental food sources--outdoor cat feeding stations and open dumpsters--to reduce raccoon populations.

**S5.2. Develop and implement a free-roaming cat control program.** Conduct workshops to inform residents about the necessity of controlling cat predation on marsh rabbits through licensing programs, leash laws, and spay and neuter programs.

**S5.3. Continue to inform military and civilian personnel at NAS. Inform personnel about the marsh rabbit's presence, its protection under the ESA, and ways to minimize impacts on it.**

**H1.2.1. Protect marsh rabbits on private lands.** Protect marsh rabbit populations on private land through acquisition, conservation easements or agreements, and education of land owners. Develop agreements or coordinate section 10 permits between the FWS and private land owners to minimize impacts such as feral cats, mowing, and exotics. For example, coordinate with Long Beach Estate Fish Camp to minimize the impact of feral cats and increase exotic control along the nature trail.

**H1.2.2. Protect marsh rabbits on public lands.** Manage public lands for exotics, off-road vehicles, dumping, feral cats and other predators, and vehicular traffic. Identify and minimize other causes of rabbit injury or mortality on public lands.

**H1.2.8. Continue cooperative management at NAS, Key West. NAS has minimized their impacts on the Lower Keys marsh rabbit through management actions.** Continue protection efforts such as controlled mowing, exotic removal, habitat restoration, and cat control.

## **Silver Rice Rat**

**S2.5. Minimize and eliminate disturbance or mortality to the silver rice rat.** Silver rice rats are preyed upon by cats, black rats, raccoons, and fire ants. Predation by these species is increased near areas of urbanization. Eliminate or reduce mortality from these sources.

**S2.5.1. Minimize cat predation on silver rice rats.** Cats are known predators of silver rice rats. Establish a program to license domestic cats, implement leash laws, eliminate cat-feeding stations, implement spay and neuter programs, increase awareness through educational material, test diseases, and remove nuisance free-roaming cats.

**S2.5.2. Minimize competition and predation by black rats.** Black rats may be able to out-compete silver rice rats for food and habitat resources and prey on young rice rats. Eliminate black rat food shelters and sources. Enforce proper disposal of refuse around residences and in silver rice rat habitat.

**S2.5.3. Minimize raccoon impacts on silver rice rats.** Raccoon populations are unnaturally high in some areas of the Lower Keys. Raccoons are capable of killing both adult and juvenile rats. Eliminate supplemental food sources, feeding by humans, outdoor cat-feeding stations, and open dumpsters to reduce raccoon populations.

**S5.2. Develop and implement a cat, black rat, and raccoon control program.** Conduct workshops to educate residents about the necessity of controlling cat and raccoon predation on silver rice rats as well as minimizing the effects of black rats and fire ants.

**H1.3.1. Protect rice rats on public lands.** Develop a habitat management plan that outlines priority habitat for acquisition and methods to protect, restore, and minimize impacts on rice rats and their habitat. Manage habitat for exotics, off-road vehicles, dumping, feral cats and other predators, and vehicular traffic.

**H1.3.2. Protect rice rats on private lands.** Protect rice rat populations on private land through acquisition, conservation easements or agreements, and education of land owners. Develop agreements (*e.g.*, Memorandum of Agreement) between the FWS and private land owners to minimize impacts such as feral cats and exotics.

## **Key Largo Woodrat**

**S2.3.1. Remove nuisance predators.** Feral dogs and cats, black rats, raccoons, and fire ants can increase woodrats mortality. Eliminate food sources and home sites for raccoons and black rats, control free-roaming feral cats and dogs, and destroy fire ant colonies near and in woodrat habitat. Enforce deed restrictions of cat control in Ocean Reef Club and other areas.

**S5. Increase public awareness and stewardship.** Develop educational materials and host public workshops to increase awareness about woodrats and instill a sense of stewardship for the protection of this endangered species.

**S5.2. Develop and implement a cat, black rat, fire ant, and raccoon control program.** Conduct workshops to educate residents about the necessity to control cat and raccoon predation on woodrats and to reduce the effects of black rats and fire ants.

**H1.2.2. Protect woodrats on private lands.** Protect woodrat populations on private land through acquisition, conservation easements or agreements, and education of landowners. Develop agreements (*e.g.*, Memorandum of Agreement) between the FWS and private landowners to minimize impacts such as feral cats and exotics.

**H1.2.3. Coordinate with Federal, State and Monroe County agencies and private entities to develop management actions to protect woodrat habitat.** Coordinate with all Federal agencies to ensure Federal actions do not impact woodrat habitat. Coordinate with these entities to ensure proposed construction activities that result in land clearing or alteration do not impact the woodrat and its habitat. Coordinate with the Audubon Society to develop a management plan for Parcel 22. Coordinate with the landowner to protect and manage habitat and minimize impacts to the woodrat (*e.g.*, trash, feral cats, *etc.*).

### **Key Largo Cotton Mouse**

**S25. Minimize and eliminate disturbance or mortality to the Key Largo cotton mouse.** The level of cotton mouse mortality has not been characterized, although sources of mortality are documented. Implement management actions that reduce mortality.

**S2.5.1. Remove nuisance predators.** Feral dogs and cats, black rats, raccoons, and fire ants can increase cotton mouse mortality. Eliminate food sources and home sites for raccoons and black rats, control free-roaming feral cats and dogs, and destroy fire ant colonies near and in cotton mouse habitat. Enforce deed restrictions of cat control in Ocean Reef Club and other areas.

**S5.2. Develop and implement a cat, black rat, fire ant, and raccoon control program.** Conduct workshops to educate residents about the necessity to control predation on cotton mice as well as to minimize the effects of black rats and fire ants.

**H1.2.1. Protect cotton mice on private lands.** Protect cotton mouse populations on private land through acquisition, conservation easements or agreements, and informing landowners. Develop agreements (*e.g.*, Memorandum of Agreement) between the FWS and private landowners to minimize impacts such as feral cats and exotics.

**H1.2.3. Coordinate with Federal, State and Monroe County agencies and private entities to develop management actions to protect cotton mouse habitat.** Coordinate with these entities to ensure proposed construction activities that result in land clearing or alteration do not impact the cotton mouse and its habitat. Coordinate with the Audubon Society to develop a management plan for Parcel 22. Coordinate with private landowners to protect and manage habitat and minimize impacts to the cotton mouse (*e.g.*, trash, feral cats, *etc.*).

## Appendix II

### Response to Public Comments on January 2011 Draft Environmental Assessment and Integrated Predator Management Plan

**Comments about addressing human threats:** Several responses to the draft referenced *“the agency’s failure to adequately address the real hazards to endangered species and fragile environments that sustain them – development, habitat loss, pollution, etc.”*

**Response:** The Service has long recognized threats to species caused by development, habitat loss, and other human-related activities. Assessment and planning regarding these issues are routinely conducted over various time intervals in recovery plans, five-year reviews, refuge Comprehensive Conservation Plans (CCPs), and other processes. Additionally, other government agencies such as the Florida Fish and Wildlife Conservation Commission (FFWCC), Florida Department of Environmental Protection (FDEP), National Oceanic and Atmospheric Administration (NOAA), and the U.S. Army Corps of Engineers (USACE) have mandates and authorities aimed at minimizing or reducing human-related impacts to wildlife, land and water such as pollution and habitat loss. Actions are implemented by agencies, non-government organizations and private individuals, within existing constraints.

Aforementioned assessments and plans broadly address the FKNWRC’s issues of habitat loss and fragmentation, climate change, fire management, invasive species, conflicts between wildlife and public uses, and other human-related stressors to species and ecosystems. Management strategies include habitat restoration, prescribed fire, control of exotic species, and land acquisition. The CCPs provide general direction for Refuge activities over a 15-year planning horizon. The Integrated Pest Management Plan (IPMP) is a step-down of the CCPs that prioritizes and outlines distinct, targeted actions to address the particular challenge. These actions are also broadly indicated (or specifically identified; see Appendix I) in other plans and assessments. The IPMP is specific to Refuge lands and how conditions in the broader landscape specifically impact listed and other native fauna on the FKNWRC.

Assessments and plans seek not only to identify various past, persistent, and new threats, but also to clarify the magnitude and imminence of those threats and what might be done to reduce the magnitude and imminence of threats. In terms of influencing the Lower Keys marsh rabbit or Key Largo woodrats chance of persisting, the significance of cat predation exceeds other threats. The USFWS strongly recognizes that there are interrelated aspects among various threats. However, the existence of historical impacts from development does not diffuse the role of free-roaming cats in the ongoing decline of some of our most vulnerable endangered species. Instead, all such impacts (e.g. increased isolation, dispersal barriers, restricted range) are specifically magnified by free-roaming cats. At present, the

more primary threat to woodrats and rabbits is free-roaming cats as opposed to habitat destruction.

**Comments about managing particular species and implications for other ecosystem components:** Example: "Single species management has never been a viable way to manage a complex, multi-faceted problem. By intensively managing one component of an ecosystem, the result may be unforeseen impacts on other components." Opposing viewpoints were also submitted, for example: "Although there is always the possibility of unexpected results from managing species numbers, the likely outcomes of reducing free-roaming cat density on refuge lands are overwhelmingly positive, especially given the documented predation by cats on sensitive species on these lands."

**Response:** The IPMP is a multi-species management plan. It pertains to an assemblage of exotic species that pose significant threats to a wide array of native fauna, likely including the majority of native vertebrates. Cats are a single species widely inserted into ecosystems around the world where they endanger multiple species and disrupt ecosystem functions, with particular voracity on island systems. Cats impact a remarkable proportion of species in affected communities. There is a vast, empirical and theoretical literature that describes real and potential impacts of inserting predators into natural systems. Cats are quintessentially opportunistic and generalist predators, with an extremely wide niche breadth. Because island ecosystems tend to lack top predators, be driven by bottom-up processes, have resource constraints, and are simpler relative to most mainland settings, the influences of exotic predators are often profound. We have not seen substantive or compelling arguments that hypothetical impacts to other ecosystem components are likely to be significant. In contrast, we view impacts on native fauna to be beyond reasonable doubt.

As described in this IPMP, local knowledge and an expansive global literature describe profound impacts of cats on diverse native fauna, notably including rare island endemic fauna as in the FKNWRC. Additionally, simulation models indicate that hypothetical concerns about mesopredator side effects of cat control are not appropriate for generalization (Russell et al. 2009). Russell et al. (2009) concluded that: "Mesopredator release only occurs in strongly top-down moderated (resource-abundant) systems. Even when mesopredator release can occur, the negative impact of more mesopredators is outweighed by the benefit of superpredator removal, allowing recovery of the prey population". A primary reason for this outcome was that the superpredator could kill all life-stages (sub-adult and adult) of the island endemic prey, whereas the (would-be released) mesopredator is limited to killing sub-adult prey, as with the case of cats (superpredator), non-native rats (would-be released mesopredator), and rabbits and woodrats (prey) in the Florida Keys.

**Comments about scientific references:** Some responses that opposed the control of free-roaming cats on Refuge lands asserted that there was a lack of data or data quality to support control of cats. Several comments were related to the scientific validity of the references included in the Draft IPMP. Others were more specific about the reliability of the marsh rabbit studies conducted by Forsys (1995), Forsys and Humphrey (1994, 1996, 1999), and Forsys et al. (1996) and the population models derived from those studies. A few comments expressed concerns that *"the data are approximately twenty years old"* and that *"the data was collected in habitat patches located on US Navy property..."* on Boca Chica Key.

**Response:** The USFWS seeks the best available science in supporting management decisions. The numerous studies referenced in the IPMP are consistent with the assertion that free-roaming cats and other invasive species interfere with achieving important purposes of the FKNWRC. No contrary evidence was substantiated in the comment process, including for the Forsys et al. findings. As with the Forsys et al. study, the majority of studies cited in the IPMP are published in peer reviewed science journals.

The Forsys et al. work in the 1990s represents the most comprehensive single research project on the biology and ecology of the Lower Keys marsh rabbit. In regards to the age and location of that study, we assert that the predator-prey relationship has not changed in the intervening years and does not differ among locations. It is reasonable to assume that twenty years has not fundamentally changed the biology of the free-roaming cat or the marsh rabbit. Cats were present and impacting rabbits prior to Forsys' study as well, and cat predation had been implicated as a threat to the long-term viability of the marsh rabbit prior to Forsys' study. Her detailed research further substantiated those concerns. Moreover, we assert that the level of impact identified in the earlier field studies has increased in imminence and magnitude as the period of exposure has been prolonged and simultaneously, rabbits experienced prolonged decline. Moreover, the number of under-cared for and at-risk cats has likely increased, which would only strengthen the general conclusions regarding cat borne risks to rabbits.

Cover and predator pressure interact to affect actual levels of prey vulnerability. Many of the habitat areas outside of Boca Chica Key have less herbaceous ground cover than does Boca Chica Key. When considering the whole range, this would only expand the level of impact observed by Forsys, not contradict them. Additionally, areas outside of Boca Chica Key (Naval Air Station) have a substantially greater abundance and density of human residences and residential areas and accordingly, higher numbers of free-roaming cats. Vulnerability to and impacts from cat predation is likely even greater on Big Pine Key than on Boca Chica Key for example, due to the interspersed neighborhoods with natural areas throughout Big Pine Key, larger numbers of cats, and less herbaceous ground cover on average. In other words, any sampling focus on Boca Chica Key would likely under-represent the magnitude of threats from cats in the broader landscape. For this reason too, impacts observed by Forsys would likely be underestimated for some areas, not contradicted. During and subsequent to those studies, rabbit abundance has declined least on Boca Chica Key and declined steadily in the Sugarloaf area and most on Big Pine Key. Throughout most of the range, rabbits are in close proximity to multiple classes of free-roaming cats. Over the entire range, approximately 55% of occupied patches were within 320 meters of existing development (Faulhaber 2003).

We see no substantive evidence that the conclusions from those studies, that cats are a major source of marsh rabbit mortalities, are outdated. Additionally, for the reasons stated above, we conclude that both the imminence and magnitude of the threat has continued to grow, particularly on Big Pine Key. Results from more recent population viability analyses (PVAs) are consistent with the findings from Dr. Forsy's study (LaFever et al. 2008). Additionally, real trends are consistent with our assertions regarding the relationship between cats and rabbits, with the rate of decline in rabbit abundance being greatest on Big Pine Key and least on Boca Chica Key and other islands lacking cats (USFWS 2007).

In addition, the Refuges are critical habitat for many other endangered species, unique subspecies, and migratory birds for which the USFWS has responsibilities under the Migratory Bird Treaty Act, Endangered Species Act, and National Wildlife Refuge System Improvement Act, among others. As outlined in the Draft IPMP and further elaborated in Section 3.0 of the Final IPMP, an extensive body of research documents the widespread effects of free-roaming cats on small mammals, birds, and reptiles. In addition to direct predation are other impacts of dominant non-native species on native wildlife, such as disease transmission, displacement due to threat, and competitive relationships.

