**Final Environmental Assessment**
**For the**
**Proposed Memorandum of Understanding with the County of Kaua‘i**
**For the Nighttime Operation of Football Facilities in 2019**

Photo Credit: Dennis Fujimoto, The Garden Island

**Prepared by**

**U.S. Fish & Wildlife Service**

## 1. Introduction

The U.S. Fish and Wildlife Service (Service) has been working with Kaua‘i County (County) to assist in the conservation and management of listed species. To address its impacts to listed seabirds, the County has been committed to participating in the Kaua‘i Seabird Habitat Conservation Plan (KSHCP), which has been under development since 2010. The County anticipates including its infrastructure and operations at football facilities, involving operation of high-intensity stadium lighting, in its application for a federal Incidental Take Permit (ITP) and a State Incidental Take License (ITL) associated with the KSHCP. However, the scope of the County's operations (e.g., duration of lighting operations and facilities) under the Memorandum of Understanding (MOU) is only one aspect of, and very limited in comparison to, the scope of County facilities that will potentially be covered by the KSHCP.

The County's participation in the KSHCP would provide take coverage for the operation of lighting at football facilities, if an ITP is granted by the Service. However, the KSHCP timeline had been delayed in order to revise the document to include additional participants. Because the KSHCP was not yet completed or approved, the County requested on July 9, 2019, to enter in to a MOU with the Service again to conserve seabirds while allowing limited nighttime operation of football facilities during the 2019 seabird fledgling season.

The nighttime operation of stadium lighting at Hanapēpē Stadium and Vidinha Stadium Complex is a regular occurrence outside of the seabird fledging season (September 15 to December 15) for sporting events or special use (e.g., fairs, graduations, 4th of July celebrations). In the years of 2015 to 2017, the following numbers of reservations were made for nighttime usage of Hanapēpē Stadium lighting: football (8); soccer (17); and baseball (30) (County of Kaua‘i 2017). Reservations for nighttime usage of lighting at Vidinha Stadium Complex were also made during this same time period in the following numbers: football (27); soccer (36); track (26); baseball (49); and special use (28) (County of Kaua‘i 2017).

## 2. Purpose and Need

An environmental assessment (EA) evaluates the environmental effects of the proposed alternatives (action and no-action) to determine whether implementation of the alternatives would have a significant impact on the environment. The proposed action alternative in this EA is for the Service to sign the MOU (Appendix 1). The MOU provides for the minimization and mitigation of impacts to the Newell's shearwater (*Puffinus auricularis newelli*) by the County in holding three nighttime football games at two football facilities on the island. With conservation measures addressing limited schedule around lower risk lunar cycle, limiting potential light attraction, monitoring of events and compensatory mitigation of effects, the nighttime lighting associated with public high school football games on Kaua‘i in the fall of 2019 is expected to incidentally take no more than three fledglings. This incidental take would be exempted from section 9 of the ESA pursuant to an incidental take statement if a biological opinion on implementation of MOU finds that it is not likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. The no-action alternative is to not sign the MOU, which would likely result in the County holding the high school football games during the afternoon hours (see Section 3). This EA is part of a decision-making process and will be used to assist in determining if the MOU should be signed.

**2.1. Purpose of Action**
The purpose of the proposed action alternative is to work with County to minimize and mitigate impacts to listed species from nighttime football games at County-operated football facilities. If the Service, in a biological opinion prepared in compliance with ESA section 7, determines that implementation of the MOU is not likely to jeopardize listed species or destroy or adversely modify designated critical habitat, it would provide an incidental take statement pursuant to ESA section 7(b)(4).

**2.2. Need for Action**
To preserve and restore native seabirds on Kaua‘i it is essential to have the support of the local community (Appendix 2). Nighttime football games are an important cultural activity for the Kaua‘i community. To foster partnership and collaboration in support of seabird conservation on Kaua‘i, the Service is working with County to meet this community need, while simultaneously minimizing and mitigating the impacts from the night-time lighting associated with such football games, in the interim period while waiting for the completion and approval of the KSHCP. The potential implications of the proposed action in relation to future actions will be discussed in the Cumulative Impacts (see Section 6).

**2.3. Authority for Action and Regulations Governing Action**

The proposed action would be carried out in compliance with various federal laws, executive orders, and supporting agency guidelines, listed below.

2.3.1. Authorizing Federal laws, Executive Orders and Supporting Agency Guidelines

*National Environmental Policy Act* of 1969 (NEPA) – NEPA requires that federal actions be evaluated for environmental impacts, that these impacts be considered by the decision maker(s) prior to implementation, and that the public be informed. This EA is prepared in compliance with NEPA (42 U.S.C. Section 4321, *et seq*.); the President’s Council for Environmental Quality Regulations, 40 CFR Section 1500 – 1508.

*National Historic Preservation Act* of 1966 (NHPA) – The NHPA requires: 1) federal agencies evaluate the effects of any federal undertaking on cultural resources, 2) consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological, and historic resources, and 3) consult with appropriate American Indian tribes or Native Hawaiians to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings.

*The Fish and Wildlife Act* of 1956 (16 U.S.C. 742a-742j, not including 742 d-l, 70 Stat. 1119), as amended – gives general guidance which can be construed to include alien species control, that requires the Secretary of the Interior take steps “required for the development, management, advancement, conservation, and protection of fish and wildlife resources.”

*Endangered Species Act* (ESA) of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884) – The ESA requires that all federal agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the ESA (Sec.2(c)). Section 7 consultations with USFWS are conducted to use the expertise of the USFWS 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)).

*Migratory Bird Treaty Act* of 1918 (MBTA) – The MBTA protects more than 1,000 species of birds, including the species native and not native to Hawai'i, by implementing U.S. obligations under four treaties within the United States. The MBTA provides that it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg of any such bird, unless authorized under a permit issued by the Secretary of the Interior.

*Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds* (66 FR 3853, Jan. 17, 2001) – This order requires federal agencies, to the extent practicable, to avoid or minimize adverse impacts on migratory bird resources when conducting agency actions, and to restore and enhance the habitat of migratory birds. Specifically, it requires federal agencies to develop and use principles, standards, and practices that will lessen the amount of unintentional take reasonably attributed to agency actions.

## 3. Alternatives

This section describes in detail the no-action alternative and the action alternative and identifies the environmental issues used to formulate the alternatives derived from ongoing discussions with regulatory agencies and stakeholders since 2010.

### 3.1. Alternatives Being Considered

#### 3.1.1. Action Alternative

If the Service signs the MOU, the County would minimize and mitigate the impacts to listed species during 2019 football games at the County-operated football facilities from stadium lights. Only three nighttime football games (September 20, September 27, and October 4) would be scheduled during the 2019 fledging season in order to minimize effects to listed species. Other minimization and mitigation measures are described below. With these conservation measures, the nighttime lighting associated with public high school football games on Kaua'i in the fall of 2019 is expected to incidentally take no more than three fledgling Newell's shearwaters. This incidental take would be exempted from section 9 of the ESA pursuant to an incidental take statement if a biological opinion on implementation of MOU finds that it is not likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat.

#### 3.1.2. No-Action Alternative

Not signing the MOU by the Service would likely result in no night-time high school football games scheduled during the 2019 season.

## 4. Affected Environment

### 4.1. Biota

The areas where County facilities are located potentially serves as habitat for a number of faunal resources.

#### 4.1.1. Seabirds

Three listed seabird species nest on the island of Kaua‘i: the endangered Hawaiian petrel (*Pterodroma sandvicensis*), the endangered Hawai‘i Distinct Population Segment of the band-rumped storm-petrel (*Oceanodroma castro*) (hereafter, band-rumped storm-petrel), and the threatened Newell's shearwater. Populations of the Hawaiian petrel are estimated to have declined by 78% (at an average rate of ~6% per year) from 1993-2013 (Raine et al. 2017). The population of the Newell's shearwater is estimated to have declined by 94% (at an average rate of ~13% per year) during the same period (Raine et al. 2017). The wedge-tailed shearwater (*Ardenna pacifica*) protected under the MBTA, nests in coastal areas of the island of Kaua‘i.

The above seabirds are attracted to lights and after circling the lights they may become exhausted and collide with nearby wires, buildings, or other structures or they may land on the ground. Downed seabirds are subject to increased mortality due to collision with automobiles, starvation, and predation by dogs, cats, and other predators. Between September 15 and December 15, young birds (fledglings) in their first flights from their mountain nests to the sea are particularly vulnerable. In addition to light attraction, these species share the following other threats: collisions with utility structures, predation at their breeding sites by introduced mammalian and avian predators, and breeding habitat loss and alteration caused by invasive plants and introduced ungulates.

#### 4.1.2. Sea Turtles

The Hawai‘i Central North Pacific Distinct Population Segment of the federally threatened green sea turtle (*Chelonia mydas*) and the endangered hawksbill sea-turtle (*Eretmochelys imbricata*) nests in locations near urbanized coastal areas along the east and south shores of Kaua‘i. Hatchlings typically emerge from the sand at night (Balazs 1980), and can be disoriented away from their path to the sea by artificial lighting (Witherington 1992). Long-term monitoring of green sea turtle populations over nearly 40 years shows that the population in Hawai‘i has increased at a rate of approximately 5.7% annually since the harvest limits were imposed in 1974 (Chaloupka and Balazs 2007, Maison et al. 2010, Tiwari et al. 2010).

#### 4.1.3. Other Biota

Many other native and non-native species of animals occur in the affected environment. However, based on data from past surveys and monitoring only the Hawaiian short-eared owl (*Asio flammeus sandwichensis*) and an un-identified species of booby (*Sula* sp.) have been detected during nighttime operation of lighting at County football facilities (Service, unpublished data 2014).