**Comments about *Trap-Neuter-Return*:** Trap-neuter-return (TNR) was frequently proposed by animal advocacy groups as an alternative to the removal of free-roaming cats from Refuge lands. An example is that TNR is a... "*humane and effective technique, supported by the local community, [that] was improperly rejected from consideration. Worse, the Draft Environmental Assessment misinterpreted and disregarded scientific research supporting Trap-Neuter-Return*". In contrast, a local commenter stated that TNR is not "*supported by the local community*", and several environmental organizations, zoological associations, and individuals stated opposition to TNR, for example: "*The overwhelming scientific evidence supports a trap and remove approach for feral cats to protect sensitive biological resources.*"

**Response:** Regardless of a continuing debate about TNR's ability to reduce cat numbers, TNR does little to reduce cat predation on native wildlife (and could fail to prevent disease transmission). The instinctive hunting and killing behavior of free-roaming cats is not related to their hunger mechanism in a simple manner, and cats typically pose a threat to wildlife even when they are not hungry. Accordingly, conducting TNR is not compatible with the purposes for which any of the Florida Keys Refuges were established, would not be appropriate for the Refuge to promote on or near Refuge lands, and would otherwise be contrary to the mission and mandates to conserve, protect, and restore native populations of wildlife.

Many animal advocacy groups adopt pro-TNR policies, whereas numerous wildlife advocacy groups and zoological societies have adopted anti-TNR policy. Additionally, some national animal advocacy groups assert that traditional TNR programs are not the most appropriate choice for managing free-roaming cats, especially where cat colonies are managed near designated wildlife areas and at-risk native wildlife populations. For example, the People for the Ethical Treatment of Animals (PETA) states: “*We believe that it can be marginally acceptable to trap, vaccinate, alter, and release feral cats when the cats are isolated from roads, people, and animals who could harm them, are regularly attended to by people who not only feed them but also provide them with veterinary care, and are kept in areas where they do not have access to wildlife and the weather is temperate.*” ([www.peta.org/about/why-peta/feral-cats.aspx](http://www.peta.org/about/why-peta/feral-cats.aspx)). Additionally, the American Society for the Prevention of Cruelty to Animals (ASPCA) states that it “*recognizes that TNR is the most humane approach to managing the feral cat population problem in the United States. At the same time, the ASPCA recognizes that feral cats can threaten wildlife species and that some environments are not suitable for feral cat colonies. Therefore the ASPCA supports TNR in general but would oppose it under circumstances that pose a threat to the welfare of the cats themselves, the public or indigenous wildlife species.*” ([www.aspca.org/about-us/policy-positions/feral-cat-management-1.aspx](http://www.aspca.org/about-us/policy-positions/feral-cat-management-1.aspx)).

Trap, neuter, and release (TNR) of free-roaming cats has been promoted as a method for reducing feral cat numbers slowly over time. TNR typically involves an outdoor colony of homeless cats that are trapped, sterilized, vaccinated, and then released back into the same area. Paid and or volunteer caretakers provide food and water to the colony. TNR has reportedly been implemented by various animal advocacy groups on both Big Pine Key and Key Largo for years and yet has failed to effectively reduce impacts to native wildlife on adjacent Refuge lands. Ocean Reef (ORCAT) in Key Largo may be one of the best examples of a continuous well-funded TNR program; however, impacts to the Key Largo woodrat in the adjacent Crocodile Lake NWR are still substantial despite laudable efforts by ORCAT (Alligood and Savage 2011).

Lethal control has been used as an alternative to TNR in some areas. We concluded that the most balanced and socially acceptable approach was to live trap cats and convey them to local animal shelters. The shelters can then use their expertise regarding the final disposition of the cats, which will likely include seeking homes with responsible pet owners or placement in long-term cat care facilities on the mainland.

**Comments about green iguanas:** A couple of commenters were opposed to the lethal control of green iguanas based on belief that the green iguana is native to the Florida Keys; for example: “*Fontenada's memoirs, written in the latter part of the 1500's, mentioned the local Indians eating snakes, turtles, lagarto (which they translated as being alligators, but it means large lizards, which could also be iguana).*”

**Response:** Regarding the translated memoirs of Hernando D'Escalante Fontenada, we do not concur that a reference to eating "largarto" is substantial information to conclude that the green iguana is part of the native fauna of the Florida Keys. Instead, the American alligator or American crocodile, both present in the native fauna, were likely the species referred to. We have not found or received any contrary information in species accounts, natural history accounts, or any other documentation to substantiate the green iguana as a native species. Contemporary scientific records and natural history accounts of *Iguana iguana*'s native range include Mexico to southern Brazil and Paraguay as well as on the Caribbean Islands, and biological disciplines firmly attribute it to being an exotic invader in Florida.

**Comments about mesopredator release:** A few comments asserted that mesopredator release was not adequately addressed in the Draft IPMP. One such comment asserted that "...even if FWS is successful at removing cats from some locations, the IPMP/EA fails to take into account the risk of mesopredator release—the inevitable spike in non-native rodent populations". Another stated that a spike in exotic rat populations will "lead to the extirpation of the marsh rabbits from any key where these rats are present". On the contrary, another comment asserted that "The reproductive ability of non-native black rats is similar to that of non-native Norway rats (*Rattus norvegicus*) and although cats will kill juvenile Norway rats, the effect on population size is not significant (Glass et al. 2009). Although cats have reputations as "ratters," the scientific research simply does not give evidence of their effectiveness as such (Anonymous 1914; Forbush 1916; Jackson 1951; Childs 1986; Glass et al. 2009), at least in and around human settlements. Note, however, that although free-roaming cats will have little or no effect on the rapidly reproducing, non-native, and human-tolerant species *Rattus rattus* and *Rattus norvegicus*, they can and do impact populations of native habitat-specialist species such as Key Largo woodrat (*Neotoma floridana smalli*)."

**Response:** In this context, meso refers to medium-sized; mesopredator typically refers to carnivores and omnivores in systems with larger (and or higher trophic level) predators that may prey upon the mesopredators or also displace them. If more dominant predators are removed, the mesopredator(s) may be released from predation and inhibitory effects of those more dominant predators. Ecological effects deriving from the top predators may constitute a trophic cascade. Examples of mesopredators include certain rays and small sharks, snakes, coyotes, skunks, and raccoons. In the context of the first comments, exotic rats are asserted to be (omnivorous) predators of Lower Keys marsh rabbits which, that is, mesopredators. In the absence of cats the rats themselves would be released from cat predation and would increase numerically, and in turn the potential for predation on rabbits by rats would increase. Accordingly, this assertion also constitutes a case of intra-guild predation, in which cats and rats constitute members of a rabbit-killing guild comprised of generalist predators and omnivores (that utilize a common resource, in this case rabbits), and cats also prey on the other guild member, rats. In the Keys, such a guild would also include raptorial birds, raccoon, opossum, armadillo, and snakes. The mesopredator release hypothesis generally emphasizes the importance of strong top-down control, often from apex predators (e.g., wolves [*Canis lupus*] in the Yellowstone ecosystem).

The black rat is the most common, widespread exotic (*Rattus* genus) rat in the Keys (Lazell 1989, Faulhaber 2003, Perry 2006). Therefore, it is the species that the comment nominates as the inevitably released mesopredator that is currently held in check by cats. Adults typically weigh less than 200 grams. Adult Lower Keys marsh rabbits weigh about 1000 grams. For any individual Lower Keys marsh rabbit (of any size or age), cats are likely a far greater threat than are rats, and cats pose a much greater risk to marsh rabbit populations than do rats. We contend that rabbits, which are low in number and localized, are more susceptible to cat predation than are rats, which are high in number, widespread, and far more fecund. Rats are more abundant, widespread, continuously distributed, and fecund than rabbits, and also likely less vulnerable on the basis of their arboreal capacities. In other words, the impact of killing even a high proportion of rats in a given area or areas, if a cat were able to do so (which is unlikely), would be expected to be less a threat to the persistence of rats in that area than the killing of even relatively few rabbits would have on persistence of rabbits. Moreover, cats could easily dispatch a high proportion of rabbits in a given area but would be unlikely to be able to kill a large portion of rats in any such area. And there are more rats in more places breeding at greater frequency, all enhancing the capacity of rats to recolonize any predator exploited place. Accordingly, we contend that there would not be an inevitable spike in rodent numbers as a result of cat control on Refuge lands, because cats are not effectively controlling rats on those lands. More generally, such mesopredator release is by no means inevitable (e.g., Gehrt and Prange 2006; Bonnaud et al. 2010; Russell et al. 2009). In summary, we contend that cats are not effectively controlling rats in the Keys ecosystems, rats are not controlling rabbits, and cats are controlling rabbits.

Additionally, the argument of mesopredator release of *Rattus* rats fails to recognize a more generally applicable role of *Rattus* and cats in the trophic dynamics on island (and other) ecosystems. Specifically, *Rattus* contribute to the prey base of exotic cats and (where present) other exotic predators, a subsidy that enhances cats capacity to exploit rare, endemic, and other native prey species. Even though it is commonly conceived that house cats control *Rattus* populations, studies indicate that feral cats do not suppress *Rattus* (e.g., Pitt and Witmer 2007, Glass et al. 2009). *Rattus* may constitute a significant portion of feral cat's diet, yet cats overwhelmingly fail to control *Rattus* populations in natural ecosystems. Thus rats can enhance the impacts of cats, particularly feral ones, but cats fail to inhibit the impacts of rats on ecosystems. The assertion that an increase in non-native rat populations will "lead to the extirpation of the marsh rabbits from any key where these rats are present" is unsupported by existing data. This is because cats do not effectively control rats in the first place, and further, rats may subsidize cat impacts on more vulnerable prey populations. In contrast to the comment's assertion, marsh rabbits persist on islands without cats, despite the ubiquity of rats.

The mesopredator release argument as applied to *Rattus* in the comments also fails to recognize the high trophic position of the cat and ignores an intermediary link. In the Lower Keys ecosystem, an important outcome deriving from intra-guild predation is more likely. Specifically, native snakes that are vulnerable to cat predation would become less vulnerable as a result of cat control, which may allow them to increase predation pressure on rats. Snakes are routinely killed by cats. Any rat-eating snake killed by a cat removes the predatory impact that the given snake would otherwise impart to the rat population during its lifetime. The native snakes of the Keys, such

as the local race of the rat snake (*Elaphe guttata* [more recently proposed as *Pantherophis guttatus*]), are important rat predators. This is partly because members of this native assemblage of predators access palm canopies, tree canopies, building rafters, and crevices below and throughout human domiciles and in natural areas that are not accessible to cats. The prominent alternative common name for the rat snake for example is corn snake, because of its well-known rodent work around silos and barns. When cats prey on snakes, they impact the benefits that in certain times and places, only snakes can provide. Raptors, which are able to prey on rats despite the presence of cats in urban areas of the Lower Keys, are far too often poisoned due to secondary effects of rat poison (Maya Totman, Florida Keys Wildlife Rescue, pers. comm.).

Snakes are pertinent to another aspect of the mesopredator release question as it applies here. In the Keys, native snakes are a prominent predator guild. With cats in the system, snakes constitute a (rat-eating) guild of mesopredators. Cases in which release of exotic rats reportedly followed control of cats may lack assemblages of rat-eating snakes. Although many feral cat removals have taken place around the world, few cases exist where mesopredator release has been implicated as a factor resulting in negative consequences. In those few cases, most were on single islands with multiple feral species that were impacting ground-nesting birds (Courchamp 1999, Downing et al. 2009, Fan et al. 2005, Rayner et al. 2007, Richie and John 2009). In one notable case, it was shown that feral cat eradication was only one of many contributing factors that resulted in a release of a feral rabbit population, but was not shown to increase rat (*Rattus norvegicus*; would-be mesopredator) abundance; further, it did find that the native seabird diversity and abundance had increased after feral cat removal and therefore the goal of the removal project was met (Downing et al. 2009).

Additionally, most of those rare cases involved oceanic islands with burrowing seabirds such as petrels as the victim (in many other cases, cited in this IPMP, such birds were clearly impacted by cats as opposed to rats). Such petrels are notoriously lacking in capacity to respond to the novel predators that exotic rats represent. In contrast, marsh rabbits are more adept at responding to ground predators. Neonatal rabbits in a den are potentially defenseless, however, particularly when unattended by the mother. In addition to black rats (potentially), such juvenile rabbits may be susceptible to cats, raccoons, opossum, armadillos, and snakes. As discussed above, release of rats typically does not occur and/or rats merely enhance cats ability to impact rare island endemic species (Downing et al. 2009; Russell et al. 2009; Bonnaud et al. 2007, 2010, 2011).

Control of non-native rats would more likely benefit silver rice rat and possibly Key Largo woodrat populations, which are potentially impacted by competition, disease, and predation by non-native rats (see IPMP section 3.1.2). Compared to exotic rats (e.g., impacts on rice rats), we have concluded that cats (e.g., impacts on marsh rabbits, woodrats) are a more imminent threat. In recent decades, the decline of the silver rice rat is not as great as the decline of the Lower Keys marsh rabbit, and the threats not as imminent (USFWS 2007, 2008). Moreover, unlike the case for rats at the present time, we have concluded that reduction of cat impacts is feasible.

If the best available scientific evidence pointed to rats as the paramount threat, we would have defined priorities differently and tasks accordingly. Available actions and resources would not reasonably be expected to eradicate rats at present. Accordingly, attempting to do so is not an objective of the IPMP, whereas reducing the well-established threats from cats is. We do not view the slim likelihood of a hypothetical mesopredator release of rats to outweigh the high risk of not controlling cats, especially since cats are not controlling rats. We contend that there is a substantial benefit gap when balancing cat control against no cat control for fear of rats. Reducing cat predation can benefit rabbits and woodrats. We are seeking to release such listed and other native prey (mammalian, avian, and reptilian) from cat predation.

**Comments about the effectiveness and cost of a previous trapping effort:** Some comments pertained to a previous trapping effort on the National Key Deer Refuge in a short-term trapping program conducted through an interagency agreement with the U.S. Department of Agriculture Wildlife Services (USDA). A few of those who commented indicated that the low success rates and monetary expense of those programs were unacceptable; for example: *"I think it's safe to say that the wildlife of the Keys received little or no benefit from these efforts."* One commenter stated that ... *"had the 2007 funding been used for TNR...the impact would have been substantial!"*

**Response:** This IPMP specifies trapping efforts in a manner that has very little in common with previous efforts. Rather than conduct a single intensive project, the trapping and removal of free-roaming cats and other non-native species on Refuge lands will be conducted on a routine basis as part of the FKNWRC's biological program operations, and continue until those and complementary efforts get the problem under control. Additionally, trapping efforts will be driven by surveillance information derived from remotely triggered cameras and other auxiliary data which will allow efforts to be more targeted and efficient. Efforts will be informed by monitoring that offers feedback on the impact of the operations.

We recognize that the problem of abandoned, under cared for, at-risk cats and other exotic animals extends beyond the FKNWRC's borders. We will continue to promote public education and outreach through the "Our Animal Family" campaign and continue collaborative efforts through the Florida Keys Exotics Task Force which includes partners from Monroe County, Florida Fish and Wildlife Conservation Commission, the City of Marathon, Naval Air Station Key West, Florida State Parks, and others to address the problem across boundaries. Goals are to inhibit the presence of exotic predators and mesopredators on the Refuges wherever possible and to reduce predation impacts on critically imperiled species and other native fauna. We believe that broader stakeholder participation will be necessary for attaining endangered species recovery (and retaining biodiversity) in the long term. At such time that broader community efforts provide for the goal, trapping will be suspended. We assert that neither status quo or TNR can facilitate the goal, that trapping can retard the decline of Lower Keys marsh rabbit and Key Largo woodrat in the short term (or the long term if necessary), and that greater community effort and broader community involvement can reverse the decline, and is proposed, over the longer term. In fact, we inherently prefer source control. Our assessment of environmental conditions, however, yielded the necessity of trapping as the proposed alternative. The status quo has failed to address the plight of homeless cats and their impacts to native fauna including the rabbit and woodrat, which are now highly imperiled.

A primary objective regarding cats is to provide listed species on the Refuges space that is free of cat predation, pursuit, and disease, as opposed to capturing any particular number of cats. One successful cat can hunt and kill dozens if not hundreds of prey animals over the course of a year, and or convey diseases to native fauna. The preponderance of available evidence fails to substantiate any assertion that funding for TNR in 2007 would have had significant benefit to any component of the problem, or that protracted TNR would facilitate the goal. In fact, the best available science suggests that a short period of TNR would likely provide little or no benefit to wildlife, and protracted TNR would virtually tie up funds in perpetuity.

We have already put far more resources into establishing monitoring, research, and adaptive management schemes for affected species than we have for control of exotic predators. In addition to focusing efforts and reducing costs over the long term, this extensive effort seeks to enable iterative assessment and reevaluation of the impacts of both threats and management actions pertaining not only to predators but also other, less imminent threats and factors pertinent to population viability. Once the IPMP and adaptive management feedbacks are in effect, any indication that reduced trapping becomes optimal for any given place or period will be welcome information, as resources could be unreservedly directed to myriad other problems that are overshadowed by the imminence and magnitude of the exotic predator problem.

**Comments about lethal removal of cats:** Some of those who commented on the Draft IPMP were in favor of lethal control of free-roaming cats on Refuge lands (Alternative C in Draft IPMP). Comments were generally related to the ineffectiveness of live trapping and removal, and some provided examples of how they thought the program could be more efficiently operated; for example, "*lethal control using professional sharpshooters hunting at night on important refuge areas should be re-considered as trapping is an ineffective control method overall.*" Some found the USFWS's efforts to reduce pest species through non-lethal methods to be unacceptable; for example, in reference to waste management strategies to indirectly control raccoons, one letter stated that: "*These efforts, if successful, would not produce immediate effects on target populations (i.e., native raccoons), nor would they immediately reduce predation pressures caused by the targeted populations.*"

**Response:** We facilitated extensive public outreach and collaborative stakeholder engagement with regard to the feral cat problem on National Key Deer Refuge, including local animal advocates and animal control shelters, in a deliberate effort to find appropriate and acceptable alternatives regarding cats and raccoons. Cats will be turned over to animal control agencies which will determine the appropriate disposition. Regarding native subspecies of raccoons, we maintain that there is not enough scientific information about impacts on other native species to justify trap and removal. Further research would be needed to determine whether any direct control of raccoons to benefit endangered species on the FKNWRC would be warranted.

Public education about the benefits of not feeding wildlife, securing garbage cans, and other passive methods will reduce unnatural food sources and wildlife concentrations that have a number of detrimental consequences. Additionally, enforcement against feeding and trespass violations will continue as needed. We anticipate that those efforts will provide a long-term positive benefit for ecosystems in the FKNWRC.

**Comments about raccoon control and green iguanas:** For example: "*overlooked by the USFWS is the role raccoons may play in limiting numbers of invasive species, such as green iguanas (Meshaka et al, 2007).*"

**Response:** The IPMP calls for managing human impacts to raccoons and further study of raccoons as opposed to direct control. Meshaka et al. (2007) provides observations, at a single place (state park) and period of time. Concomitantly, green iguana numbers also grew in other parks and other places, even though raccoons were not manipulated in those places. In short, there is no compelling evidence that raccoons are exerting substantial control over iguana populations in the Florida Keys.

**Comments about removal of raccoons:** There were a variety of comments about trapping and removing raccoons.

**Response:** We are not removing raccoons. However, we will clarify our position on the predatory relationship of raccoons and rabbits that we have long asserted. Raccoons are extremely wide-ranging omnivorous mesopredators that inhabit diverse environments. The overall, rangewide diet of raccoons is very diverse, and they respond opportunistically to available food resources. As with any potential predator-prey relationship, broadly assuming that there is no interaction may constitute an overly prescriptive assumption. Animals interact through scent, sight, sound, and or physically whether humans are watching or not, and they are not bound to any contrary supposition. With predators and potential prey, the interaction may be lethal (predation) or sub-lethal (prey alters its behavior due to predator, for example). Where they overlap in limited habitat, increasing numbers of one or the other increases the probability of interaction. All Lower Keys marsh rabbits live in proximity to raccoons. Omnivorous mesopredators react to a wide range of useful food sources, including vulnerable animals, by consuming it. We found no reason to presuppose that predator-prey interactions never occur in the case of raccoons and marsh rabbits. We have not and do not assert that raccoons seek free-ranging adult rabbits for pursuit hunting. However, we would not unreservedly concur with an assertion that predation never occurs; if food-seeking raccoons were to intersect a den of vulnerable rabbit pups, for example, they would likely feed on them. Nonetheless, there is anecdotal evidence that is pertinent. Raccoons are known to dismember adult rabbits that are vulnerable due to constrained movement. This occurs in the same habitats in which rabbits den. Any assertion that raccoons would not opportunistically prey on vulnerable rabbit kits in the same places would be difficult to rectify with existing knowledge, including any reasonable expectations about parental protection. Disease transmission is another potential interaction, the likelihood of which increases with raccoon density.

We continue to assert that raccoon-rabbit interactions may manifest as population level impacts on rabbits, but continue to assert that the question remains unanswered (neither the mechanism nor level of impact is clearly elucidated). Numerous raccoons range over the habitats used by rabbits. Rabbits likely exhibit behavioral strategies to mitigate against potential impacts of raccoons, but those same strategies may involve tradeoffs that inhibit resource exploitation and impact productivity and other vital demographics. Because the relationship of raccoons and rabbits are at least semi-natural, raccoons are widespread and abundant, and not known to pose an imminent threat of high magnitude, removal of raccoons was not selected. Instead, controlling human subsidies was deemed prudent and commensurate with the problem as per the best available information. In contrast, we view free-ranging cats to be an imminent threat, the mechanism (predation) is well known, and reducing that threat is feasible and will also benefit the entire gamut of susceptible native fauna.

## Appendix III

### Finding Of No Significant Impact (FONSI) and Final Environmental Assessment

## **Finding of No Significant Impact**

### **Introduction**

The U.S. Fish and Wildlife Service (USFWS) proposes to implement an integrated pest management program on the Florida Keys National Wildlife Refuges Complex (NWRC) that focuses on controlling invasive exotic species and a potentially nuisance native species that prey upon or compete with native species, particularly several federal and state listed threatened and endangered (listed) species.

An Environmental Assessment (EA) has been prepared to inform the public of the possible environmental consequences of implementing the Florida Keys NWRC Integrated Pest Management Plan (IPMP). A description of the alternatives, the rationale for selecting the proposed alternative, the environmental effects of the proposed alternative, the potential adverse effects of the action, and a declaration concerning the factors determining the significance of effects, in compliance with the National Environmental Policy Act of 1969, are summarized below.

The supporting information can be found in the Draft Environmental Assessment for the Florida Keys NWRC IPMP, published in January 2011

Copies of the Environmental Assessment and Draft Integrated Predator Management Plan may be found at the refuge complex headquarters and on the following website: <http://www.fws.gov/nationalkeydeer/predatormanagement.html>.

### **Alternatives**

In developing the IPMP, we evaluated three alternatives. We subsequently adopted Alternative B (Proposed Action) as our proposed alternative for guiding the implementation of an integrated pest management program, stepped down from the overall goals and objectives of the respective Comprehensive Conservation Plans (CCP) for the Lower Florida Keys NWRs (2009) and Crocodile Lake NWR (2006). These plans all reflect the National Wildlife Refuge System's strong and singular mission of wildlife conservation.

The importance of reducing impacts of invasive exotic animals on federally listed species in the Florida Keys has been well documented and prescribed in the scientific literature, the South Florida Multi-Species Recovery Plan, the Big Pine and No Name Keys Habitat Conservation Plan (2006), the USFWS's Biological Opinion for the Federal Emergency Management Agency's administration of flood insurance in the Florida Keys (2010), in addition to the aforementioned CCPs. The removal of invasive exotic species to protect native species and habitat is a widespread practice that is essential for wildlife conservation in human-altered ecosystems. Strategies for controlling pest animals are consistent with standard protocols adopted by local, state and federal agencies involved in wildlife management throughout Florida.

A description of the three alternatives follows.

**ALTERNATIVE A - NO ACTION (STATUS QUO)**

This alternative summarizes the past and current situation and would maintain the status quo. Free-roaming cats would be allowed to continue occupying Refuge lands unchecked and preying on endangered wildlife and native fauna, and other non-native exotic species would continue invading and expanding across Refuge lands, thereby jeopardizing threatened and endangered species as well as the biological integrity and natural diversity of the Florida Keys NWRC. In some cases, recovery of certain endangered species, such as the Key Largo woodrat and Lower Keys marsh rabbit, will be precluded and their long-term persistence would be in jeopardy.

**ALTERNATIVE B - INTEGRATED MANAGEMENT (PROPOSED ALTERNATIVE)**

This alternative includes a range of non-lethal and lethal methods for controlling exotic species and consequently reducing the impacts of predation, disease, and sub-lethal effects (exclusion, competition) by free-roaming cats, rats, opossums, armadillos, green iguana, and other large-bodied lizards and snakes. Additionally, the native raccoon can impact other native species when their abundance is inflated by human-subsidized food sources. Methods are summarized here:

- **Free-roaming cats:** The USFWS will remove all free-roaming cats found on Refuge lands through live trapping. Baited walk-in live traps will be used. Traps will be set at dusk and closed each morning, reducing exposure of trapped animals to adverse diurnal weather conditions (e.g. solar heat, humidity). A variety of baits, visual attractants, and trap design modifications will be used to target free-roaming cats while trying to avoid attracting non-target species to the greatest extent possible. Cats trapped on Refuge lands will be transferred and surrendered to a Monroe County animal control shelter facility.
- **Opossum, armadillo, and rats:** Any opossum, armadillo, or rat caught on Refuge lands (excluding opossums on Crocodile Lake NWR where they are considered native) will be immediately dispatched in accordance with the American Veterinary Medical Association (AVMA) guidelines for euthanasia. Opossums are native on Key Largo, and accordingly, any caught on Crocodile Lake NWR will be released alive.
- **Green iguana:** The USFWS may engage in intensive trapping of green iguanas in specific locations on Refuge lands if monitoring shows that iguanas are negatively impacting native species or assemblage of native fauna. Such efforts may become necessary on remote islands of the Key West NWR, which are occupied by endangered Miami blue butterfly that relies exclusively on the blackbead (*Pithecellobium keyense*) as the host plant. Trapping effort would focus on the capture of gravid females during the egg-laying period using a variety of trap types, including standard live traps and artificial iguana nest box traps. Trapped iguanas will be lethally dispatched in accordance with AVMA and other available guidelines for humane euthanasia of reptiles. Concurrently, as many iguana nests as feasible will be dug up and the eggs will be destroyed.

- **Other large-bodied lizards and snakes:** Other exotic reptile species of concern include Nile monitor, black spiny-tailed iguana, giant black and white tegu, python, and boa. The presence of exotic large-bodied snakes and lizards on Refuge lands will be detected through camera traps, reports, incidental sightings, and the community-based interagency “Python Patrol”. The Python Patrol is a network of trained responders that are deployed when reptile sightings are called into a dedicated 24-hour hotline at 1–888–I’ve Got 1 (1-888-483-4681). Exotic reptiles will be lethally dispatched in accordance with AVMA and other available guidelines for humane euthanasia of reptiles.
- **Fire ants:** Imported red fire ants will be treated with a USFWS-approved insecticide to prevent, to the extent possible, the impacts of the imported red fire ant upon native wildlife in areas where unintended damage to non-target species can be avoided.
- **Raccoons:** Raccoons are native to the Florida Keys, and accordingly, any raccoons incidentally caught in traps targeting free-roaming cats will be released alive. The USFWS will strive to reduce raccoon numbers indirectly by working with Monroe County, neighborhood associations, civic organizations, commercial businesses, homeowners and others to distribute wildlife-proof garbage cans and trash dumpsters to homes and businesses located near Refuge lands, and to discourage outdoor pet feeding stations and intentional feeding or watering of wildlife.
- **Education & Outreach:** The USFWS will actively promote the Our Animal Family campaign ([www.ouranimalfamily.org](http://www.ouranimalfamily.org)) that is coordinated by Friends and Volunteers of Refuges (FAVOR) and their partners. This innovative partnership and educational effort promotes the humane treatment of all animals, including native wildlife and domestic pets, and seeks to reduce human-induced pressures on endangered species. The USFWS will also support local ordinances which require micro-chips, tattoos, or identification tags for all cats owned, sold, adopted, licensed or taken to a vet in order to promote responsible pet ownership.

#### **ALTERNATIVE C – LETHAL CONTROL ONLY**

This alternative would allow the lethal removal of all targeted exotic and native pest species that pose a threat to native species, especially those listed as threatened or endangered. Lethal control methods would be applied in all areas of the Florida Keys NWRC. Predators would be lethally dispatched on site in a humane manner utilizing AVMA approved methods. Euthanized animals would be disposed in accordance with local and state animal disposal regulations. Non-target native species caught incidentally would be released on site.

#### **Selection Rationale**

Alternative B was selected for implementation because it provides an integrated and adaptive approach that best achieves our mission to protect, enhance, and restore the biological diversity and natural integrity of the unique ecological landscapes of the Florida Keys NWRC. It attempts to address a complex ecological problem with roots in a long-standing sociopolitical debate in relation to protecting native wildlife in a wildland-urban

interface. Alternative B incorporates many points of agreement developed by a stakeholder group during the professionally-facilitated public scoping process to a greater degree than any of the other alternatives. The IPMP strives to be both socially acceptable as well as ecologically appropriate by proactively addressing the *cause* (people abandoning cats and other exotic species in natural areas; availability of trash and human food to wildlife) of the problem through public education and enforcement, as well as deliberately addressing the *consequences* (non-native animals killing and competing with native wildlife) of the problem through trapping and removing certain animals from Refuge lands.