## 5. Environmental Consequences

The purpose of this section of the EA is to determine whether any significant impacts to the environment would be expected from either of the alternatives. According to federal Council on

Environmental Quality (CEQ) regulations (40 CFR 1508.27), significance is determined by considering both the context in which the proposed action would occur and the intensity of the proposed action. "Context" is the setting within which an impact is analyzed, such as a particular locality, the affected region, or society as a whole. "Intensity" is a measure of the severity of an impact. Determining the intensity of an impact requires consideration of the appropriate context of that impact as well as a number of other factors.

In the analysis below, the potential significance of impacts of the proposed action alternative and the no-action alternative will be discussed on a case-by-case basis for each impact topic, with an identification of both the context used for the analysis and the considerations included for a determination of the intensity of the impact, including the role of mitigation measures in the significance determination.

## 5.1. Aspects of the Environment Excluded from Detailed Analysis (With Rationale)

### 5.1.1. 5.1.1. Air and water quality, hydrology, cultural and archaeological resources, human health and safety, and environmental justice

Potential impacts to air and water quality, hydrology, cultural and archaeological resources, human health and safety, and environmental justice are not analyzed in this EA. Regardless of whether the MOU is signed or not, the football games would likely occur, with lighting being the only distinction between the two alternatives, and lighting during three football games would not be an issue for these resources. Furthermore, other sporting events (e.g., baseball) occur at night on Kaua‘i with the associated lighting. Thus, any potential impacts to these resources would be the same under both the no-action and action alternatives.

## 5.2. Action Alternative

### 5.2.1. Biota

#### 5.2.1.1. Seabirds

The operation of the lighting at nighttime has the potential to affect threatened and endangered seabirds (Hawaiian petrel, band-rumped storm-petrel, and Newell's shearwater) as well as the wedge-tailed shearwater. To mitigate the potential impact to seabirds, the County stadium lighting at football facilities is shielded to prevent upward radiation of lighting and downcast to direct light toward the ground and reduce the amount of light spillage that projects into areas outside of the football facilities. To further mitigate this potential impact, the nights during which lighting will be allowed are scheduled early in the seabird fledging season (September 20, September 27, and October 4).

The mitigation proposed as part of the action would likely reduce, but not eliminate the potential for impacts to Newell's shearwater. It is likely that three fledgling Newell's shearwaters would be impacted by the nighttime lighting at football facilities, based on the Service's analysis of data on shearwaters recovered by the Save Our Shearwaters (SOS) program on the island of Kaua‘i (Appendix 2). The Service has determined that the incidental take of three Newell's shearwaters would not have a population level impact on the Kaua‘i population and jeopardize the continued

existence of the species (Appendix 2). The proposed action alterative is not likely to have indirect effects on Newell's shearwaters.

The three football games with nighttime lighting will occur on dates (September 20, September 27, and October 4) outside of the Hawaiian petrel fledging season, based on estimates of the time period which Hawaiian petrels will fledge this year (KESRP unpublished data, 2019). No band-rumped storm-petrels downed due to light attraction have been recovered by the SOS program from September 20 through October 4 over the past five years at any location on Kaua'i (SOS unpublished data, 2014-2018). Because the downing of a band-rumped storm-petrel is a rare event in any given year, it is highly unlikely that any band-rumped storm-petrels would be downed over the three nights during the period of the nighttime football game lighting. On the island of Kaua'i, both the Hawaiian petrel and the band-rumped storm-petrel primarily breed on the Nā Pali Coast (Raine et al. 2017, Raine et al. 2016a, 2016b, 2016c, and 2016d). Based on the above information and mitigation measures, the proposed action alternative would be unlikely to directly or indirectly impact any Hawaiian petrel or band-rumped storm-petrel.

Wedge-tailed shearwater adults and fledglings appear to be impacted by lights in coastal areas near breeding colonies on the island of Kaua'i, based on the locations where wedge-tailed shearwaters were recovered by the SOS program (DOFAW 2017) and known colony locations (such as Po'ipū, Princeville, Keālia, Kapa'a). Wedge-tailed shearwaters primarily begin fledging in November (Byrd et. al 1983, Pyle and Pyle 2009), which is after the proposed three nighttime football games. Based on the above information, the proposed action alternative would be unlikely to directly or indirectly impact any wedge-tailed shearwaters.

#### 5.2.1.1.1. Mitigation Measures

The light associated with nighttime football games presents potential environmental hazards to seabirds. No stadium lighting will be on at any County-operated football facility, including but not limited to Vidinha and Hanapēpē, in the evenings between September 15, 2019 and December 15, 2019, except as described in the EA. Precautions must be taken minimize the incidental take of seabirds due to fallout. The mitigation measures for the proposed action are listed below:

1. Football facility lighting operations at Hanapēpē and Vidinha Stadiums will adhere to exterior shielding as described in the biological opinion (Appendix 2).
2. All lighting will be turned off within one hour after the game (11:00 pm.) to reduce the amount of time lighting will be required after sunset and further minimize impacts to the Newell's shearwater.
3. The County will establish, at its sole cost and expense, an escrow account, no later than November 15, 2019, in the amount of $45,000 to be used in the event that a seabird(s) are found downed for the purpose of mitigating impacts to the seabird(s). If, in the sole judgment of the Service, such an event occurs on any of the September 20, September 27, or October 4 dates, for each such event, the County will direct the escrow agent to transfer $15,000 from the escrow account to a qualified entity selected by the County in consultation with, and with approval from, the DLNR-DOFAW for use in mitigating the takings of seabirds on Kaua'i. The amounts to be spent on mitigation have been set to reflect levels of effort sufficient for the Service

to exercise its discretion to agree to the terms of this MOU. Any funds remaining in the escrow account as of January 30, 2020, may be returned to the County. Notwithstanding the above, should the number of such takings equal or exceed three seabirds during the September 20 game, the September 27 and October 4 games may not occur at night. Additionally, should the number of such takings equal or exceed three seabirds during the September 20 and September 27 games, the October 4 game may not occur at night.

4. Whenever lights are on at night at any County-operated football facility between September 15, 2019 and December 15, 2019, the County will monitor the facility grounds. The County will coordinate monitoring with at least four biologists from the DLNR-DOFAW, the Kaua‘i Endangered Seabird Recovery Project, or PIFWO whom will assist the County in monitoring seabirds at each of the games. Such monitoring shall include: (1) documentation of number, species, timing, height and flight patterns of observed seabirds; (2) the number of apparently downed seabirds that were searched for and in fact found to be downed; (3) the number of apparently downed seabirds that were searched for and not found; (4) the number of apparently downed seabirds that were not searched for with an explanation of why a search was not conducted; (5) the number of seabirds found downed that did not correspond to an observed apparent downing; and (6) information on the condition of any recovered downed seabirds. Such monitoring will further include, immediately upon conclusion of any game and before the lights are turned off, a search of the facility grounds for any downed seabirds. For all such monitoring, the County will maintain records of the location, times, dates, and biologists involved, as well as the location, condition, identification, in situ photographs, and fate of each recovered bird. Any seabird encountered during such monitoring will be reported by the County via telephone or email to the Service, Pacific Islands Fish and Wildlife Office (PIFWO) and the Service, Office of Law Enforcement (OLE) within 48 hours. Unless otherwise directed by the OLE, all retrieved seabirds will be transferred to the SOS program in conformance with recommendations of that program, along with all associated location and photographic data for each bird.
5. Whenever lights are on at night at any County-operated football facility for a publicly attended event, held between September 15, 2019 and December 15, 2019, the County shall ensure that public service announcements regarding seabirds, mutually agreeable and reviewed by PIFWO and OLE, are delivered over the loudspeakers during any such event.
6. The County will complete and provide to PIFWO and OLE, no later than June 1, 2020, a report documenting the results of its monitoring and other observations from the 2019 football season.

#### 5.2.1.2. Sea Turtles

Artificial lighting has the potential to disorient hatchling green sea turtles and hawksbill sea-turtles on Kaua‘i. However, no known suitable nesting locations are in proximity to the County football facilities. Therefore, no direct or indirect impacts to sea turtles would be likely to occur from the proposed action alternative.

#### 5.2.2. Other Biota

Based on data from past surveys and monitoring of nighttime operation of lighting at County football facilities (Service, unpublished data 2014), the proposed action alternative would be unlikely to directly or indirectly impact any species, aside from that mentioned in Section 5.1.1.

### 5.3. No-Action Alternative

#### 5.3.1. Biota

##### 5.3.1.1. Seabirds

The impacts of the no-action alternative to seabirds would be the same, as under the proposed action alternative, except no Newell's shearwaters would be impacted because of fallout from lighting.

##### 5.3.1.2. Sea Turtles

The impacts of the no-action alternative to sea turtles would be the same as under the proposed action alternative.

#### 5.3.2. Other Biota

The impacts of the no-action alternative to other species not discussed in Sections 5.3.2 and 5.3.3 would be the same as under the proposed action alternative.

## 6. Cumulative Impacts

### 6.1. Assessing Cumulative Impacts

The NEPA regulations require federal agencies to consider the direct, indirect and cumulative impacts of an action. Analyzing cumulative impacts to the affected environment requires consideration of other, unrelated impacts that are occurring simultaneously to those resources, impacts that have occurred in the past, or impacts that are likely to occur in the foreseeable future.

The following is a breakdown of the past, present, and foreseeable future actions that would likely contribute to the cumulative impacts associated with the two identified alternatives. Direct and indirect impacts from each alternative would be analyzed with the following list of activities to determine the cumulative impacts for the given alternative.

Actions that occurred in the past but have ongoing impacts (i.e., presently occurring) could contribute to the impacts associated with the proposed action. Actions are actions that are occurring within the same timeframe as the proposed action, or within the planning and compliance phase of the proposed action, could contribute to the impacts from the proposed action. Actions that san be reasonably foreseeable in the future, could contribute to the cumulative impacts from the proposed action.