We do not expect to achieve complete eradication of any targeted pest species, especially since sources of invasion (escapes, releases, free-roaming pets, immigration from adjacent areas, continued reproduction of pest species, etc.) will likely endure for some time. However, a concerted and sustained effort to control and reduce the number of pest animals on Refuge lands in addition to extensive public outreach, education, and enforcement, will have substantial benefits for listed and other native species that inhabit the Florida Keys NWRC.

### **Environmental Effects**

Implementation of the Florida Keys NWRC Integrated Pest Management Plan is expected to result in environmental (physical and biological), social and economic effects as outlined in the Environmental Assessment (January 2010). Under this alternative, the USFWS has the greatest potential for effectively reducing predation of listed species because all potential nonlethal and lethal control alternatives and methods would be available for use on the Florida Keys NWRC. Additionally, Alternative B would allow for the most efficient protection of other wildlife species such as small mammals, birds, and reptiles by focusing efforts with minimum impact upon non-target species with using both passive and active predation reducing efforts.

### **Why the Proposed Alternative Will Not Have a Significant Effect on the Human Environment**

**Wildlife Disturbance** - Implementation of the proposed alternative is not expected to significantly cause disturbance to wildlife. Live-trapping will be conducted in such a manner to attract targeted species and minimize the capture of non-target native wildlife species. Traps will be open during the cooler night-time hours, and checked daily the following morning. All native wildlife will be immediately released. The management actions to be implemented have been carefully planned to avoid unacceptable levels of impact to native wildlife.

**Adjacent Landowners** - Implementation of the proposed alternative is not expected to significantly affect the owners of private lands adjacent to the refuges. Positive impacts that would be expected include reduced intrusion of invasive exotic animals originating on Refuge lands and reduced abundance of nuisance animals around homes. Short-term negative impacts may include the unintentional capture of a homeowner's pet if it is allowed to roam freely on adjacent Refuge lands when trapping occurs. To minimize this potential impact, the Service will provide information to homeowners and the general public in advance of conducting animal trapping and removal, including clear messages about keeping pets indoors or at least constrained within outdoor areas on their property. Additionally, all trapped cats will be transferred to the local animal shelter where owners

can retrieve their pet. General public outreach will be conducted on a regular basis under the auspices of the Our Animal Family campaign.

**Public Health and Safety** – The control of free-roaming cats on Refuge lands is expected to have a beneficial impact on public health and safety by reducing the potential for disease transmission from infected free-roaming cats to domestic pets, wildlife, and humans. Free-roaming cats serve as vectors for a number of diseases including rabies, cat scratch fever, hookworms, roundworms and toxoplasmosis. Dense populations of feral cats can also lead to increased prevalence of ectoparasites (e.g., fleas, ticks, mites); in addition to being nuisances, these parasites may transmit bacteria of the genera *Bartonella*, *Rickettsia*, and *Coxiella* from cats to humans, causing diseases such as endocarditis, bacteremia, and Rocky Mountain spotted fever.

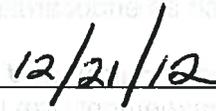
**Coordination and Public Outreach:** The development of the integrated pest management plan has been coordinated with all interested or affected parties including Monroe County, Florida Fish and Wildlife Conservation Commission, wildlife rescue groups, domestic animal protection groups, contracted animal control organizations, veterinarians, environmental organizations, and interested citizens and refuge neighbors. In anticipation of the potential for public controversy with animal rights groups, the USFWS hosted an extensive stakeholder process professionally facilitated by the Florida Conflict Resolution Consortium, resulting in a number of points of agreement and socially-acceptable management strategies. The resulting pest management plan reflects the integration of direct intervention (trapping and removal), education and outreach, enforcement, and research and monitoring as a balanced approach to a critical ecological and sociopolitical issue.

In addition, this determination is based on an analysis of the following factors (40 CFR 1508.27):

1. Both beneficial and adverse effects have been considered and this action will not have a significant effect on the human environment.
2. The actions will not have a significant effect on public health and safety.
3. The project will not significantly affect any unique characteristics of the geographic area, such as proximity to historical or cultural resources, wild or scenic rivers, or ecologically critical areas.
4. The effects on the quality of the human environment are not likely to be highly controversial.
5. The actions do not involve highly uncertain, unique, or unknown environmental risks to the human environment.
6. The actions will not establish a precedent for future actions with significant effects nor do they represent a decision in principle about a future consideration.
7. There will be no cumulatively significant impacts on the environment.
8. The actions will not significantly affect any site listed in, or eligible for listing in, the National Register of Historic Places, nor will they cause loss or destruction of significant scientific, cultural, or historic resources.
9. The actions are not likely to adversely affect threatened or endangered species or their habitats
10. The actions will not lead to a violation of federal, state, or local laws imposed for the protection of the environment.

Therefore, it is my determination that the management action does not constitute a major federal action significantly affecting the quality of the human environment under the meaning of Section 102(2) (c) of the National Environmental Policy Act of 1969 as amended. As such, an environmental impact statement is not required.





**Acting Regional Director**

**Date**

## **Environmental Assessment**

### **I. Background**

#### **Purpose and Need**

FKNWRC includes four units of the National Wildlife Refuge System, the National Key Deer Refuge and the Key West, Great White Heron, and Crocodile Lake National Wildlife Refuges. The FKNWRC is a collection of low-lying, subtropical islands between the Gulf of Mexico and the Atlantic Ocean that protect all the vital habitats representative of the Florida Keys ecosystem, including the globally imperiled pine rockland, tropical hardwood hammock, and mangrove forests. These geologically and climatically distinct islands provide a haven for diverse native flora and fauna, including endemic threatened and endangered species.

Many native habitat areas in the Florida Keys ecosystem were historically diminished from outright destruction or fragmentation during the development of neighborhoods, roads, canals, and mosquito ditches. The rate of direct habitat loss due to development has declined substantially in the case of roads and buildings, and has essentially ceased in the case of mosquito ditches and canals. In contrast, a secondary effect of development, the proliferation of non-native animal species, has endured as a prominent threat to native wildlife including species listed under the ESA. The importance of reducing predation by exotic species on federally listed species in the Florida Keys has been well documented and prescribed in scientific literature (see Section 3.0), assessments, and plans, including the South Florida Multi-Species Recovery Plan, subsequent Five Year Reviews for listed, the USFWS's Biological Opinion for the Federal Emergency Management Agency's administration of flood insurance in the Florida Keys (USFWS 2010), and the FKNWRC's Comprehensive Conservation Plans (CCPs).

The USFWS developed CCPs for the Crocodile Lake NWR (2006) and the Lower Keys Refuges (2009) to guide management and conservation strategies for these refuges over a 15 year planning horizon. The CCPs address issues that threaten the long-term conservation of imperiled species and their habitats, including habitat loss and fragmentation, invasive species, sea-level rise, altered fire regimes, changing public uses and demands, and inadequacy of resources for management and protection. The CCPs lay out broad goals, objectives and strategies to protect and maintain diverse habitats and eliminate adverse human impacts to the extent possible, so that ecosystems, species diversity, and imperiled species are protected or restored. Some species require additional attention and direct intervention to increase their population abundance and distribution and improve their long-term viability. This IPMP is a step-down plan that tiers off the CCPs to specifically address the relevant management objectives and strategies for minimizing current and foreseeable threats from exotic animals.

#### **Proposed Action**

Based on the environmental effects analysis of the proposed action (PA), also known as Alternative B or the proposed action, and public comments concerning the significance of these effects, the USFWS has concluded that the proposed action is not found to be significant. Based on public comments on the Draft Environmental Assessment (EA), the EA was revised and is contained herein as an appendix to the Final Integrated Pest Management Plan.

## **II. Affected Environment**

### **Physical Resources**

*For a detailed description of the physical environment of the Florida Keys, including climate, geology, soils, hydrology, water quality and quantity, and air quality, refer to the Crocodile Lake and Lower Florida Keys Comprehensive Conservation Plans (available at <http://www.fws.gov/southeast/planning/CCPFinalRefugesDocuments.html>).*

### **Biological Resources**

#### **Plant Communities**

The Florida Keys National Wildlife Refuges are a collection of low-lying, subtropical islands between the Gulf of Mexico and the Atlantic Ocean that protect all the vital habitats representative of the Florida Keys ecosystem, including the globally imperiled pine rockland forests, tropical hardwood hammocks, and mangrove wetlands. Within the continental United States, these habitat types are found only in extreme south Florida and the Florida Keys. Pine rocklands have the highest plant diversity of all plant communities in the Florida Keys, with a total of 250 species of plants including 14 herbs endemic to south Florida, 5 of which occur only in the Lower Keys settings. The tropical hardwood forests contain more than 120 native trees and shrubs, nearly 80 percent of which are of West Indian origin. Mangrove wetlands are dominated by black mangrove, white mangrove, or red mangrove species ranging from tall, coastal forest to low, dense scrub communities. Other major habitat types in the Florida Keys National Wildlife Refuges include freshwater wetlands, salt marsh transition, inland salt ponds, beach ridge hammock, coastal rock barren, coastal berm, beach and dune, and marine. *Each habitat type and its associated flora and fauna is more fully described in the Crocodile Lake and Lower Florida Keys Comprehensive Conservation Plans (available at <http://www.fws.gov/southeast/planning/CCPFinalRefugesDocuments.html>).*

#### **Native Wildlife and Targeted Pest Species**

These ecologically, geologically and climatically distinct islands provide a haven for a diversity of native fish and wildlife. Unfortunately, many habitats, such as hardwood hammock and pine rockland, have been lost or altered due to human development. Other impacts of development include the fragmentation of native habitats due to roads, canals, and mosquito ditches; and the introduction and invasion of non-native exotic plant and animal species that compete with or prey on native species. These impacts have led to considerable population declines in several species which are currently listed as endangered, threatened, or candidate species under the Endangered Species Act (Appendix I). "Endangered" means a species is in danger of extinction throughout all

or a significant portion of its range. "Threatened" means a species is likely to become endangered within the foreseeable future. "Candidate" species are those for which the Service has enough information to warrant proposing them for listing but is precluded from doing so by higher listing priorities; however, the Service carries out priority conservation actions for these species to prevent further decline and possibly preclude the need to list. The Service's South Florida Multi-Species Recovery Plan provides a full description of all federally listed species that occur within the Florida Keys (available for free download at <http://www.fws.gov/verobeach>). The following provides a brief overview of the different wildlife species groups found in the Florida Keys.

**Birds** - The Florida Keys National Wildlife Refuges support more than 250 species of birds, including wading and water birds, shorebirds, waterfowl, raptors, and neotropical migratory songbirds. Priority species include the great white heron, reddish egret, brown pelican, piping plover, Wilson's plover, roseate tern, white-crowned pigeon, bald eagle, osprey, and northern harrier.

**Mammals** - As with many island chains, few land-dwelling species occur in the Florida Keys. Most of the native mammals represent sub-species of those found on mainland Florida, but they became genetically distinct after thousands of years of geographic isolation when the last drop in sea level rise formed the island chain. Raccoons are the most commonly seen native mammals in the Florida Keys and they inhabit most habitat types as well as developed areas. Key deer can be found on up to 26 islands from Big Pine Key to Sugarloaf Key, with the center of its population on Big Pine and No-Name Keys. Key deer use most habitat types, including developed areas. Lower Keys marsh rabbits are predominantly found in scattered low-density populations in salt marsh transition and freshwater wetland communities in the Lower Keys from Big Pine Key to Boca Chica Key. Silver rice rat habitat includes mangrove wetlands and salt marsh transition on at least 13 islands from Big Pine Key to Lower Sugarloaf Key. The Key Largo woodrat and Key Largo cottonmouse are only found in protected tropical hardwood hammocks on upper Key Largo.

**Amphibians** - Amphibians require freshwater and therefore only occur in freshwater solution holes, wetland ponds, and man-made mosquito ditches and borrow pits. At least seven native amphibians are known from the Florida Keys, including the southern leopard frog.

**Reptiles** - The mosaic of habitats throughout the Florida Keys National Wildlife Refuges support a variety of native snake species, including the Big Pine ringneck snake, eastern diamondback rattlesnake, eastern indigo snake, rim rock crowned snake, and the Florida Keys mole skink. Crocodile Lake National Wildlife Refuge supports nearly 25 percent of the existing American crocodile population and is one of only three areas in the United States that provides nesting habitat for the species. The green, loggerhead, and hawksbill sea turtles are nesting species, while leatherback and Kemp's ridley forage in waters surrounding the refuges. The Florida box turtle and Keys mud turtle inhabit upland areas of National Key Deer Refuge, and mangrove terrapin are found on offshore islands of the Key West National Wildlife Refuge and in Florida Bay.

**Invertebrates** - The National Key Deer Refuge and Crocodile Lake National Wildlife Refuges contain the only known remaining populations of the Stock Island tree snail. There are also a variety of *Liguus* tree snails that inhabit similar tropical hardwood hammock communities that merit attention and conservation. There are more than 200 species of

butterflies, moths and dragonflies that have been described in the Florida Keys. The Schaus swallowtail butterfly is found in the hammocks on Key Largo, including Crocodile Lake National Wildlife Refuge. The endangered Miami Blue Butterfly is currently found only on islands in the Key West National Wildlife Refuge. At least eight resident species of butterflies found in the lower Keys are imperiled, including Bartram's hairstreak and the Florida leafwing, both currently candidates for listing under the Endangered Species Act.

**Non-native vertebrate communities-** Because of the Florida Keys have been occupied by humans for many years; some non-native species such as the Iguana, the Fire Ant, and the house cat have been present or established for some time while others such as the Burmese python, Black and White tegu, and opossum are relatively new arrivals. Due to the fact that the Florida Keys are islands disbursement of some species, especially those which cannot swim or fly such as cats, can be slow and limited unless aided by humans. At this time cats are only known to inhabit refuge islands with some form of development. Tropical Islands, especially when altered by humans, have many available niches that exotic invaders can fill. Because of this some species populations, such as the iguana, now occupy every island in the chain at relatively high densities. Iguanas have grown beyond the control of most wildlife managers due to their generalist diet and niche requirement combined with their ability move between islands freely. However, iguanas have been controlled in small, isolated natural areas such as Bahia Honda State Park. Early detection and extirpation is possible for some new invaders. Due to intensive management efforts the Gambian pouch rat has been restricted to one island, Grassy key, and the population remains in low numbers. Other non-native species which occupied a limited number of Keys have been fully eradicated. Feral pigs once inhabited some islands within the FKNWRC, but were removed through an integrated approach of eradication techniques.

## **Cultural and Historic Resources**

*For a detailed description of the cultural history of the Florida Keys, refer to the Crocodile Lake and Lower Florida Keys Comprehensive Conservation Plans (available at <http://www.fws.gov/southeast/planning/CCPFinalRefugesDocuments.html>).*

## **Sociopolitical Setting**

The Florida Keys are sparsely populated compared to Florida as a whole. Many of the islands are semi-rural though there are several large, densely developed island communities--Islamorada, Marathon, and Key West. According to the U.S. Census Bureau, for the year 2000, compared to the state as a whole, the county represents only a half percent of the state population and about 0.7 percent of the state's housing. The Keys represent only 5.6 percent of Monroe County's total area, 1.8 percent of the state's land area, and 23 percent of the state's waters.

There is still much undeveloped land that is in private ownership. The county and state has limited the rate of development to prevent the human population from exceeding the carrying capacity of the water, electric, sewage, and road services. The latter pertains to concerns about hurricane evacuation times of the current resident and tourist populations with the present road and bridge infrastructure. With many private lands in the Florida Keys containing habitat for threatened or endangered species, habitat loss or degradation from

development remains a concern. Secondary impacts from development include the potential introduction of invasive exotic species that compete with and/or predate on native species.

The economy of the Keys is supported primarily by tourism. There is extensive service support for the tourist industry and local resident needs. Almost every island accessible by U.S. Highway 1 has one or more residential subdivisions, trailer parks, RV parks, and/or campgrounds and associated commercial services. Water-based sports (e.g., sport fishing, diving, and kayaking) and the night life of Key West have become major draws to the area, with associated economic gains. Also important to the economy of the Keys is real estate—the renting, selling, and buying of homes, many of them to seasonal residents.

The average age of residents over 65 living in the Florida Keys is higher than the U.S. average; there has been a decline in population of residents between the ages of 18 to 65 years old. The Florida Keys are experiencing a decline of local residents who grew-up with the knowledge of the intrinsic and economic value of the Keys' natural resources. This is pertinent to the IPMP in terms of the continuing effort needed to educate new residents about natural resources and the needs of endangered and imperiled species, especially with a large, seasonal influx of visitors.

### **Ethics and Values Related to Pest Management**

A subcomponent of the sociopolitical setting is the public's attitude toward pest management as a strategy for conserving imperiled wildlife. Public attitudes are based on individual ethics and values which effect how we perceive the relationship of humans with animals and nature. These different perceptions give rise to conflict especially between an agency's mission to preserve a particular species by controlling another versus an animal rights group's mission to ensure the welfare of all animals (Gamborg et al 2012).

Various authors have reported on the public attitudes toward the control of invasive, pest or predatory species (for example, see Timm and Schemnitz 1988, Reiter et al 1999, Fraser 2006, Bremner and Park 2007, Peterson et al 2012). Invasive non-native species are one of the main threats to biodiversity worldwide; consequently there is a growing need to control or eradicate those species that are causing problems in order to mitigate their impact on native wildlife and natural habitats. Such efforts can be controversial and in some cases have been delayed or halted because of opposition from the public. Therefore, public support can be critical to the success of such projects, and understanding the underlying attitudes of the public can help inform outreach efforts and stakeholder participation. In one study of public attitudes (Reiter et al. 1999), respondents rated animal suffering as the second most important factor to be considered in wildlife control options, after human safety. Other factors, in order of decreasing importance, included: effectiveness, environmental impacts, severity of the problem, specificity, cost, and public opinion. Reiter concluded that the low rating given to public opinion suggests that respondents, while having management preferences, think management authorities should be able to engage in actions they consider appropriate without being restricted by public opinion, especially if the management authority is forthright with the public about explaining the need for action.

Since public attitudes are linked to one's personal ethics and values, the magnitude and nature of the impact as perceived by each individual evaluating the alternative management actions will be entirely subjective. Fraser (2006) reported that the public's

acceptability for individual control options appears to be mediated by the favorability of the pest species in question. For example, feral cats are viewed favorably by the public because of their traditional association with cats as pets, whereas Burmese pythons are viewed as dangerous predators; consequently, they are more likely to support control of the latter but oppose control of feral cats as being unnecessary or inhumane.

In order to better understand such conflicts that arise from differences in views of the problem and appropriate responses to it, Peterson et al (2012) conducted a survey of opinions about outdoor cats and their management with two contrasting stakeholder groups, cat colony caretakers (CCCs) and bird conservation professionals (BCPs) across the United States. Group opinions were polarized (for example, CCCs supported treating feral cats as protected wildlife and using trap neuter and release and BCPs supported treating feral cats as pests and using euthanasia), and further related to gender, age, and education. The authors recommended that agencies should engage stakeholders in identifying shared goals related to caring for animals and promoting a common understanding of the core issues. The FKNWRC facilitated a public stakeholder process that identified a common goal of “no homeless pets” to be achieved through a collaborative public and private effort of education, enforcement, live-trapping and removing free-roaming cats from Refuge lands, and applying proper waste management practices (Taylor 2008) (more fully described in Section 4.1 Public Scoping in the Final Integrated Pest Management Plan).

## **Description of Alternatives**

In developing the IPMP, three alternatives were evaluated. Alternative B (Proposed Action) was subsequently adopted as the preferred alternative for guiding the implementation of an integrated pest management program, stepped down from the overall goals and objectives of the respective Comprehensive Conservation Plans (CCP) for the Lower Florida Keys NWRs (2009) and Crocodile Lake NWR (2006). These plans all reflect the National Wildlife Refuge System’s strong and singular mission of wildlife conservation.

The importance of reducing impacts of invasive exotic animals on federally listed species in the Florida Keys has been well documented and prescribed in the scientific literature, the South Florida Multi-Species Recovery Plan, the Big Pine and No Name Keys Habitat Conservation Plan (2006), the USFWS’s Biological Opinion for the Federal Emergency Management Agency’s administration of flood insurance in the Florida Keys (2010), in addition to the aforementioned CCPs. The removal of invasive exotic species to protect native species and habitat is a widespread practice that is essential for wildlife conservation in human-altered ecosystems. Strategies for controlling pest animals are consistent with standard protocols adopted by local, state and federal agencies involved in wildlife management throughout Florida.

A description of the three alternatives follows.

### **ALTERNATIVE A - NO ACTION (STATUS QUO)**

This alternative summarizes the past and current situation and would maintain the status quo. Free-roaming cats would be allowed to continue occupying Refuge lands unchecked and preying on endangered wildlife and native fauna, and other non-native

exotic species would continue invading and expanding across Refuge lands, thereby jeopardizing threatened and endangered species as well as the biological integrity and natural diversity of the Florida Keys NWRC. In some cases, recovery of certain endangered species, such as the Key Largo woodrat and Lower Keys marsh rabbit, will be precluded and their long-term persistence would be in jeopardy.

#### **ALTERNATIVE B - INTEGRATED MANAGEMENT (PROPOSED ACTION)**

This alternative includes a range of non-lethal and lethal methods for controlling exotic species and consequently reducing the impacts of predation, disease, and sub-lethal effects (exclusion, competition) by free-roaming cats, rats, opossums, armadillos, green iguana, and other large-bodied lizards and snakes. Additionally, the native raccoon can impact other native species when their abundance is inflated by human-subsidized food sources. Methods are summarized here:

- **Free-roaming cats:** The USFWS will remove all free-roaming cats found on Refuge lands through live trapping. Traps will be set, to reduce exposure of trapped animals to adverse diurnal weather conditions (e.g. solar heat, humidity). A variety of baits, visual attractants, and trap design modifications may be used to target free-roaming cats while trying to avoid attracting non-target species to the greatest extent possible. Cats trapped on Refuge lands will be transferred and surrendered to a Monroe County animal control shelter facility. If any shelter declines to accept any cat trapped, or is deemed otherwise unacceptable under this IPMP, the USFWS reserves the right to transfer the animals to other willing shelters in Monroe County, mainland Florida, or beyond.
- **Opossum, armadillo, and rats:** Any opossum, armadillo, or rat caught cats on Refuge lands (excluding opossums on Crocodile Lake NWR where they are considered native) will be removed. Removal could include transfer to a wildlife park or zoo, a state-certified wildlife rehabilitator, or immediately dispatched in accordance with the American Veterinary Medical Association (AVMA) guidelines for euthanasia. Opossums are native on Key Largo, and accordingly, any caught on Crocodile Lake NWR will be released alive.
- **Green iguana:** The USFWS may engage in intensive trapping of green iguanas in specific locations on Refuge lands if monitoring shows that iguanas are negatively impacting native species or assemblage of native fauna. Such efforts may become necessary on remote islands of the Key West NWR, which are occupied by endangered Miami blue butterfly that relies exclusively on the blackbead as the host plant. Trapping effort would focus on the capture of gravid females during the egg-laying period using a variety of trap types, including standard live traps and artificial iguana nest box traps. Trapped iguanas will be lethally dispatched in accordance with AVMA and other available guidelines for humane euthanasia of reptiles. Concurrently, as many iguana nests as feasible will be dug up and the eggs will be destroyed.

- **Other large-bodied lizards and snakes:** Other exotic reptile species of concern include Nile monitor, black spiny-tailed iguana, giant black and white tegu, python, and boa. The presence of exotic large-bodied snakes and lizards on Refuge lands will be detected through camera traps, reports, incidental sightings, and the community-based interagency “Python Patrol”. The Python Patrol is a network of trained responders that are deployed when reptile sightings are called into a dedicated 24-hour hotline at 1–888–I’ve Got 1 (1-888-483-4681). Exotic reptiles will be lethally dispatched in accordance with AVMA and other available guidelines for humane euthanasia of reptiles.
- **Fire ants:** Imported red fire ants will be treated with a USFWS-approved insecticide to prevent, to the extent possible, the impacts of the imported red fire ant upon native wildlife in areas where unintended damage to non-target species can be avoided.
- **Raccoons:** Raccoons are native to the Florida Keys, and accordingly, any raccoons incidentally caught in traps targeting free-roaming cats will be released alive. The USFWS will strive to reduce raccoon numbers indirectly by working with Monroe County, neighborhood associations, civic organizations, commercial businesses, homeowners and others to distribute wildlife-proof garbage cans and trash dumpsters to homes and businesses located near Refuge lands, and to discourage outdoor pet feeding stations and intentional feeding or watering of wildlife.
- **Education & Outreach:** The USFWS will actively promote the Our Animal Family campaign ([www.ouranimalfamily.org](http://www.ouranimalfamily.org)) that is coordinated by Friends and Volunteers of Refuges (FAVOR) and their partners. This innovative partnership and educational effort promotes the humane treatment of all animals, including native wildlife and domestic pets, and seeks to reduce human-induced pressures on endangered species. The USFWS will also support local ordinances which require micro-chips, tattoos, or identification tags for all cats owned, sold, adopted, licensed or taken to a vet in order to promote responsible pet ownership.

#### **ALTERNATIVE C – LETHAL CONTROL ONLY**

This alternative would allow the lethal removal of all targeted exotic and native pest species that pose a threat to native species, especially those listed as threatened or endangered. Lethal control methods, such as shooting and poisoning, would be applied in all areas of the Florida Keys NWRC. Predators would be lethally dispatched on site in a humane manner utilizing AMVA approved methods. Euthanized animals would be disposed in accordance with local and state animal disposal regulations. Non-target native species caught incidentally would be released on site.

#### **ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER EVALUATION**

Trap, neuter, release of free-roaming cats on refuge lands - Trap, neuter, and release (TNR) of free-roaming cats has been widely promoted by cat advocates from around the country as a method for reducing feral cat numbers slowly over time. Local advocates reportedly conduct TNR in the Florida Keys. TNR typically involves a colony that is established in which homeless cats are trapped, sterilized, vaccinated, and then

released back into the environment, and volunteer caretakers provide food and water to the colony. However, TNR does little to reduce cat predation on native wildlife. Studies have shown that the instinctive hunting and killing behavior of cats is unrelated to their hunger mechanism, so that cats kill impulsively and pose a threat to wildlife even when they are not hungry (Adamec 1976, Fitzgerald and Turner 2000, Liberg 1984). In addition, the TNR method has little valid scientific support for claims that it consistently reduces cat colony numbers over time and often has been shown to attract people to release new cats into an area (Foley et al. 2005, Neville 1989, Natoli et al. 2006, Castillo and Clark 2003, Longcore et al. 2009). Despite best efforts of the local cat advocacy groups and animal control agents, free roaming cats will continue to occupy critical wildlife habitats within the FKNWRC. TNR practices are prohibited on National Wildlife Refuges, and violate the Endangered Species Act (ESA) and the Migratory Bird Treaty Act (MBTA) because they may result in the direct harm of protected species. Some animal advocate groups such as PETA and ASPCA therefore agree that traditional TNR programs are not the most appropriate choice, especially where cats are released near designated wildlife areas and at-risk wildlife populations. For these reasons, TNR was dismissed from further evaluation.

Live capture and translocation of pest animals to other natural areas – The live capture and translocation of pest species to other natural areas was considered as an alternative to the proposed action. Translocation of exotic species to their respective native habitats is not practical or economically feasible given that they originated in other states or countries, such as the Burmese python. In most cases, exotic animals were once pets that were released, abandoned, or escaped from their homes. In the case of native species, moving common animals from one area to another is widely discouraged by wildlife biologists and researchers. Suitable habitat is often fully occupied, and the translocated animal is at a disadvantage when establishing a new territory and the exchange of disease is always a threat in addition to other factors such as transmission of disease. For these reasons, the live capture and translocation of pest animals to other natural areas was dismissed from further evaluation.

## **IV. Environmental Consequences**

### **ALTERNATIVE A - NO ACTION (STATUS QUO)**

This alternative summarizes the past and current situation and would maintain the status quo. No passive or active management strategies would be utilized under this alternative. Under the No Action Alternative (NAA), the FKNWRC would not be involved in any management actions to reduce predation of, or competition with, federally listed species on Refuge lands in the FKNWRC. Many species of native wildlife would continue to incur potentially unsustainable levels of mortality or competition by exotic pest species, provided that the USFWS did not implement their own pest management program (Table 2). Birds, small mammals, and reptile species would continue to be impacted by predation from non-native pest species (Table 3). This alternative is likely to result in continued impacts on protected species populations, and impacts upon other native species would continue to occur unabated. Per the current status quo, limited public outreach in the form of visitor center information and other materials would continue. In addition, the NAA would not implement the USFWS's responsibilities as agreed to in the stakeholder process (Taylor 2008).

Continued long term and unsustainable biological impacts are likely for the species addressed in this EA under a no action alternative. In addition, a continued policy of No Action would not be in compliance with the South Florida Multispecies Recovery Plan (USFWS 1999), which includes recovery actions such as predator control to benefit the listed species, as required by the ESA (Appendix I). This alternative would also not be in compliance with other mandates such as the Migratory Bird Treaty Act, Refuge System policies, Executive Order 13122, or Florida State law which are intended to prevent unacceptable environmental impacts.