#### 6.1.1. Seabirds

Past, current, and future actions that have affected and continue to affect the Newell's shearwater include artificial nighttime lighting and collisions with power lines and utility structures.

*Artificial nighttime lighting* - The KSHCP is being developed to address nighttime lighting impacts to Newell's shearwater populations within the action area; however, the total amount of take potentially covered under the KSHCP would be less than the total island-wide light attraction effects identified through SOS data. KSHCP would address about 24% of existing Newell's shearwater take attributed to light attraction. However greater than 50% of the total downed birds recovered by SOS are not attributable to any specific, known source of light attraction, whereby there is no identifiable individual or entity to apply for take authorization. There are several entities with identified ongoing take that will be mitigated through other means Not all of the eligible entities identified by DLNR expressed interest in participating in the KSHCP (5-10% of annual fallout).

*KIUC nighttime lighting and collisions with power lines and structures* – KIUC has addressed impacts to Newell's shearwater caused by their streetlights, their other facilities with nighttime lighting, and collisions with power lines and structures under the KIUC Short-Term Habitat Conservation Plan (STHCP) and ITP. In addition to effects caused by attraction to artificial nighttime lighting, Newell's shearwaters are subject to collisions with power lines while flying between their nesting colonies and at-sea foraging areas (Cooper and Day 1998, p. 18; Podolsky *et al.* 1998, p. 21). Nestlings are indirectly affected as they rely on provisioning from both parents in order to survive, thus the loss of either parent due to collision results in nestling fatality. As a result of covered activities under the KIUC STHCP, the Service estimates that 1,800 Newell's shearwater mortalities are occurring per year as a direct result of power line strikes under the KIUC STHCP and ITP, using the rounded average of 2014 and 2015 strikes from scenarios IV, VB, and VIA selected in the USFWS Newell's Shearwater Landscape Strategy Appendix 2 (2017, p. 123). These numbers are substantially greater than what was anticipated at the time the STHCP was approved. Since 2012, KIUC has conducted research and development of a novel minimization tool, including laser fences, but the effectiveness of this tool has been under evaluation and is not a substitute for actual power line minimization measures (e.g., line reconfiguration or undergrounding).

Under the KIUC STHCP, mitigation measures were designed to compensate for an impact to Newell's shearwater, Hawaiian petrel, and band-rumped storm-petrels by replacing individuals or providing substitute resources or environments critical to the species' survival. The management under the HCP likely, fully offsets the annual light attraction impacts to Newell's shearwaters (72 fledglings) and Hawaiian petrels (2 fledglings), considering the predicted range of the numbers of nestlings that fledge from the Upper Limahuli breeding site alone (115-167 shearwaters and 27-46 petrels; Raine et al. 2018); however, the management does not fully offset take impacts due to collisions with power lines and structures. The following summarize the mitigation measures identified in the STHCP and required under the terms of the original ITP:

- KIUC funded Covered Species colony monitoring, predator control, and invasive plant control within the 148-hectare Upper Limahuli Preserve (ULP), owned and managed by the National Tropical Botanical Garden, with an estimated annual budget of $256,000;
- KIUC funded Covered Species colony monitoring and predator control at known breeding colonies within the State's Hono o Nā Pali Natural Area Reserve (HNP NAR) with an estimated annual budget of $127,000;

- KIUC funded predator control efforts in Wainiha Valley or an equivalent not-yet-identified location with an estimated annual budget of $271,000, should the STHCP be in effect 4 or 5 years from the 2011 ITP issuance (not initiated);
- Should the State's DOFAW not have sufficient funding in its budget to continue its annual seabird radar monitoring efforts, KIUC will provide $80,000 to DOFAW in Year 4 to conduct radar surveys at each of the 13 historical reference sites to continue seabird population monitoring; and
- In 2014, the Service approved use of funds for predator control efforts in Wainiha Valley and funds for radar monitoring (the above two items) to be used at HNP NAR. The Kaua'i Endangered Seabird Recovery Project (KESRP) continues to conduct annual seabird radar monitoring surveys at historical reference sites throughout the island, including radar data analyses, funded in part by KIUC under the terms of the original STHCP and permit.

KIUC submitted a permit renewal request to the Service for its Short-term HCP and ITP, prior to its expiration in May of 2016, to cover the period until Service renders a decision on their Long-term HCP, which is currently under development. Based on coordination with KIUC since 2016, the Service anticipates receiving a revised draft Long-term HCP by the end of 2020 that will propose minimization and mitigation measures to address these take impacts. However, at this time, we do not have enough information to reasonably forecast the amount of take and minimization and mitigation measures that will be included in the HCP. The Service will conduct NEPA compliance before making a decision on issuance of a long-term permit to KIUC.

*Federal actions*– Several federal actions involving artificial nighttime lighting, powerlines, and communication towers effects one or more of the Covered Seabirds:

| *Project* | *Federal Entity* | *Covered Seabird Take* | *Duration* | *Mitigation to Offset Take?* |
|---|---|---|---|---|
| Pacific Missile Range Facility (PMRF) Base-wide Operations | Navy | Newell's shearwater –<br>3 juveniles per year;<br>Hawaiian petrel –<br>1 juvenile every 10 years;<br>band-rumped storm-petrel –<br>2 juveniles every 10 years | 2014-2015 | No |
| Kōke'e Air Force Station | Air Force | Newell's shearwater –<br>2 adults/juveniles,<br>1 egg/chick per year;<br>Hawaiian petrel –<br>1 adult/juvenile,<br>1 egg/chick per year;<br>band-rumped storm-petrel –<br>1 adult/juvenile,<br>1 egg/chick every 10 years | 2017-foreseeable future | Yes-barn owl control in seabird colonies |
| Kālepa Comm. Tower | Coast Guard | Newell's shearwater –<br>4 adults, 2 eggs/chicks;<br>Hawaiian petrel –<br>2 adults, 1 egg/chick | 2013-2033 | Yes- seabird colony mgmt. |

| | | | | |
|---|---|---|---|---|
| Kalāheo Comm. Tower | FCC | Newell's shearwater – 3 adults, 2 eggs/chicks; Hawaiian petrel – 1 adult, 1 egg/chick | 2013-2033 | Yes-seabird colony mgmt. |
| PMRF Base-wide Reinitiation | Navy | Newell's shearwater – Total maximum of 63 fledglings, 450 adults, 63 chicks or eggs over 50 years | 2018-2068 | Yes-seabird colony mgmt. |

*Other management of seabird colonies* - Management actions to benefit the species that have occurred in the last five years in addition to actions related to HCPs and ongoing federal actions include:

- Completion of the 3-hectare predator exclusion fence in 2015, at the Nihoku conservation unit within Kīlauea Point National Wildlife Refuge. Newell's shearwater nestling translocations began in 2016 and will continue over the next three years with the goal of establishing a new Newell's shearwater breeding colony within a fully protected predator-free area on Kaua'i;
- Predator control efforts to benefit Newell's shearwater that began in June 2016 and expected to continue for the next 2-4 years, within a discrete area (≤ 1 hectare) in Hono o Nā Pali Natural Area Reserve, funded by the American Bird Conservancy.
- A 5-year partnership (Honopū Seabird Conservation Initiative) supported with funding from the Department of Defense Readiness and Environmental Protection Integration (REPI) program began in 2019 to establish an effective predator control program in Honopū Valley on Kaua'i. The purpose of the initiative is to construct a 3 acre predator-proof fence, within a 214 acre ungulate fence, to eradicate and control predators, to restore native habitat, to use social attraction with the goal of establishing and protecting a new breeding colony of Newell's shearwater within a fully protected predator-free area on Kaua'i.

*Impact of past, present, and future actions on the status of the Covered Seabirds* - The effects of the past, present, and reasonable foreseeable future actions have a cumulative negative impact on the status of the Newell's shearwater. The take impacts that are not offset include impacts caused by the nighttime lighting of eligible entities that did not express interest in participating in the KSHCP and impacts caused by KIUC powerlines and structures. As stated above, the amount of take and minimization and mitigation measures that will be included under the KIUC long-term HCP is unknown as it continues to be under active development.

### 6.2. Cumulative Impacts under the Action Alternative

There would be no major negative impacts to the biological resources of the affected environment under the proposed action alternative. The impacts to biological resources because of the proposed action alternative will be reduced by mitigation. The mitigation measures are important factors in reducing the number of individual species impacted by the action and the non-significant determination is reliant on the mitigation measures. Based on these reasons, this alternative would not significantly add to the negative cumulative effects from the past, present,

and future actions described in this chapter, and may provide some positive effects in the future. For these reasons, the action alternative would not create significant cumulative impacts.

### 6.3. Cumulative Impacts under the No-Action Alternative

Under the no-action alternative, there would be no negative impacts to the biological resources of the affected environment, thus would not contribute to the impacts related to any separate, current, or future projects.

## 7. Literature Cited

Balazs, G. H. 1980. Synopsis of biological data on the green turtle in the Hawaiian Islands.

Byrd, G.V., D.I. Moriary, and B.G. Brady. 1983. Breeding biology of the wedge-tailed shearwaters at Kīlauea Point, Hawaiʻi. *Condor* 85: 292-296.

Chaloupka, M., and G. Balazs. 2007. Using Bayesian state-space modelling to assess the recovery and harvest potential of the Hawaiian green sea turtle stock. Ecological modelling **205**:93-109.

Cooper, B. A., and R. H. Day. 1998. Summer Behavior and Mortality of Dark-Rumped Petrels and Newell's Shearwaters at Power Lines on Kauaʻi. *Colonial Waterbirds* 21(1): 11–19.

County of Kauaʻi. 2017. Email to USFWS on light usage at Vidinha Stadium Complex and Hanapēpē Stadium for 2015, 2016, and 2017.