### **Effects of No Action on Plant Communities**

The NAA is not likely to have substantial impacts on plant communities as a whole. Although species level impacts are possible as a result of browsing from exotic herbivores and omnivores, such as iguanas. Little is known about the diet of the exotic herbivore and omnivore species within the refuge, but many rare plant populations exist at low densities in narrow ranges making local extirpation possible. Because species level effects are plausible for a number of plants under Alternative A, some potential exists for effects seen at the plant community level.

### **Effects of No Action on Native Wildlife and Targeted Pest Species**

The NAA would result in continuing competition and predation of native species by non-native species. Assumedly, non-native species, being generalist omnivores or predators with few predators, would continue to out-compete native species and assure population declines and changes to which result in ecosystem imbalance.

For listed species the status quo will ensure continued losses to populations, including shrinking ranges and lowered abundances as seen historically in the absence of pest management. As has been seen in the past, these losses are likely to occur despite ongoing law enforcement protection from poaching, land acquisition, growth management and other protections that are currently, and will continue to occur.

### **Birds**

Direct and indirect impacts on bird species in habitats protected by the FKNWRC would continue to occur unabated. State and Federally listed species such the Piping plover, white-crowned pigeon would continue to face continuing, and likely increasing pressure from invasive species. Extirpated species like the Key West quail dove (*Geotrygon chrysia*), would be unlikely to re-colonize hammock habitats of the FKNWRC. Neotropical migrants would continue to face threats during spring and fall migrations when they are most vulnerable. Common species would also be impacted, but likely to a lesser degree.

### **Mammals**

The Lower Keys marsh rabbit has seen a steady decline in percentage of habitat patches occupied and total range (see 3.1.1 of Management Plan). This trend is expected to continue to occur under the no action alternative. Invasive predators are likely to continue to breed. In addition, occurrences of other non-native species have also increased in range, diversity and abundance in the areas adjacent to the FKNWRC. Therefore, LKMR in the National Key Deer Refuge are likely to see continued predation

pressure from additional cats and other invasive predators such as pythons. Secondary impacts such as disease, genetic depression, and lowered dispersal capability are likely to continue or increase. Population viability analysis models suggest that the LKMR will go extinct under the no action alternative (Sec. 3 1.1).

The Key Largo woodrat (KLWR) and cottonmouse (KLCR) have seen a decline in range and abundance in recent history (Winchester et al 2009). This trend is expected to continue to occur under the no action alternative. Winchester et al found that models containing availability of nest sites and the abundance of mammalian predator to be the most important predictors of woodrat presence. Under the NAA, supplemental nest structures would continue to be added. However, mammal predators would be unregulated which would thereby result in continued suppression of woodrat populations. Much of the tropical hammock habitat that supports the KLWR and KLCM has been cleared for development. The relict hammock that remains is surrounded by development. The edge habitat created by development creates access points for non-native prey species, such as cats and pythons. National trends estimate cat ownership will continue to rise, as has been seen in the past. Occurrences of other non-native species have also increased throughout recent history. There is no evidence that population trends of non-native species is likely to be different in the areas adjacent to the Crocodile Lake NWR. Therefore, KLWR and KLCM in the Crocodile Lake NWR are likely to see continued predation pressure from additional cats, and potentially pythons, in addition to secondary impacts such as disease, and lowered dispersal capability under the NAA. Non-native predators may also restrict natural defense behaviors, such as nest construction and reduce the quality and quantity of feeding activity. Similar pressures are likely to be experienced by the silver rice rat.

### Amphibians

Little is known about the impacts of non-native wildlife on amphibians. However, it is known that the opossum is known to prey on small amphibians. Cats are also a potential source of mortality for amphibians. Under the NAA, it is reasonable to assume that this group of species may be affected through direct predation, competition for resources, and/or disease resulting from the introduction of non-native species.

### Reptiles

A variety of native snake species, especially juveniles, including the Big Pine ringneck snake, eastern diamondback rattlesnake, eastern indigo snake, rimrock crowned snake, and the Florida Keys mole skink would continue to be threatened under the NAA. Invasive vertebrates such as cats, pythons and tegus would continue to potentially suppress populations through competition for resources, disease and direct predation. Crocodile Lake National Wildlife Refuge supports nearly 25 percent of the existing American crocodile population and is one of only three areas in the United States that provides nesting habitat for the species. Crocodile hatchlings and eggs may be especially vulnerable to several non-native invaders under the NAA. The green, loggerhead, and hawksbill sea turtles are nesting species, while leatherback and Kemp's ridley forage in waters surrounding the refuges. High densities of raccoons have been known to cause high levels of mortality for sea turtle eggs and under the NAA this is likely to continue to occur in beach habitats associated with neighborhoods. The Florida box turtle and Keys mud turtle inhabit upland areas of National Key Deer Refuge, and

mangrove terrapin are found on offshore islands of the Key West National Wildlife Refuge and in Florida Bay are unlikely to be affected by the NAA.

### Invertebrates

The National Key Deer Refuge and Crocodile Lake National Wildlife Refuges contain the only known remaining populations of the Stock Island tree snail. The tree snail is likely experiencing some level of take through predation of fire ants, green iguanas and spiny tailed lizards, and possibly opossums under the NAA. In addition, there are also a variety of *Liguus* tree snails that inhabit similar tropical hardwood hammock communities that merit attention and conservation which would not be provided under the NAA. Populations could potentially be impacted through predation of larval stages of these butterflies under the NAA.

### Feral Cats

Under the NAA, free-roaming feral cats will likely continue to threaten native species, especially those which are critically endangered. As the population of the Florida Keys is likely to remain stable or increase, so too will the secondary impacts from free roaming cats. As has been seen in past, despite best efforts of the local cat advocacy groups and animal control agents, free roaming cats will continue to occupy critical wildlife habitats within the FKNWRC.

### Opossums, Armadillos and Rat Species

Opossums will likely increase under the NAA as has been seen over recent years as they occupy habitats on other islands. Due to access to food and water, both from native and suburban habitats, is likely that opossums will become a common species in the lower keys as the habitats are similar to its native range in southern peninsular Florida and Key Largo where abundances are high. In addition, local private wildlife rehabilitation groups continue to rescue and release opossums which may further aid in dispersal and population growth. Armadillos are likely to become established as habitats in the Lower Keys are similar to those occupied in mainland Florida. Non-native rats will continue to occupy habitats within the FKNWRC, and may increase if population centers adjacent and surrounding the Refuge increases.

### Green Iguana

Because green iguana populations have likely already reached carrying capacity, their populations will likely remain stable under the NAA.

### Other large bodied snakes and lizards

Under the NAA, recent invaders such as the Burmese python may establish breeding populations within the Refuge. If populations were to establish, after a brief lag period, they would likely increase rapidly.

### Fire Ants

Because fire ant populations have been established for some time and have occupied disturbed habitats throughout the Florida Keys, their abundance would likely remain stable within the boundaries of the FKNWC under the NAA.

### Raccoons

Raccoon populations would likely remain stable but could fluctuate based on human population and waste management practices in areas adjacent to properties of the FKNWC. As has been seen in the past, a disease outbreak such as distemper, could drastically affect those populations living in dense, human-influenced populations. Many islands in the FKNWRC have no manmade structures; these populations are unlikely to be affected by any alternative.

### **Effects of No Action on Cultural and Historic Resources**

Since the NAA does not propose disturbance of the soil and will not be conducted in areas with known cultural or historical resources, this alternative is not likely to impact cultural or historic resources.

### **Effects of No Action on Sociopolitical Setting**

The no action alternative is often considered to be the most humane and preferred by some groups and individuals who advocate animal rights. Most people would probably agree that nonlethal damage management is preferable to killing an individual animal if it accomplishes the goals intended. However, this alternative is anticipated to be the least effective in reducing predation or competition with native species. Therefore, individuals who place greater emphasis on native rare species than common pests or nonnative predators may perceive this alternative as less humane than alternatives that provide greater protection for rare and endangered wildlife.

For those who place aesthetic value on native wildlife viewing, the NAA would likely have an adverse effect on their environment as invasive non-native species such as free-roaming cats will likely be commonly encountered whereas native wildlife species will be less likely to be encountered within FKNWRC boundaries. Most visitors who spend time within the FKNWRC likely appreciate native wildlife viewing, especially rare species sightings, and therefore will be negatively affected by the NAA. For those who place little or no aesthetic value on native species, but instead place a higher value on all, or one non-native species such as cats, the NAA alternative will positively, or neutrally, affect their experience.

### **ALTERNATIVE B - INTEGRATED PEST MANAGEMENT (PROPOSED ACTION)**

Under the Proposed Action the Florida Keys Refuges complex has the greatest potential for effectively reducing predation to listed species because all potential nonlethal and lethal control alternatives and methods would be available for use on Refuge lands in the FKNWRC (Table 2). Additionally, this alternative would allow for the most efficient protection of other wildlife species such as small mammals, birds, and reptiles by focusing efforts with minimum impact upon non-target species with using passive and active predation reducing efforts. An integrated pest management approach would be

comprehensive and proactive by attempting to address the core problem – people abandoning exotic pets and feeding native wildlife - through public outreach, education, and enforcement programs (FFWCC 2003). It also incorporates the points of consensus developed by the stakeholder group to a greater degree than any of the other alternatives (Taylor 2008). This alternative would also allow for the greatest flexibility for adaptive management in the framework of strategic habitat conservation by incorporating an iterative decision-making process based on targeted monitoring and informed research (Nichols and Williams 2006, Martin et al. 2009).

The proposed action would be in compliance with the South Florida Multispecies Recovery Plan, which includes recovery actions such as predator control to benefit listed species as required by the ESA (Appendix I). It would also be in compliance with other mandates such as the Migratory Bird Treaty Act, Refuge System policies, Executive Order 13122, and Florida State law which are intended to prevent unacceptable environmental impacts.

### **Effects of Proposed Action on Plant Communities**

The proposed action is not likely to have substantial impacts on plant communities as a whole. But positive species level impacts may be seen from reduction of herbivory from exotic herbivores and omnivores in key areas. Little is known about the diet of the herbivore and omnivore exotics species within the refuge, but many rare plant populations exist at low densities in narrow ranges making local extirpation possible. Because beneficial species level effects are plausible for a number of plants due to the reduction of diversity and density of non-native species within the FKNWRC under the proposed alternative, some potential for benefits at the plant community level is possible. Removal of exotic herbivores would be limited to specific management goals in limited geographic areas; under this scenario individual populations, or sub-populations, of species is possible.

### **Effects of Proposed Action on Native Wildlife and Targeted Pest Species**

The proposed action (PA) would result in reductions of potential for competition and predation of native species by non-native species. Non-native species, being generalist omnivores or predators with few predators, dominate invaded habitats and often cause ecosystem imbalance. The proposed action seeks to reduce the invasive potential non-native species through active strategies such as direct removal and passive strategies such as waste management reform and public outreach. Through this combination of tactics, the proposed action will likely reduce the pressure placed upon the native species within the FKNWRC. Assisted by monitoring, an integrated approach of public outreach, removal of species, and placing species with animal control authorities the alternative B will seek to restore native fauna and progress towards the recovery goals of listed species.

For listed species the integrated approach of the proposed action will allow more potential for expanding ranges and increased abundances. These benefits will work in combination with other ongoing efforts such as law enforcement, land acquisition, growth management, ESA recovery and other protections that are currently, and will continue to occur.

### Birds

Direct and indirect impacts on bird species in habitats protected by the FKNWRC would likely be mitigated to some degree under the PA as resource competitors and direct predators are removed. State and Federally listed species such as the Piping plover, white-crowned pigeon would benefit from decreased pressures (predation and competition) from invasive species. Species like the Key West quail dove (*Geotrygon chrysis*), would be much more likely to re-colonize hammock habitats of the FKNWRC. Neotropical migrants would face reduced threats during spring and fall migrations when they are most vulnerable. Common species would also be less impacted, but likely to a lesser degree.

### Mammals

The Lower Keys marsh rabbit has seen a steady decline in percentage of habitat patches occupied and total range (USFWS 2007). The goal of the PA is intended to take actions to reduce potential causes of population declines. LKMR in the National Key Deer Refuge are likely to see relief from predation pressure related to the introduction of non-native species, especially cats, and potentially pythons, in addition to reductions of secondary impacts such as disease, and lowered dispersal capability. Population viability analysis models suggest that removal of cats, as proposed in the PA, offers the most substantial contributions to the long term viability of the LKMR (Forys 1995, LaFever 2008). Additionally due to the high number of residents around and near critical LKMR habitat, public outreach campaigns may be effective in reducing the number of non-native wildlife and free-roaming cats through “wildlife wise” education through Our Animal Family. For all of these reasons it is expected that, LKMR populations would see reduced pressure in the form of juvenile predation, competition, and increased potential for spread of disease from other non-native species under the Proposed Alternative.

The PA is expected to reduce the negative ecological consequences of introduced species. Much of the tropical hammock habitat that supports the KLWR and KLCM has been cleared for development. The relict hammock that remains is surrounded by development. The edge habitat created by development creates access points for non-native prey species, such as cats and pythons. Under the proposed alternative, actions will be enacted to reduce the impacts created by urban/ wild land interface. By implementing mammalian predator reduction and creating habitat structures, the integrated approach of the PA is the alternative most likely to reduce the number of non-native species in the Crocodile Lake NWR based on PVA models (Winchester et al 2009), KLWR and KLCM in the Crocodile Lake NWR are likely to see reduced predation pressure from additional non-native species, in addition to a reduction in secondary impacts such as disease, genetic depression, and lowered dispersal capability. Because non-native predators may also restrict natural defense behaviors, such as nest construction, and reduce the quality and quantity of feeding activity. Control of non-native species may have positive secondary and tertiary benefits. Similar benefits are likely to be experienced by the silver rice rat in the lower Keys under the PA.

### Amphibians

Little is known about the impacts of non-native wildlife on amphibians. However, it is known that the opossum is known to prey on small amphibians. Cats are also a potential source of mortality for amphibians. Under the Proposed Alternative, it is reasonable to

assume that this group of species may be positively affected through reduction of direct predation, competition for resources, and/or disease which results from non-native species.

### Reptiles

A variety of native snake species, especially juveniles, including the Big Pine ringneck snake, eastern diamondback rattlesnake, eastern indigo snake, rimrock crowned snake, and the Florida Keys mole skink would likely see a reduction to threats under the PA. Invasive vertebrates such as cats, pythons and tegus would be less likely to suppress populations through competition for resources, disease and direct predation. Crocodile Lake National Wildlife Refuge supports nearly 25 percent of the existing American crocodile population and is one of only three areas in the United States that provides nesting habitat for the species (USFWS 1999, 2006). Crocodile hatchlings and eggs may be less vulnerable to several non-native invaders under the PA. The green, loggerhead, and hawksbill sea turtles are nesting species, while leatherback and Kemp's ridley forage in waters surrounding the refuges. High densities of raccoons have been known to cause high levels of mortality for sea turtle eggs and under the PA this is not as likely to occur in beach habitats. The Florida box turtle and Keys mud turtle inhabit upland areas of National Key Deer Refuge and could potentially benefit through the removal of non-native herbivores and omnivores. Mangrove terrapin are found on offshore islands of the Key West National Wildlife Refuge and in Florida Bay are unlikely to be affected by non-native species.