[DOFAW] Hawaiʻi Department of Land and Natural Resources, Division of Forestry and Wildlife. 2018. Kauaʻi Save Our Shearwater data 1979-2017. Summarized by Service Pacific Islands Fish and Wildlife Office, Honolulu, HI.

[KESRP] Kauaʻi Endangered Seabird Recovery Project. 2019. KESRP Risk Predictor - Night Football Games 2019. Unpublished data.

[KHS] Kauaʻi Humane Society. 2014. Save Our Shearwaters Program 2013, Annual Report. Līhuʻe, Hawaiʻi.

[KISC] Kauaʻi Invasive Species Committee. 2018. Kauaʻi Mongoose Population Status Assessment Report. 7 pp.

Maison, K. A., I. K. Kelly, and K. P. Frutchey. 2010. Green turtle nesting sites and sea turtle legislation throughout Oceania. US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

Podolsky, R., D. G. Ainley, G. Spencer, L. Deforest, and N. Nur. 1998. Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kauaʻi. *Colonial Waterbirds* 21(1): 20–34.

Pyle, R.L., and P.Pyle. 2009. The Birds of the Hawaiian Islands: Occurrence, History, Distribution, and Status. B.P. Bishop Museum, Honolulu, HI, U.S.A. Version 1 (31 December 2009). Available at http://hbs.bishopmuseum.org/birds/rlp-monograph/.

Raine, A., Vynne, M., McFarlin, M., and M. Massie. 2016a. Monitoring of Endangered Seabirds in Upper Limahuli Preserve Annual Report 2015. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Raine, A. F., M. Vynne, M. McFarlin, and M. Massie. 2016b. Monitoring of Endangered Seabirds in Hono o Nā Pali Natural Area Reserve (Part I): Pihea, Annual Report 2015. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Raine, A. F., M. Vynne, M. McFarlin, and M. Massie. 2016c. Monitoring of Endangered Seabirds in Hono o Nā Pali Natural Area Reserve (Part II): Pōhākea, Annual Report 2015. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Raine, A. F., M. Vynne, M. McFarlin, and M. Massie. 2016d. Monitoring of Endangered Seabirds in Hono o Nā Pali Natural Area Reserve (Part III): North Bog, Annual Report 2015. Kaua‘i Endangered Seabird Recovery Project. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA

Raine, A.F., N.D. Holmes, M. Travers, B.A. Cooper, and R.H. Day. 2017. Declining population trends of Hawaiian petrel and Newell’s shearwater on the island of Kaua‘i, Hawai‘i, USA. *Condor* 119: 405-415.

Raine, A., Vynne, M., Driskill, S., and K. Stoner. 2018. Monitoring of Endangered Seabirds in Upper Limahuli Preserve Annual Report 2017. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Tiwari, M., G. H. Balazs, and S. Hargrove. 2010. Estimating carrying capacity at the green turtle nesting beach of East Island, French Frigate Shoals. Marine Ecology Progress Series 419:289-294.

[USFWS] U.S. Fish and Wildlife Service. 2017. Appendix II. Modelling Methods and Results used to Inform the Newell’s Shearwater Landscape Strategy. Portland, Oregon.

Witherington, B. E. 1992. Behavioral responses of nesting sea turtles to artificial lighting. Herpetologica 48(1):31-39.

## 8. Appendices

## 8.1. Memorandum of Understanding

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai'i 96850


In Reply Refer To:
01EPIF00-2019-TA-0442

# Memorandum of Understanding
# Between
# County of Kaua'i
# And
# U.S. Fish and Wildlife Service

## A. Purpose

The U.S. Fish and Wildlife Service (Service) and County of Kaua'i (County) (collectively referred to as the "Parties") have entered into this Memorandum of Understanding (MOU) for the purpose of conserving seabird species listed as endangered or threatened under the Endangered Species Act (ESA).

The County owns and operates football stadium lights. These lights may harm or kill ("take") the following species in violation of state and federal laws: the endangered Hawai'i Distinct Population Segment of the band-rumped storm petrel (*Oceanodroma castro*) and Hawaiian petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus auricularis newelli*) (hereafter collectively referred to as "seabirds").

The Kaua'i Seabird Habitat Conservation Plan (KSHCP) is currently being developed by the State of Hawai'i, Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW). The County proposes to include all of its facilities (including its football stadiums) as covered activities in the KSHCP, and apply for a federal incidental take permit (ITP) and state incidental take license (ITL) to address the anticipated take of seabirds. In the interim, the County would like to work with the Service to address the potential take of seabirds resulting from its stadium lights. This MOU addresses this narrow concern.

B. Legal Authority:

The Service enters into this MOU pursuant to legal authority provided by the Fish and Wildlife Coordination Act (16 U.S.C. §661 *et seq.*) and the Endangered Species Act (16 U.S.C. § 1531 *et seq.*).

C. Responsibilities of the Parties

1. Responsibilities of the County

   a. In the interim period while awaiting completion of the KSHCP, no stadium lighting will be on at any County-operated football facility, including but not limited to Vidinha and Hanapepe, in the evenings between September 15, 2019 and December 15, 2019 except as described below:

      i. The following football games of the 2019 season may be scheduled for a time that would require the use of the stadium lights at nighttime, in recognition that the games are early in the fledging season and that shielding of the stadium lighting and/or moon presence in the evening will minimize any anticipated takings: September 20 and September 27, and October 4. Lighting will be turned off within one hour after the end of each night game.
      ii. The following football games of the 2019 season may not be scheduled for a time that would require the use of the stadium lights at nighttime due to the medium to high risk of anticipated taking associated with absence of moon in the evening and/or timing of the fledging season: October 19 and October 26.
      iii. Football game dates in November 2019 are outside of the regularly scheduled football season, but if a game(s) is held in November it may not be scheduled for a time that would require the use of the stadium lights at nighttime due to the medium to high risk of anticipated taking associated with absence of moon in the evening and/or timing of the fledging season.

   b. The County will establish, at its sole cost and expense, an escrow account, no later than November 15, 2019, in the amount of $45,000 to be used in the event that a seabird(s) are found downed for the purpose of mitigating impacts to the seabird(s). If, in the sole judgment of the Service, such an event occurs on either of the September 20, September 27, or October 4 dates, for each such event, the County will direct the escrow agent to transfer $15,000 from the escrow account to a qualified entity selected by the County in consultation with, and with approval from, the DLNR-DOFAW for use in mitigating the takings of seabirds on Kaua'i. The amounts to be spent on mitigation have been set to reflect levels of effort sufficient for the Service to exercise its discretion to agree to the terms of this MOU. Any funds remaining in the escrow account as of January 30, 2020, may be returned to the County. Notwithstanding the above, should the number of

such takings equal or exceed three seabirds during the September 20 game, the September 27 and October 4 games may not occur at night. Additionally, should the number of such takings equal or exceed three seabirds during the September 20 and September 27 games, the October 4 game may not occur at night.

c. Whenever lights are on at night at any County-operated football facility between September 15, 2019 and December 15, 2019, the County will monitor the facility grounds. The County will coordinate monitoring with at least four biologists from the DLNR-DOFAW, the Kaua'i Endangered Seabird Recovery Project, or Pacific Islands Fish and Wildlife Office (PIFWO) whom will assist the County in monitoring seabirds at each of the games. Such monitoring shall include: (1) documentation of number, species, timing, height and flight patterns of observed seabirds; (2) the number of apparently downed seabirds that were searched for and in fact found to be downed; (3) the number of apparently downed seabirds that were searched for and not found; (4) the number of apparently downed seabirds that were not searched for with an explanation of why a search was not conducted; (5) the number of seabirds found downed that did not correspond to an observed apparent downing; and (6) information on the condition of any recovered downed seabirds. Such monitoring will further include, immediately upon conclusion of any game and before the lights are turned off, a search of the facility grounds for any downed seabirds. For all such monitoring, the County will maintain records of the location, times, dates, and biologists involved, as well as the location, condition, identification, in situ photographs, and fate of each recovered bird. Any seabird encountered during such monitoring will be reported by the County via telephone or email to the Service, PIFWO and the Service, Office of Law Enforcement (OLE) within 48 hours. Unless otherwise directed by the OLE, all retrieved seabirds will be transferred to the Save Our Shearwaters program in conformance with recommendations of that program, along with all associated location and photographic data for each bird.

d. Whenever lights are on at night at any County-operated football facility for a publicly attended event, held between September 15, 2019 and December 15, 2019, the County shall ensure that public service announcements regarding seabirds, mutually agreeable and reviewed by PIFWO and OLE, are delivered over the loudspeakers during any such event.

e. The County will complete and provide to PIFWO and OLE, no later than June 1, 2020, a report documenting the results of its monitoring and other observations from the 2019 football season.

2. Responsibilities of the Service

a. By entering into this MOU, the PIFWO is taking an "action" as defined in 50 C.F.R. §402.02. PIFWO will conduct consultation pursuant to Section 7 of the ESA on the provisions of the MOU and, if appropriate, provide an incidental take statement.

b. To the extent possible, PIFWO will continue to provide technical assistance to the County on steps to minimize the impacts of its activities on the seabirds.

3. The Parties Jointly Agree That –

a. The County will comply with the terms of this MOU in good faith, and provide timely notification to the Service of any known or suspected taking ESA-protected seabirds. The Service will conduct consultation on its action pursuant to Section 7 of the ESA, prepare a biological opinion, and exempt incidental take for seabirds as appropriate and only as described in the biological opinion and incidental take statement for the MOU. The County will be responsible for implementing the MOU as described in the biological opinion and incidental take statement for the MOU, including implementation of the mandatory terms and conditions of the incidental take statement.

b. This MOU memorializes the understanding of the parties that, during the interim period while the KSHCP is being actively developed in good faith, the County will minimize and mitigate take of seabirds in accordance with the terms of this MOU.

c. This MOU is unique to the special circumstances presented by this matter and is not intended to be, nor should it be construed as, precedent for any other action by the U.S. Fish and Wildlife Service or the U.S. Department of the Interior of matters of a similar type or subject matter.

D. Administrative Provision

1. Nothing in the MOU may be construed to obligate the Service to any current or future expenditure of funds or resources in advance of the availability of appropriations from Congress, or to expend any funds or resources if they are available.

2. The MOU is effective on the date it is signed by the Service and expires on the date the report documenting the results of the County's monitoring is received by PIFWO and OLE.

3. Either party may terminate its participation in the MOU with advanced written notice to the other party. Termination will immediately invalidate the ESA section 7 incidental take statement on the MOU.

4. In the event that the County fails to comply with the mandatory terms and conditions contained in the incidental take statement, this MOU will automatically terminate.

5. This MOU is not intended to be a legally enforceable contract in any administrative or judicial body.

6. This MOU is not intended to benefit any third-party, and is not enforceable by any third-party.

| | |
|---|---|
| Service, Field Supervisor | 9-13-19<br>Date |
| County of Kaua'i | 9.3.19<br>Date |

## 8.2. Biological Opinion

# Biological Opinion on the U.S. Fish and Wildlife Service's Proposed Entering into a Memorandum of Understanding with the County of Kaua'i for the Nighttime Operation of Football Facilities in 2019

Photo Credit: Dennis Fujimoto, The Garden Island

**September 13, 2019**
**(01EPIF00-2019-F-0442)**

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# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai‘i 96850

In Reply Refer To:
01EPIF00-2019-F-0442

Memorandum

Note to File: Ms. Katherine Mullett, Field Supervisor, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i

KATHERINE MULLETT Digitally signed by KATHERINE MULLETT Date: 2019.09.13 09:14:07 -10'00'

Subject: Consultation on U.S. Fish and Wildlife Service Entering into a Memorandum of Understanding with the County of Kaua‘i for the Nighttime Operation of Football Facilities

This document is the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) addressing the effects of the subject action on the threatened Newell's Shearwater (*Puffinus auricularis newelli*). Under the Memorandum of Understanding (MOU), the County of Kaua‘i (County) will operate lighting during the nighttime for three football games at two County football facilities, including Hanapēpē Stadium and Vidinha Stadium Complex. No critical habitat has been designated for the Newell's shearwater. This BO was prepared in accordance with section 7 of the Endangered Species Act of 1973 as amended (Act) (16 U.S.C. 1531 *et seq*.).

The proposed action may affect, but is not likely to adversely affect (NLAA), the endangered Hawaiian petrel (*Pterodroma sandwichensis*) and the endangered Hawai‘i population (distinct population segment) of the band-rumped storm-petrel (*Oceanodroma castro*). For the 2019 Kaua‘i Island Football Season the three football games with nighttime lighting will occur on dates (September 20, September 27, and October 4) outside of the Hawaiian petrel fledging season, based on estimates of the time period when Hawaiian petrels will fledge this year (KESRP unpublished data, 2019). No band-rumped storm-petrels downed due to light attraction have been recovered by the Save Our Shearwaters (SOS) program from September 20 through October 4 over the past five years at any location on Kaua‘i (SOS 2019). Because the downing of a band-rumped storm-petrel is a rare event in any given year, it is highly unlikely that any band-rumped storm-petrels would be downed during the three football games with nighttime lighting. On the island of Kaua‘i, both Hawaiian petrel and band-rumped storm-petrel primarily breed on the Nā Pali Coast (Raine *et al.* 2017, Raine *et al.* 2016a, 2016b, 2016c, and 2016d). Based on the above information (fledgling season, downed seabird recoveries, and breeding locations) and implementation of minimization measures (e.g., use of shielded stadium lighting and timing of game schedule in relation to fledging of these species), seabird disorientation or light attraction of the Hawaiian petrel and band-rumped storm-petrel due to nighttime lighting at Hanapēpē Stadium or Vidinha Stadium Complex is not probable, and therefore discountable.

Because effects from the action are discountable, the proposed project is not likely to adversely affect these species.

This BO is based on information provided in: (1) the County of Kaua‘i’s (County) request dated July 9, 2019 to enter into a Memorandum of Understanding; (2) email communication between the Office of the County Attorney and our office; and (3) other information available to us.

## CONSULTATION HISTORY

The Service has been working with the County to assist in the conservation and management of listed species. Correspondence applicable to technical assistance prior to this consultation is discussed below. The following represents a detailed chronology of actions and correspondence applicable to beginning work on this BO.

July 9, 2019 – The Service received the County’s request via email for assistance in evaluating the risk to seabirds associated with nighttime operation of County football facilities during the seabird fledging season, September 15 to December 15. The Service recommended the County work with us and the Kaua‘i Endangered Seabird Recovery Project (KESRP) staff to inform risk to seabirds.

July 31, 2019 – The Service emailed the seabird risk assessment (produced by the KESRP staff) to the County to help inform the County’s selection of proposed nighttime football games.

August 2, 2019 – The County emailed the Service to request three Friday night football games occurring at two stadiums.

August 29, 2019 – The Service emailed the County a draft MOU that would be entered into by the County and the Service, including MOU purpose, responsibilities, and administrative provision. Part of the County responsibilities in the MOU include scheduling football games on dates when nighttime operations of County football facilities would pose low risk to seabirds as well as mitigating, monitoring, and reporting impacts to seabirds.

September 5, 2019 - The County requested participation in the draft MOU and sent a copy of the MOU with the County’s signature to the Service.

## DESCRIPTION OF THE PROPOSED ACTION

### Project Description

The proposed action is the signing of the MOU which describes actions to minimize and mitigate impacts to Newell’s shearwater from holding County high school football games at night on the island of Kaua‘i during the 2019 fall season. The County’s football facilities and lighting, facility operations, mitigation, and monitoring and reporting that would be implemented by the County under the MOU are described below. Key minimization measures include holding only three night games on specified dates scheduled to avoid the peak fledgling migration period

and requiring that night games be discontinued for the season if three Newell's shearwater fledglings are taken from light attraction during the first night game, or taken during the first two night games. If this biological opinion finds that implementation of the MOU is not likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, it will include an incidental take statement exempting incidental take from the prohibitions of the ESA not to exceed three fledglings.

*Football Facilities - Lighting and Operations*
The County-operated football facilities included in this proposed action are Hanapēpē Stadium and Vidinha Stadium on the island of Kaua'i.

Hanapēpē Stadium is located along Puolo Road, south of Kaumuali'i Highway, in Hanapēpē (TMK: 1-9-09-01). The exterior shielded lighting at the football field in Hanapēpē stadium consists of 75 lamps each with 1,000 watt metal halide lamps (County of Kaua'i 2016a). The location of the football field at Hanapēpē stadium and a summary of all facility lighting at the stadium are provided in Figure 1.

Vidinha Stadium Complex is located along Kapule Highway at its junction with Ho'olako street in Līhu'e (TMK: 3-6-02-16). The shielded exterior lighting of the football field at Vidinha Stadium Complex consists of 108 lamps each with 1,500 watt metal halide lamps (County of Kaua'i 2016b). The parking area for the stadium includes 37 lamps each with 100 watt sodium lamps (County of Kaua'i 2016b). Figure 2 provides the location of the football stadium and a summary of all facility lighting at Vidinha Stadium Complex.

Under the MOU, the County will operate football facility lighting at nighttime on the following three dates: September 20, September 27, and October 4. This schedule will be followed in order to minimize impacts to the Newell's shearwater, in recognition of the timing of the fledging period (dates chicks fledge their breeding sites) and the presence of the moon in the evening. Varsity football games on these dates will be scheduled to begin at, or before 7:30 pm. All lighting will be turned off within one hour after the game (11:00 pm) to reduce the amount of time lighting will be required after sunset and further minimize impacts to the Newell's shearwater.

The duration of the proposed action is approximately two weeks (September 20 to October 4); however, lighting will only be operated at County football facilities on three nights within this timeframe.

**Figure 1.** Location of the football field and summary of all facility lighting at Hanapepe Stadium (County of Kaua‘i 2016a).

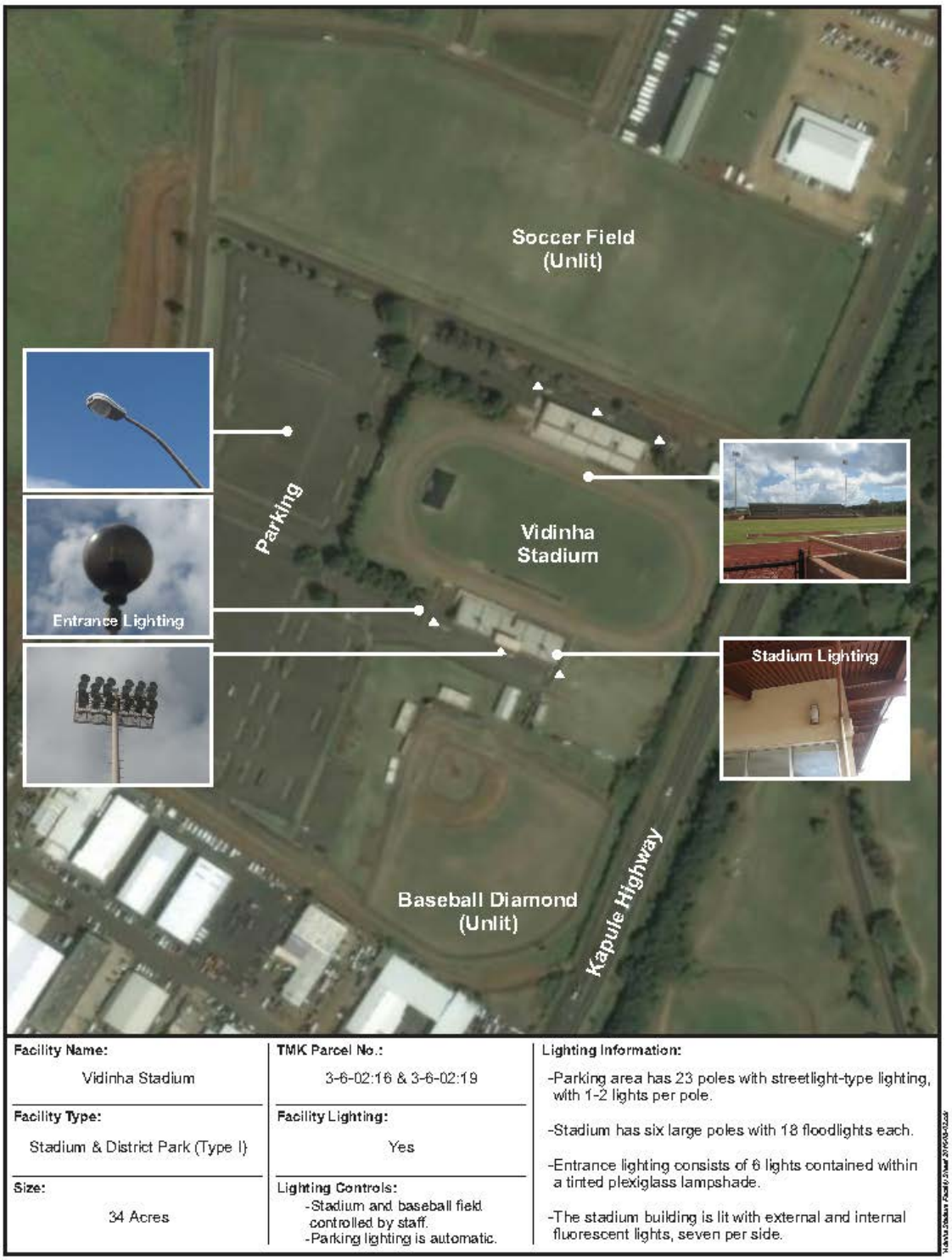


**Figure 2**. Location of the football field and summary of all facility lighting at Mayor Bryan J. Vidinha Stadium Complex (County of Kaua‘i 2016b).

*Mitigation*
The County will establish (at its sole cost and expense) an escrow account, no later than November 15, 2019, in the amount of $45,000 to be used in the event that Newell's shearwaters are found downed for the purpose of mitigating impacts to Newell's shearwaters. If, in the sole judgment of the Service, such an event occurs on either of the September 20, September 27, or October 4 dates, for each such event, the County will direct the escrow agent to transfer $15,000 from the escrow account to a qualified entity selected by the County in consultation with, and approval from, the State of Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) for use in mitigating the takings of Newell's shearwaters on Kaua‘i.

Should the number of such takings equal or exceed three Newell's shearwaters during the September 20 game, the September 27 and October 4 games will not occur at night. Additionally, should the number of such takings equal or exceed three seabirds during the September 20 and September 27 games, the October 4 game will not occur at night.

The mitigation funding is intended for Newell's shearwater research and management to support a long-term effort to recover listed seabird populations that, among other goals, are designed to:

- Support habitat management and predator control efforts at known colonies;
- Refine methods to identify new colonies;
- Develop techniques to establish new colonies;
- Improve predator control and habitat management techniques; and
- Improve population monitoring techniques.

The research and/or management of Newell's shearwater implemented from the funding provided would contribute to the knowledge of the species and/or improve its habitat. Information developed through these efforts would fill in data gaps and contribute to the ability to adaptively manage mitigation efforts in the future. The mitigation resources from multiple sources would likely be pooled, thereby increasing the potential scope of research and management efforts and the value of the research or management to the species.

*Monitoring and Reporting*
Monitoring and reporting will address compliance with the provisions of the MOU and this BO. Whenever lights are on at night at any County-operated football facility between September 15, 2019 and December 15, 2019, the County will monitor the facility grounds. The County will coordinate monitoring with at least four biologists from DOFAW, the KESRP, or the Service, Pacific Islands Fish and Wildlife Office (PIFWO) whom will assist the County in monitoring seabirds at each of the games. Such monitoring shall include: (1) documentation of number, species, timing, height and flight patterns of observed seabirds; (2) the number of apparently downed seabirds that were searched for and in fact found to be downed; (3) the number of apparently downed seabirds that were searched for and not found; (4) the number of apparently downed seabirds that were not searched for with an explanation of why a search was not conducted; (5) the number of seabirds found downed that did not correspond to an observed apparent downing; and (6) information on the condition of any recovered downed seabirds. Such monitoring will further include, immediately upon conclusion of any game and before the lights

are turned off, a search of the facility grounds for any downed seabirds. For all such monitoring, the County will maintain records of the location, times, dates, and biologists involved, as well as the location, condition, identification, in situ photographs, and fate of each recovered bird. Any seabird encountered during such monitoring will be reported by the County via telephone or email to the Service, PIFWO and the Service, Office of Law Enforcement (OLE) within 48 hours. Unless otherwise directed by the OLE, all retrieved seabirds will be transferred to the Save Our Shearwaters program in conformance with recommendations of that program, along with all associated location and photographic data for each bird.

Whenever lights are on at night at any County-operated football facility for a publicly attended event, held between September 15, 2019 and December 15, 2019, the County shall ensure that public service announcements regarding seabirds, mutually agreeable and reviewed by PIFWO and OLE, are delivered over the loudspeakers during any such event.

The County will complete and provide to PIFWO and OLE, no later than June 1, 2020, a report documenting the results of its monitoring and other observations from the 2019 football season.

## ACTION AREA

The action area of a project is defined by regulation as all areas [likely] to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). In delineating the action area, we evaluated the farthest reaching physical and biotic effects of the action on the environment, including all County football facilities and infrastructure, as well as conservation measures identified in the MOU. The action area for this consultation is the island of Kaua‘i.

## ANALYTICAL FRAMEWORK FOR THE JEOPARDY/ADVERSE MODIFICATION ANALYSES

In accordance with policy and regulation, the jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which evaluates the Newell’s shearwater range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which evaluates the condition of the Newell’s shearwater in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the Newell’s shearwater; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the Newell’s shearwater; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the Newell’s shearwater.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the Newell’s shearwater’s current status, taking into account cumulative effects, to determine if implementation of the proposed action is

likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the Newell's shearwater in the wild.

The jeopardy analysis in this biological opinion places an emphasis on consideration of the range-wide survival and recovery needs of the Newell's shearwater and the role of the action area in the survival and recovery of the Newell's shearwater as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

## STATUS OF THE NEWELL'S SHEARWATER

### *Listing Status, Taxonomy, and Species Description*

The Newell's shearwater was listed as a threatened species in 1975 (USFWS 1983), pursuant to the Endangered Species Preservation Act of 1966. *The Hawaiian Dark-rumped Petrel and Newell's Manx Shearwater Recovery Plan* was published in 1983 (USFWS 1983). Species five-year reviews on Newell's shearwater were completed in 2011 and 2017. Each of the reviews recommended up-listing the Newell's shearwater to endangered status primarily due to precipitous declines in the global population over the last two decades. Critical habitat has not been designated for the Newell's shearwater (USFWS 1983).

The Newell's shearwater taxonomically belongs to the *Puffinus* genus, in the *Procellariidae* family and *Procellariiformes* order, along with 20 other extant shearwaters ranging throughout the Indian, Atlantic, and Pacific oceans (Gill and Donsker 2016). Shearwaters are characterized by exhibiting a "shearing" flight pattern, dipping from side to side on stiff, straight wings with few wing beats. Genetic analyses conducted by Martíinez-Gómez *et al.* (2015) confirmed the taxonomic status of Newell's shearwaters (*P. auricularis newelli*) as a subspecies alongside the Townsend's shearwater (*P. auricularis auricularis*). These two subspecies comprise *P. auricularis*. The two subspecies exhibit minor differences in plumage patterns and breeding chronology (Martíinez-Gómez *et al.* 2015, p. 1026). The Townsend's shearwater is endemic to the Revillagigedo Archipelago located off the coast of Mexico and south of Baja California Peninsula. The Townsend's shearwater's range and distribution has been significantly contracted to a single island with less than 100 breeding pairs remaining (Martíinez-Gómez *et al.* 2015, p. 1032; and BirdLife International 2016a).

The Newell's shearwater is approximately 12 to 14 inches long, with a wingspan of 30 to 35 inches (Berger 1972, p. 46), and weighs approximately 14 ounces (Ainley *et al.* 1997, p. 15). Its plumage is glossy black above, and white below (Ainley *et al.* 1997, p. 15). The Newell's shearwaters' maneuverability is characterized by fast, directional, and a low-to-water flight pattern, due to high wing-loading. A Newell's shearwater wing-loading averages about 60 N [newtons]/m2 (± 5.3 SD) with a low aspect ratio (10.3 ± 0.45 SD); significantly different from other shearwaters or petrels (Spear *et al.* 1995; Warham 1977). Observations of Newell's shearwaters transiting over land show a distinct flight pattern characterized by an almost frantic flapping style with the wings held straight (KESRP 2017). It has a dark gray to brown bill that is

sharply hooked at the tip (Ainley *et al.* 1997, p. 15). Its claws are well adapted for burrow excavation and climbing.