### Invertebrates

The National Key Deer Refuge and Crocodile Lake National Wildlife Refuges contain the only known remaining populations of the Stock Island tree snail. The tree snail is likely experience a reduced level of take through predation of fire ants, green iguanas and spiny tailed iguanas, and possibly opossums under the PA. In addition, a variety of *Liguus* tree snails inhabit similar tropical hardwood hammock communities that merit attention and conservation which would provide under the PA. The adaptive management approach outlined in the PA would help to identify areas needing management actions and place the proper intensity and duration of control actions. Populations would have less potential to be impacted through predation of larval stages of these butterflies under the PA.

### Feral Cats

Under the PA, free-roaming feral cats will be less likely to threaten native species, especially those which are critically endangered and especially vulnerable. Every fertile feral female cat that is removed from the Refuge will be unable to reproduce and add additional feral animals to the wild. As the population of the Florida Keys is likely to remain stable or increase, the PA is essential to reducing threats from free roaming cats. Under the PA, efforts of the local spay-neuter groups and animal control agents will work in combination with removal efforts of the FKNWRC to reduce the number of free roaming cats who occupy critical wildlife habitats. In addition, the PA will seek to increase public awareness through outreach campaigns about the threats to native wildlife and pets when cats are allowed to roam or abandoned on Refuge lands. This public outreach may help to reduce the number free roaming cats within the Refuges.

### Opossums, Armadillos and Rat Species

Within the boundaries of critical habitats Opossums will likely decrease under the PA. Opossums are still becoming established in some areas; therefore significant reduction or even eradication may be possible on some islands or key habitat patches. Due to access to food and water, both from suburban habitats outside the Refuges, is likely that opossums will become a common species in the lower keys as the habitats are similar to its native range in southern peninsular Florida and Key Largo. Under the PA, the Refuge will work with local private wildlife rehabilitation groups to reduce or eliminate release of opossums. In addition, the PA will include public outreach campaigns directed at the general public about better waste management, which if widely adapted may greatly suppress the ability for these species to rapidly expand and further impact the FKNWRC. Under this alternative, armadillos may be eradicated before they become fully established. Non-native rats will continue to occupy habitats within the FKNWRC, and may increase if population centers around the Refuge increase. If significant population increases are detected through monitoring, either because of changes in the human landscape or because of predator removals, intensive spot trapping will be conducted as necessary. Under the PA, the Refuge will also conduct public outreach about proper refuse containment and other methods for reducing unintentional feeding of wildlife with the goal of reducing populations of pest species.

### Green Iguana

Because Green iguana populations have likely already reached carrying capacity throughout the Keys, their overall populations are unlikely to be affected by the PA. However, control could be attempted in small areas if actions were needed to prevent unacceptable damage to resources. Outreach campaigns under the PA would also include information about the green iguana.

### Other large bodied snakes and lizards

Under the Proposed Alternative, recent invaders large bodied snakes such as the Burmese python would be less likely to establish populations within the Refuge. Active early detection rapid response would be conducted to reduce potential for establishment. If populations were to establish, after a brief lag period, they would be less likely to rapidly spread under the PA. In addition, outreach would likely reduce the potential for invasion as it will aid in public awareness and provide contact numbers for sightings such as 1-888-IVE-GOT1.

### Fire Ants

Fire ant populations would likely remain stable within the boundaries of the FKNWC. However, spot treatments could be conducted to as an emergency action to prevent unacceptable damage to resources in areas where appropriate.

### Raccoons

Raccoon populations would likely remain stable, or decrease but could fluctuate based on human population and waste management practices in areas adjacent to properties of the FKNWC. The PA will seek to work with larger community to improve waste management practices to suppress population increases based on human subsidized

food sources. Many islands in the FKNWRC have no human structures; these populations are unlikely to be affected by any alternative.

### **Effects of Proposed Action on Cultural and Historic Resources**

Since the PA does not propose disturbance of the soil and will not be conducted in areas with known cultural or historical resources, this alternative is not likely to impact cultural or historic resources.

### **Effects of Proposed Action on Sociopolitical Setting**

The integrated management approach described for this alternative involves tradeoffs between efforts to maximize the responsibility of Federal agencies to protect wildlife and their habitat with the perceived humaneness and effectiveness of the control methods used on non-native or pest animals. An objective analysis of this issue must consider not only the welfare of a feral non-native animal caught in a live-trap or euthanized, but also the welfare of the endangered native animal that may be killed by predation if the actions are not being taken.

Under this alternative, feral cats would be captured live and provided to animal shelters or humane groups. The USFWS would not destroy cats. The cats' ultimate fate would be up to the shelter or group receiving the cats and their ability to find homes for the feral cats. Some cats may be euthanized by animal shelters because feral cats are often difficult to adopt due to their wild nature. Advocates for free-roaming and feral cats would find this alternative unacceptable because it could lead to the death of some cats. TNR advocates would also find this alternative less favorable because they believe that feral and free-roaming cats have a right to live outdoors and they may not agree with the agency's justification for removal.

A foster network coordinated through the Our Animal Family and Key Lime Kitties initiatives under this alternative may reduce the number of cats that may be euthanized. It will be incumbent upon animal advocacy groups to actively engage in these collaborative efforts to realize positive results, and subsequently determine the realized impacts to the sociopolitical setting.

Animal rights advocates that favor all individual animals over a protected species may find this alternative less than fully acceptable because, although free-roaming cats will be captured live, it may include trapping and killing of other invasive non-native feral species such as opossum, armadillos, snakes, and iguanas.

Alternatively, those who strongly value native species and support the ESA would likely find the PA to be the most acceptable alternative for proactively addressing threats to imperiled species and actively reducing the potential for invasive non-native species to prey upon or compete with native species on a National Wildlife Refuge.

For those who place aesthetic value on native wildlife viewing, the PA would likely have a positive effect on their environment as native wildlife species will be more likely to be encountered within FKNWRC boundaries. For those who place little or no aesthetic value on native species, but instead place a higher value on all or one non-native species, the PA alternative will negatively or neutrally affect their experience. Most

visitors who spend time within the FKNWRC likely appreciate native wildlife viewing, especially rare species sightings, and therefore will be positively affected by the PA.

### **ALTERNATIVE C - LETHAL CONTROL ONLY**

Under this alternative, the Service would implement lethal control methods to all exotic species and native raccoons trapped on FKNWRC lands, without applying or considering nonlethal methods. Efforts would be focused on trapping and removing or exotic species and native raccoons, with minimal monitoring or research. Predation of listed species would likely be reduced or eliminated under this alternative, providing that lethal control methods could be safely and effectively implemented. This alternative would likely be more effective at preventing or reducing predation to listed and non-listed species than Alternatives A or B if some effective level of lethal management could be implemented (Table 2, 3). While lethal control is allowed by Refuge System policy, it is not a socially acceptable approach and is inconsistent with the points of consensus developed by the stakeholder group (Taylor 2008). This alternative would likely not be logistically feasible on a FKNWRC-wide basis and would not allow for adaptive management under a strategic habitat conservation approach (Appendix III).

Alternative C would be in compliance with the South Florida Multispecies Recovery Plan which includes recovery actions such as predator control to benefit the silver rice rat, Lower Keys marsh rabbit, Key Largo woodrat, Key Largo cotton mouse, and the Stock Island tree snail, as required by the ESA (Appendix I). Alternative C would also be in compliance with other mandates such as the Migratory Bird Treaty Act, Refuge System policies, Executive Order 13122, or Florida State law which are intended to prevent unacceptable environmental impacts.

#### **Effects of Lethal Control Only Action on Plant Communities**

Same as Alternative B – Proposed Action, except for no passive actions such as public outreach will be included.

#### **Effects of Lethal Control Only Action on Native Wildlife and Targeted Pest Species**

Same as Alternative B – Proposed Action, except that instead of capturing feral cats and transporting to animal shelters and release of captured raccoons, both species would be euthanized upon capture by field personnel in the field regardless of health status or adoptability.

#### **Effects of Lethal Control Only Action on Cultural and Historic Resources**

Same as Alternative B – Proposed Action.

#### **Effects of Lethal Control Only Action on Sociopolitical Setting**

The lethal control only alternative gives greater weight to efforts to maximize the responsibility of Federal agencies to protect wildlife and their habitat, with less consideration of perceived humaneness and effectiveness of the control methods used on non-native and pest animals. An objective analysis of this issue must consider not only the welfare of a feral non-native animal or pest species that is caught in a live-trap

and subsequently euthanized, but also the welfare of the endangered native animal that may be killed by predation or competition if the actions are not being taken.

Animal advocates this alternative the most unacceptable and less humane alternative because it involves the killing of animals of targeted species in favor of protecting other species. Conversely, advocates for rare and endangered species may favor this alternative as the most effective for reducing predation on rare and endangered wildlife.

For those who place aesthetic value on native wildlife viewing, the lethal control only action would likely have a positive or neutral effect on their environment as native wildlife species will be more likely to be encountered within FKNWRC boundaries. However, for those who value even common species such as the native raccoon, this action may have a negative effect on their experience knowing that raccoons are being controlled through trapping and euthanasia. For those who place little or no aesthetic value on native species, but instead place a higher value on all or one non-native species, this alternative will negatively affect their experience.

## **V. Cumulative Effects of Proposed Action**

### **Cumulative Effects on Plant Communities**

It is unlikely that cumulative effects will be seen at the plant community level, such as hammocks, freshwater marshes, or pine rocklands. However, some individual plant species may, over time, see positive cumulative effects as non-native species are removed.

### **Cumulative Effects on Wildlife, Including Native and Targeted Pest Species**

The proposed predator management activities will seek to minimize the direct and indirect effects of non-native species, such as feral cats and exotic snakes, on the Lower Keys marsh rabbit and other native wildlife. Thoughtful execution of the proposed action will result in negligible impacts on non-target species.

Adaptive management based on current monitoring data will guide the amount, duration, and location of the proposed action which will further minimize the existing potential for negative cumulative biological impacts. Instead, it is likely that effects on biological resources will be positive in nature due to the fact that the proposed action will be executed with the goal of benefiting wildlife populations by removing the competition and predation that occurs as a result of the presence of non-native animals.

Other factors aside from direct predation and competition such as increased capacity to disperse to suitable habitat would likely positively affect rare species such as the Key Largo woodrat and Lower Keys marsh rabbit. The compounding effects of increased dispersal would lead to an increase on overall population size and long term viability of any species that would compete with or be preyed upon by an exotic pest species.

Cumulatively, this integrated approach is intended to curtail the impact and prevent further growth of targeted non-native species with the FKNWRC. This reduction should compound over time and constant application and enhancement of techniques through the adaptive management approach. The cumulative effect of a consistent public

outreach campaign will work overtime to educate citizens about the dangers to wildlife and pets that can result from irresponsible pet ownership.

### **Cumulative Effects on Cultural and Historic Resources**

Since the PA does not propose disturbance of the soil and will not be conducted in areas with known cultural or historical resources, no cumulative effects on cultural or historic resources are anticipated.

### **Cumulative Effects on Sociopolitical Setting**

The integrated management approach of the Proposed Action involves tradeoffs between efforts to maximize the responsibility of Federal agencies to protect wildlife and their habitat with the perceived humaneness and effectiveness of the control methods used on non-native or pest animals. It is the most acceptable course of action for a number of reasons: 1) the management approach can be adjusted over time in response to effectiveness of predator control methods monitored over time; 2) it involves collaboration among county government, animal advocacy groups, animal caretakers, refuge volunteers, and the general public, thereby fostering broader local support; 3) it attempts to completely remove cat colonies and reduce human-subsidized raccoon populations through additional means other than lethal methods alone; 4) it engages the public and promotes individual responsibility for both wildlife and pet stewardship through education and outreach through the Our Animal Family and Key Lime Kitties initiative; and 5) it upholds the mission and purposes of the Florida Keys National Wildlife Refuges as special places set aside primarily for the conservation and recovery of endangered wildlife. Accordingly, the cumulative effects are anticipated to be positive over time.

## **VI. Short-Term Uses Versus Long-Term Productivity**

The No Action Alternative would likely result continued short-term and long-term losses in productivity due to continue direct predation, and other indirect damage to resources within the FKNWRC.

The management actions proposed under the Proposed Action are designed to enhance the long term and short-term productivity of all species, but especially listed species, through an integrated approach that operates on multiple time horizons and strategies which are expected to be improved over time. While some short-term increases in productivity are expected, effective exotic control programs require consistent, on-going efforts to produce long-term effects population level effects on productivity. Passive strategies, which include public outreach or community and partner engagement, are expected to be effective over longer time horizons; therefore these actions are expected to be beneficial for long-term productivity.

The Lethal Control Only Alternative would likely have a greater short-term effect on productivity due to the immediate impact of instant removal. However, because Alternative C does not have passive strategies that result in long-term benefits, the initial advantage will, at best, remain as the maximum affect. Without passive strategies such

as public outreach and community involvement, removal efforts will continue to face unabated effects from actions outside of the Refuge.

## **VII. Unavoidable Adverse Impacts**

The No Action Alternative, Alternative A, would likely result in a number of unavoidable adverse impacts to the natural environment such as species extirpation, extinction, population losses, loss of diversity, and general decreased biological function, among others are possible. Because loss of habitat, poaching, pollution and other major threats have been mitigated by a series of policies, regulations, and management actions, threats from non-native species are among the highest priorities for the FKNWRC. Alternative A, the No Action Alternative, would be unable to address the unavoidable impacts that are already, and will continue to be, experienced by the natural environment. Unavoidable impacts to the human environment are possible, but unlikely as discussed in Sec. V.

The Proposed Action, Alternative B, will result in the least amount of unavoidable impacts although some are possible. Unavoidable impacts to the natural environment will be mitigated by using a range of passive and active management actions. In addition, multiple techniques working on different time horizons can address both small scale and Refuge Complex wide issues. Some native species may be caught as bi-catch but the use of live traps, checked frequently, will curtail the possibility of significant impacts. Because species that will be euthanized will be caught in live traps risk of injury to non-target species or wildlife technicians is unlikely, but possible. The strategic habitat management philosophy will help to improve the efficiency and effect of Alternative B to further reduce unavoidable adverse impacts. Removal of animals may trigger unfavorable population changes of other non-native species. However, the monitoring plan of the Proposed Action will allow for a range of changes to be detected and accounted for. Thus, unavoidable impacts resulting from removal of species under the integrated approach of the Proposed Action are unlikely. Unavoidable impacts to the human environment are not expected under Alternative B.

Under the Lethal Removal Only Alternative, Alternative C, unavoidable impacts are likely. Likely impacts include poisoning or shooting of non-target species. In addition, the chance of injury to wildlife technicians is possible. Significant unavoidable impacts to the human environment are not likely under Alternative C.