*Historic and Current Distribution*

The Newell's shearwater is believed to have colonized, historically, many of the southeastern Hawaiian Islands, including Hawai'i, Maui, Moloka'i, O'ahu, and Kaua'i (USFWS 1983, p. 2; Pyle and Pyle 2009, p.3). Newell's shearwaters were thought to be extinct after 1908, due largely to habitat loss and predation, but in 1954 a specimen was collected on the island of O'ahu (King and Gould 1967) and in 1967 a breeding colony was found on Kaua'i (Sincock and Swedberg 1969). Although no Newell's shearwater breeding colonies have been identified on the island of O'ahu, downed Newell's shearwaters have been recovered throughout the island since the 1950s (Pyle and Pyle 2009, p.3). In a study conducted by Young *et al.* (2019, p. 3) song meters detected Newell's shearwaters at two sites on O'ahu. Calls were detected on the leeward slope of Mount Ka'ala in the Wai'anae Mountains and at Poamoho in the Ko'olau Mountains. Both sites are intact native forests, free from major light pollution. To date no burrows have been detected but recorded calls may be remnant bird populations, or outer island individuals prospecting for new burrow sites (Young *et al.* 2019, p. 6). Three fragmented breeding areas were identified in the Puna District on the southeast island of Hawai'i in 1993, based on nocturnal calling, visual detections of birds in flight, and two Newell's shearwater carcasses found along the highway; however no active burrows were found (Reynolds and Ritchotte 1997, p. 31). Currently, research staff at Haleakalā National Park on Maui Island consistently report Newell's shearwater ground calling within Kīpahulu Valley and along the northern slope of Mount Haleakalā near Ko'olau Gap, indicating a breeding site (NPS 2012, p. 18). However, due to sensitive resources in the area and the difficult terrain, no ground surveys have been conducted in these locations (NPS 2012, p. 19). In 2015, acoustic song meters were placed at 41 sites in remote areas of Haleakalā National Park to detect potential new seabird breeding colonies (McKown and Savage 2015, p. 1). Song meters detected Newell's shearwater ground calls in low numbers (averaging 2 ground calls per survey night) at five of the 41 sites, with only one site recording regular activity during the 30-day study period (McKown and Savage 2015, p. 15). The song meters in this study were programmed to record 1 out of every 5 minutes, for 5 hours starting at sunset, then record 1 out of every 10 minutes for the 5 hours preceding sunrise (McKown and Savage 2015, p. 3). This schedule amounted to an hour and a half of data each night. Additional longer-term acoustic and ground surveys are needed to evaluate the extent, distribution, and viability of Newell's shearwater on Maui, Hawai'i and O'ahu islands.

While some knowledge gaps remain concerning its distribution, the Newell's shearwater has experienced a significant breeding range contraction and currently, all known extant breeding colonies with documented burrows are located on the islands of Hawai'i, Maui, Lāna'i, Kaua'i, and Lehua islet (Figure 3). Estimates indicate 90 percent of the global population resides on Kaua'i (Ainley *et al.* 1997; Griesemer and Holmes 2011).

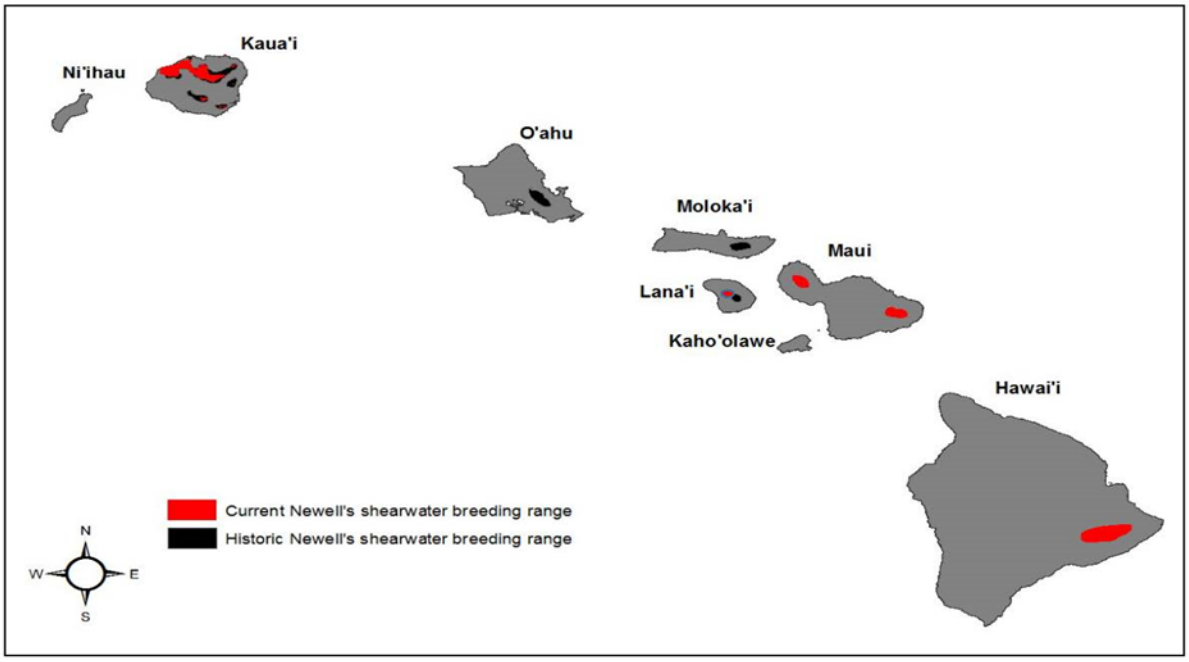


**Figure 3.** A comparison of the historic and current breeding range for the Newell's shearwater. Map shows current breeding range contraction from the historic breeding range for the Newell's shearwater within the Hawaiian Archipelago. While the Newell's shearwater may breed on Hawai'i and Maui islands, the only known extant breeding colonies with documented burrows of Newell's are located on the islands of Kaua'i, Lāna'i, and Lehua.

Of the Newell's shearwater breeding on the island of Kaua'i, 104 breeding pairs were being monitored and an additional 64 burrows in Upper Limahuli Preserve (ULP) were monitored in 2015 but could not be identified to species (i.e., burrows were either Newell's or petrels) (Raine *et al.* 2016a, 2016c). The majority of the monitored shearwaters (82 breeding pairs) in 2015 were concentrated within the ULP, enclosed by an ungulate exclusion fence. Auditory surveys documented several additional areas of concentrated shearwater ground-calls indicating breeding activity within Lumaha'i Valley and La'au Mountain in montane habitat and within Honopū Valley along the Nā Pali coast (Banfield *et al.* 2013). However, due to inaccessible and difficult terrain, no numbers or estimates exist for shearwaters breeding in these locations.

Based on historic and current distribution of breeding sites, Newell's shearwaters prefer breeding habitat in montane wet (e.g., Hono o Nā Pali colony) to lowland wet and wet cliff (e.g., Upper Limahuli colony) habitat of 200m to 1,000m in elevation, steep to moderate slopes with thick native understory of uluhe fern (*Dicranopteris linearis*) and open canopy of dispersed 'ōhi'a trees (*Metrosideros polymorpha*) (Troy *et al.* 2014, p. 325). The preference for montane forested habitat beneath dense uluhe fern helps to conceal shearwater burrows from predators while dispersed 'ōhi'a trees may provide a take-off point for shearwaters to regain flight (Troy *et al.* 2014, p. 318). The Newell's substrate preference includes rocky volcanic soils with a moderate amount of fine soil particles and suitable drainage to prevent burrow flooding (Troy *et al.* 2014, p. 324). Recent seabird surveys have resulted in the first confirmed Newell's shearwater burrows (n=3) along the Nā Pali coast, in dry cliff habitat (Raine and Banfield 2015a, p. 11).

*Life History*

Newell's shearwaters have a long lifespan (up to 36 years), do not reproduce until 6 years of age, lay one egg per year, and offspring require significant parental investment (Ainley *et al.* 2001). As with other k-selected species[1], these traits of long lifespans and low reproduction at high energetic cost define the life strategy of a species that has evolved in a stable, predictable environment (i.e. the succession of ecosystem development in the Hawaiian Islands following a period of volcanic eruptions).

Newell's shearwater breeding season begins in late March/early April when adults and sub-adults arrive to inland breeding colonies, followed by a 2-4 week exodus when breeding adults forage to build-up reserves (Raine and McFarland 2013, p. 2; Raine and Banfield 2015a, p.2). The incubation period begins in May and continues through July, and the chick provisioning stage occurs in late July through September (Raine and McFarland 2013, p. 2). Both sexes equally incubate the egg (Ainley *et al.* 1997, p. 10). The fledging or late chick rearing stage, when young leave the nest for the first time, occurs in September through December (DOFAW 2018; Raine and McFarland 2013, p. 2). Adults travel from breeding to feeding areas and return to feed their chicks irregularly every one to three nights throughout the chick rearing stage (Ainley *et al.* 1997). Newell's shearwaters, similar to other birds in the Order Procellariiformes, exhibit strong natal philopatry, with breeding pairs returning to the same burrow to breed each year (Bried *et al.* 2003, p. 242).

Ainley *et al.* (2001, p. 117) documented higher than expected numbers of active shearwater burrows with no egg or nestling signs present (11%-22%), indicating no breeding attempt was made. Monitoring data of shearwater colonies indicate at least 10% or more of activity within breeding colonies is comprised of non-breeding birds or sub-adults (<6 years old) prospecting for mates or excavating burrows during the breeding season (Raine *et al.* 2016a, 2016c). Ainley *et al.* (1997, p. 11) suggested shearwaters on Kaua'i begin returning to their breeding habitat as sub-adults at 2-3 years of age. The full shearwater breeding season is treated as March 1 to January 1 to cover the entire period when shearwaters may transit to and from the ocean and inland breeding sites (Travers *et al.* 2016, p. 5). All transit over land occurs in darkness, with a peak over land passage during the year coinciding with the late incubation and chick rearing stages (Travers *et al.* 2013, p. 35). Fledglings leaving the nest for the first time exhibit strong phototropic behavior and rely on ambient light from the moon to navigate to open ocean (Telfer *et al.* 1987, p. 410).

Newell's shearwaters are pelagic, spending much of their time foraging over deep waters where 96 percent of their diet consists of cephalopods, primarily the Ommastrephidae family of flying squid with the remaining 4 percent consisting of flying fish (*Exocoetus* sp.) (Ainley *et al.* 2014, p. 70). Newell's shearwaters likely specialize in feeding over yellowfin tuna (*Thunnus albacares*), as both flying squid and flying fish are important in the diet of yellowfin tuna.

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[1] K-selected species are those characterized by long lifespans and low reproduction at high energetic cost due to their evolution in stable environments.

*Current Population Demographics*

At-sea surveys conducted in the central and eastern tropical Pacific between 1980 and 1994 (Spear *et al.* 1995) estimated the total Newell's shearwater population at 84,000 (95% CI = 57,000-115,000) including juveniles and sub-adults. An updated assessment based on survey data collected by the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA-NMFS) Southwest and Pacific Islands Fisheries Science Centers from 1998 to 2011, estimated the total Newell's shearwater population at 27,011 (95% CI = 18,254-37,125) including juveniles and sub-adults (Joyce 2013). Given 90 percent of the global population resides on Kaua'i (Ainley *et al.* 1997; Griesemer and Holmes 2011), the estimated population of Kaua'i is 24,310 individuals (USFWS 2017b, p. 113). The percentage of the population that is breeding age (6 years of age or older) is estimated at 0.637 (Ainley *et al.* 2001, p.115), equaling an adult population size of 15,485 (approximately 7,500 pairs).

Annual survivorship and juvenile/sub-adult survivorship of the Newell's shearwater has not been studied in the field (i.e., estimated from banding efforts and recapture). Population viability modeling efforts estimate Newell's shearwater adult survivorship at 0.905 (Ainley *et al.* 2001, p. 116) to 0.920 (Griesemer and Holmes 2011, p. 20; USFWS 2017b) and juvenile/sub-adult survivorship at 0.333 (Ainley *et al.* 2001, p. 116) based on long-term survivorship data of related species. The likelihood of Newell's shearwater adults (≥ 6 years of age) to breed in any one year was estimated to vary between 0.60 and 0.50 (Ainley *et al.* 2001, p. 118), which is markedly lower than the breeding probability (0.82) of other Procellariidae species. Based on a five-year monitoring study of a single Newell's shearwater colony on Kaua'i the annual reproductive success of shearwaters was estimated at 0.66 fledglings per breeding pair (Ainley *et al.* 2001, p. 117).[2] In comparison, the Manx shearwater, a closely related species with an extensive range and a stable global population has a reproductive success of 0.70 (Brooke 1990; and Ainley *et al.* 2001, p. 117).

Based on Newell's shearwater population parameters, SOS data, and carcass searches under power lines, Ainley *et al.* (2001) estimated the global population of Newell's shearwaters are declining at least 5.9 percent per year ($\lambda$=0.941). Ainley *et al.* (2001, p. 118) found that the main factor limiting the population growth rate of the Newell's shearwater was the extremely low breeding probability (0.547), which is associated with individual fitness and habitat quality. Ainley *et al.* (2001) suggested that the low breeding probability could be the result of high mate loss due to predation or other threats affecting individual fitness. Indeed, adults that lose a mate due to predation cannot obtain a new one quickly and have been observed not to breed the following season (Ainley *et al*. 2001, p. 118). The purpose of the Ainley *et al.* (2001) population demographic study was to evaluate the status of Newell's on Kaua'i. The study sampled an average of 65 burrows for seven seabird seasons, 1981–1985 and 1993–1994. The colony sampled was in a natural state (i.e., receiving no conservation management actions) and the sample was not constrained to only experienced breeders, but rather sought to maximize the total number of burrows monitored each season (Ainley *et al.* 2001, p. 112).

[2] Reproductive success is defined as the number of chicks fledged from active burrows (Ainley *et al*. 2001).

Ornithological radar data was first used to monitor populations of Newell's shearwaters and Hawaiian petrels on Kaua'i in 1992-1993 (Day *et al.* 2003, p. 670), based on methods developed to monitor marbled murrelet (*Brachyramphus marmoratus*) populations in the Pacific Northwest (Cooper *et al*. 2001). Radar has been used to monitor the summer movement patterns of Newell's shearwaters and provide an accurate estimate of birds as they transit through the detection area at 13 sites throughout the island (Day and Cooper 1995; Raine *et al.* 2017). Day *et al.* (2003) reported a mean annual rate of 11.2 percent decline in the Newell's shearwater population between 1993 and 2001, based on the analyses of ornithological radar data.

A subsequent study using visual observations, species-specific timing of petrel and shearwater movements, and radar data analysis showed an appreciable reduction in the number of shearwaters transiting to and from montane breeding colonies from 1993 to 2013 (Raine *et al.* 2017), updating the analyses presented in Day *et al.* (2003). Radar surveys were conducted in coastal areas of known seabird flyways in May through mid-July, during the incubation and early chick-rearing stage. Therefore, these radar data are a conservative index of breeding activity. The overall mean for shearwaters across all 13 radar sites surveyed in 1993 was 524 ± 207 targets/h and in 2013 was 34 ± 9 targets/h, representing a mean decrease of 94% between the two periods ($t = 2.37$, $P = 0.03$; Raine *et al.* 2017). All of the 13 sites showed a large decrease in movement rates over the entire period, with movement rates at 12 (92%) out of 13 sites showing statistically significant declines (Raine *et al.* 2017). Based on the radar data (Raine *et al.* 2017) as a proxy for the breeding population, the Newell's shearwater population on the island of Kaua'i declined, annually, at a mean rate of 12.5 percent over the 20-year period. This updated rate of decline of the Newell's shearwater population is comparable to the mean annual rate of -11.2 percent between 1993 and 2001 reported by Day *et al.* (2003, p. 673).

Ainley *et al.* (2001) had documented 14 shearwater breeding colonies distributed across Kaua'i (Figure 4). Several of these formerly large Newell's shearwater colonies in Kalāheo, Kaluahonu, and Makaleha on the island of Kaua'i have declined dramatically in recent decades to near extirpation (Raine *et al.* 2017). No population data exists for Newell's breeding on other islands.

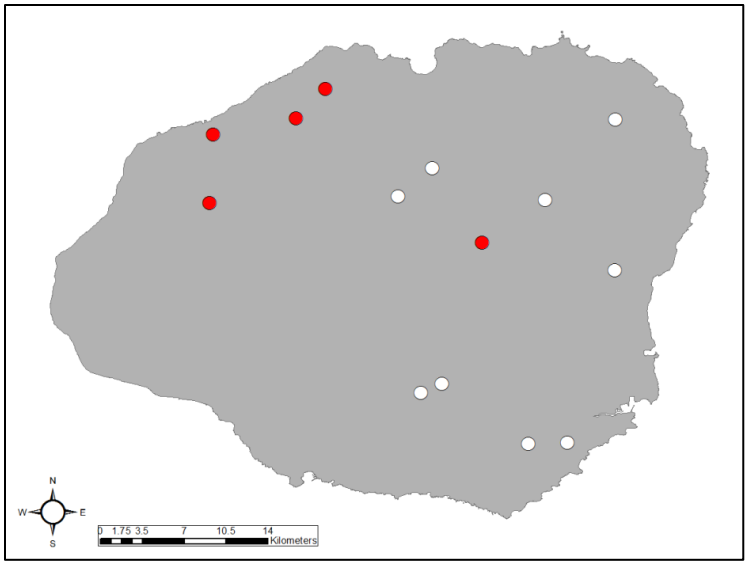


**Figure 4.** Map of Kaua‘i showing Newell’s shearwater breeding colony locations (n=14) (Ainley *et al.* 2001); unfilled circles (n=9) represent colonies near extirpation (<5 burrows).

In two breeding colonies on Kaua‘i, ULP and Hono o Nā Pali Natural Area Reserve (NAR), efforts are currently underway to curtail the population decline through the removal of predators. The reproduction output of the 104 monitored Newell’s shearwater pairs breeding within these areas are measured in terms of their reproductive success.[3] Since 2011, the reproductive success of Newell’s shearwater pairs within ULP has increased by 27 percent, from 0.692 to 0.882 in 2011 and 2015, respectively (Raine *et al.* 2016a, p. 16). This increase appears to be a direct result of the ungulate exclusion fence completed in 2010 and intensive predator control that began in 2011. Indeed prior to these conservation efforts, surveys at ULP documented a 0.545 reproductive success rate (Table 1). Newell’s are less prevalent than petrels within Hono o Nā Pali NAR and have not been as successful in reproducing (Table 1) due primarily to predation by cats, rats and feral pigs, despite the ungulate exclusion fencing and predator control. In addition to the reproductive success rates from Newell’s burrows listed in Table 1, there were an additional 162 burrows at ULP and Hono o Nā Pali NAR monitored in 2015 that could not be identified to species (i.e., burrows were either used by Newell’s shearwaters or petrels).

**Table 1.** Reproductive success rates for Newell’s shearwater breeding pairs (*n*) monitored each year (2010–2015) at Upper Limahuli Preserve and Hono o Nā Pali Natural Area Reserve’s Pōhākea site.

| Year | **2010 (*n*)** | **2011 (*n*)** | **2012 (*n*)** | **2013 (*n*)** | **2014 (*n*)** | **2015 (*n*)** |
|---|---|---|---|---|---|---|
| ULP | 0.545 (11) | 0.692 (15) | 0.682 (34) | 0.784 (46) | 0.840 (59) | 0.882 (82) |
| Hono o Nā Pali NAR-Pōhākea | no data | no data | no data | 0.571 (8) | 0.375 (20) | 0.667 (22) |

[3] Reproductive success in Procellariformes, also commonly referred to in scientific literature as breeding success, is the percentage of eggs laid that result in young fledged (Warham 1996).

*Threats*

Primary threats to the