**Table 2: Comparison of the Alternatives**

|  | <b>Predation and Competition Pressure on T&amp;E species</b> | <b>Compatibility with Existing Regulations/Mandates/Stakeholder Consensus</b> |
|--|--|---|
| <b>Alternative A – No Action</b>           | High   | Low   |
| <b>Alternative B - Proposed Action</b>     | Low  | High  |
| <b>Alternative C – Lethal Removal Only</b> | Low  | Medium  |

**Table 3: Comparison of the Environmental Consequences of Each Alternative**

|   | <i>Lower Keys Marsh Rabbit</i>  | <i>Key Largo Woodrat</i>  | <i>Other Wildlife</i>   | <i>Sociopolitical</i>  |
|---|---|---|---|--|
| <b>Alternative A<br/>No Action</b>                              | <p>May persist in isolated populations, in low numbers</p> <p>Low probability of colonization and minimal disbursal potential</p> <p>Extirpation probable</p> | <p>May persist in low numbers</p> <p>Low success for rate re-introduction</p> <p>Genetic depression likely</p> <p>Extirpation probable</p>                            | <p>Continued, unmitigated predation of listed and non-listed species</p> <p>Population decreases likely</p> <p>Decreased disbursal</p>  | <p>Effect may be seen because of increased potential for ESA listing of more species and/or additional recovery actions for listed species</p> <p>Less socially acceptable</p> <p>Low compatibility with stakeholder group consensus</p> |
| <b>Alternative B<br/>(Proposed Action)<br/>Integrated Mgmt.</b> | <p>Population increase as predation pressure decreased</p> <p>Dispersal to formerly occupied patches likely</p> <p>Extirpation less likely</p>                | <p>Populations would likely increase as predation pressure decreased</p> <p>Re-introduction more likely to succeed</p> <p>Colonization of suitable habitat likely</p> | <p>Native Wildlife such as reptiles, birds and small mammals would benefit from decreased predation pressure</p> <p>Population decreases less likely</p> <p>Increased disbursal</p> | <p>Increased likelihood of ESA delisting and resulting deregulations</p> <p>Most socially acceptable</p> <p>High compatibility with stakeholder group consensus</p>  |
| <b>Alternative C<br/>Lethal Removal Only</b>                    | <p>Population increase as predation pressure decreased</p> <p>Dispersal to formerly occupied patches likely</p> <p>Extirpation less likely</p>                | <p>Populations likely increase as predation pressure decreased</p> <p>Re-introductions highly likely successful</p> <p>Colonization of suitable habitat likely</p>    | <p>Species associated with protected sites and/or vegetation would benefit.</p>   | <p>Increased likelihood of ESA delisting and resulting deregulations</p> <p>Least socially acceptable</p> <p>Low compatibility with stakeholder group consensus.</p>   |

## Appendix IV

### Intra-Service 7 Consultation Biological Evaluation and Concurrence

| Activity   | Start Date | End Date | Biological Evaluation | Concurrence |
|------------|------------|----------|-----------------------|-------------|
| Activity 1 | 2011       | 2011     |                       |             |
| Activity 2 | 2011       | 2011     |                       |             |
| Activity 3 | 2011       | 2011     |                       |             |

Table 7. Intra-Service 7 Consultation Biological Evaluation and Concurrence

| Activity     | Start Date | End Date | Biological Evaluation | Concurrence |
|--------------|------------|----------|-----------------------|-------------|
| Activity 1   | 2011       | 2011     |                       |             |
| Activity 2   | 2011       | 2011     |                       |             |
| Activity 3   | 2011       | 2011     |                       |             |
| Activity 4   | 2011       | 2011     |                       |             |
| Activity 5   | 2011       | 2011     |                       |             |
| Activity 6   | 2011       | 2011     |                       |             |
| Activity 7   | 2011       | 2011     |                       |             |
| Activity 8   | 2011       | 2011     |                       |             |
| Activity 9   | 2011       | 2011     |                       |             |
| Activity 10  | 2011       | 2011     |                       |             |
| Activity 11  | 2011       | 2011     |                       |             |
| Activity 12  | 2011       | 2011     |                       |             |
| Activity 13  | 2011       | 2011     |                       |             |
| Activity 14  | 2011       | 2011     |                       |             |
| Activity 15  | 2011       | 2011     |                       |             |
| Activity 16  | 2011       | 2011     |                       |             |
| Activity 17  | 2011       | 2011     |                       |             |
| Activity 18  | 2011       | 2011     |                       |             |
| Activity 19  | 2011       | 2011     |                       |             |
| Activity 20  | 2011       | 2011     |                       |             |
| Activity 21  | 2011       | 2011     |                       |             |
| Activity 22  | 2011       | 2011     |                       |             |
| Activity 23  | 2011       | 2011     |                       |             |
| Activity 24  | 2011       | 2011     |                       |             |
| Activity 25  | 2011       | 2011     |                       |             |
| Activity 26  | 2011       | 2011     |                       |             |
| Activity 27  | 2011       | 2011     |                       |             |
| Activity 28  | 2011       | 2011     |                       |             |
| Activity 29  | 2011       | 2011     |                       |             |
| Activity 30  | 2011       | 2011     |                       |             |
| Activity 31  | 2011       | 2011     |                       |             |
| Activity 32  | 2011       | 2011     |                       |             |
| Activity 33  | 2011       | 2011     |                       |             |
| Activity 34  | 2011       | 2011     |                       |             |
| Activity 35  | 2011       | 2011     |                       |             |
| Activity 36  | 2011       | 2011     |                       |             |
| Activity 37  | 2011       | 2011     |                       |             |
| Activity 38  | 2011       | 2011     |                       |             |
| Activity 39  | 2011       | 2011     |                       |             |
| Activity 40  | 2011       | 2011     |                       |             |
| Activity 41  | 2011       | 2011     |                       |             |
| Activity 42  | 2011       | 2011     |                       |             |
| Activity 43  | 2011       | 2011     |                       |             |
| Activity 44  | 2011       | 2011     |                       |             |
| Activity 45  | 2011       | 2011     |                       |             |
| Activity 46  | 2011       | 2011     |                       |             |
| Activity 47  | 2011       | 2011     |                       |             |
| Activity 48  | 2011       | 2011     |                       |             |
| Activity 49  | 2011       | 2011     |                       |             |
| Activity 50  | 2011       | 2011     |                       |             |
| Activity 51  | 2011       | 2011     |                       |             |
| Activity 52  | 2011       | 2011     |                       |             |
| Activity 53  | 2011       | 2011     |                       |             |
| Activity 54  | 2011       | 2011     |                       |             |
| Activity 55  | 2011       | 2011     |                       |             |
| Activity 56  | 2011       | 2011     |                       |             |
| Activity 57  | 2011       | 2011     |                       |             |
| Activity 58  | 2011       | 2011     |                       |             |
| Activity 59  | 2011       | 2011     |                       |             |
| Activity 60  | 2011       | 2011     |                       |             |
| Activity 61  | 2011       | 2011     |                       |             |
| Activity 62  | 2011       | 2011     |                       |             |
| Activity 63  | 2011       | 2011     |                       |             |
| Activity 64  | 2011       | 2011     |                       |             |
| Activity 65  | 2011       | 2011     |                       |             |
| Activity 66  | 2011       | 2011     |                       |             |
| Activity 67  | 2011       | 2011     |                       |             |
| Activity 68  | 2011       | 2011     |                       |             |
| Activity 69  | 2011       | 2011     |                       |             |
| Activity 70  | 2011       | 2011     |                       |             |
| Activity 71  | 2011       | 2011     |                       |             |
| Activity 72  | 2011       | 2011     |                       |             |
| Activity 73  | 2011       | 2011     |                       |             |
| Activity 74  | 2011       | 2011     |                       |             |
| Activity 75  | 2011       | 2011     |                       |             |
| Activity 76  | 2011       | 2011     |                       |             |
| Activity 77  | 2011       | 2011     |                       |             |
| Activity 78  | 2011       | 2011     |                       |             |
| Activity 79  | 2011       | 2011     |                       |             |
| Activity 80  | 2011       | 2011     |                       |             |
| Activity 81  | 2011       | 2011     |                       |             |
| Activity 82  | 2011       | 2011     |                       |             |
| Activity 83  | 2011       | 2011     |                       |             |
| Activity 84  | 2011       | 2011     |                       |             |
| Activity 85  | 2011       | 2011     |                       |             |
| Activity 86  | 2011       | 2011     |                       |             |
| Activity 87  | 2011       | 2011     |                       |             |
| Activity 88  | 2011       | 2011     |                       |             |
| Activity 89  | 2011       | 2011     |                       |             |
| Activity 90  | 2011       | 2011     |                       |             |
| Activity 91  | 2011       | 2011     |                       |             |
| Activity 92  | 2011       | 2011     |                       |             |
| Activity 93  | 2011       | 2011     |                       |             |
| Activity 94  | 2011       | 2011     |                       |             |
| Activity 95  | 2011       | 2011     |                       |             |
| Activity 96  | 2011       | 2011     |                       |             |
| Activity 97  | 2011       | 2011     |                       |             |
| Activity 98  | 2011       | 2011     |                       |             |
| Activity 99  | 2011       | 2011     |                       |             |
| Activity 100 | 2011       | 2011     |                       |             |

## Appendix V

### Sample Materials for Our Animal Family and Key Lime Kitties Initiatives



**ONE ANIMAL FAMILY**  
A Partnership for the Betterment of all  
our Animals – Domestic and Wild.



[About Us](#) [Partners](#) [Fundraising](#) [Keep Wildlife Wild](#) [Protect Your Pets](#)

All animals have the right to a safe and healthy life:  
Domestic pets need to be well cared for and healthy.  
Wild creatures deserve to live in a safe and natural environment.

[Join us](#) to make our wildlands and neighborhoods a better place for all our animals.



Big Pine  
Bark  
Park



Your  
Logo  
Here!



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### Who We Are

The One Animal Family partnership and educational effort hinges on the humane treatment of all animals.

It started in the Florida Keys in 2008 as a workshop to decrease predator pressure on the endangered Lower Keys Marsh Rabbit. Because both native raccoons and feral cats were fingered as "problems that needed to be dealt with" early meetings got a little heated as the group worked through a lot of misinformation and mistrust between the "cat people" the "raccoon people" and US Fish & Wildlife Service.

Those that were brave or foolhardy enough to keep listening to each other came to a couple of conclusions. No cat should be dumped in the first place and that backyard practices that encourage raccoon ganging should be avoided.

**In other words, we cannot change animal behavior, but we can change our own.**

The local effort focuses on two main themes: **Keep Wildlife Wild & Protect Your Pets**. We work together on grant writing and educational campaigns, and have appeared in a documentary by American Bird Conservancy.

The One Animal Family movement has now become a way for all animal organizations to pool their effort, talents and money towards the big picture. We invite any organization, agency or individual that is committed to our themes and actions to get involved where they live.

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# Help Protect Your Environment!



## Keep Wildlife Wild

- Drive Carefully
- Secure Trash
- Maintain Distance
- Don't Feed
- Plant Natives

[OurAnimalFamily.org](http://OurAnimalFamily.org)



## Protect Your Pets

- Spay & Neuter
- Keep Dogs Leashed
- Keep Cats Indoors
- License & Microchip
- Never Abandon

[OurAnimalFamily.org](http://OurAnimalFamily.org)

**For More Information, Please Call The  
National Key Deer Refuge At (305) 872-2239**



## Fundraising Opportunities!



These 18-ounce travel mugs are the first product of the One Animal Family collaboration. They are recyclable, BPA-free, made in the U.S.A. and fits most car cup holders. They are available in red, blue, purple, smoke and green

We specifically put no logos on our products in order to help all organizations spread the word without having to print their own products. By simply agreeing to the 10 actions of the One Animal Family partnership, we will put your logo on this website!

Both retail and giveaway prices include your logo on the brochure insert and the website. We will send you the latest version to print and stuff into the mugs. Please feel free to add your own materials too!

Order as many as you like, we'll make more!

### What you can do with this mug

#### Sell It!

If you plan to sell this mug as a fundraiser, the suggested retail price is \$5.

You can buy them wholesale from us at the following ranges:

1-24 mugs: \$2.50 each

25-100 mugs \$2.25 each

101+ mugs: \$2.00 each

#### Or Give Them Away!

These make great gifts for volunteers or dignitaries. Or maybe you just want to promote the cause!





**Mission:** Establish and maintain a network to foster and provide forever homes for feral cats removed from the National Key Deer Refuge.

**Step 1.**  
Animals collected on the refuge will be transported to the appropriate animal shelter (currently SHARK) for the following procedures:  
A) Photographs for public notification  
B) Health assessment  
C) Spay/Neuter  
D) Microchip?



**Step 2.**  
Locate foster home if the cat is deemed healthy enough for adoption.  
This should be a one or two cat household to give the cat the best chance for acclimation. The costs and labor of this would need to be covered by cat rescue groups, animal welfare groups, grants, and shared match from Our Animal Family/FAVOR from donations or sales.

**Step 3a: Adoptable to General Public**  
Use website like *Petfinder* or *Petango* to advertise info and criteria for the cat adoption.  
Use FAVOR funds with matching other funds and/or volunteers to transport cat to "forever home".

**Step 3b: Deemed Not Adoptable to General Public**  
**Step 3c: Not adopted within a prescribed time frame.**

**Adoption Success Stories-**  
Highlight adopted cat success stories on "Our Animal Family" website



**Step 4:**  
Transport to humane cat shelter/ "forever shelter"  
Ex- Best Friends (UT), Oak Grove Sanctuary (NC), <http://feralcatsanctuary.org/index.html>, Noah's Ark Rescue, The Cat Depot (Sarasota), etc.  
Provide funding for transportation and support

**\$\$ Potential Funding Sources \$\$ :**

- ⇒ Direct donations to Our Animal Family/FAVOR
- ⇒ FAVOR bookstore sales:
  - Adopt a Key Lime Cat (Like *Adopt a Manatee*)
  - Sell "Key Lime Cat" collars, t-shirts, mugs
- ⇒ Grants
- ⇒ Donations from business, community, general public
- ⇒ Donations from Cat/Animal Rescue organizations

**Needs:**

- ⇒ Research existing rescue organizations
- ⇒ Research successful protocols
- ⇒ Volunteers to foster cats
- ⇒ Identify and train partners
- ⇒ Volunteers to help transport cats
- ⇒ Volunteers to maintain cat adoption info on *Petfinder* or similar website.
- ⇒ Volunteers to maintain list of 'success stories' on Our Animal Family website.
- ⇒ Identify local, regional and national cat/animal rescue organizations willing to partner with Key Lime Cats and provide financial and logistical support.

Ex- Forgotten Felines, Arkangels, Alley Cat Rescue, Casting for Cats, any and all cat/ animal rescue organizations.

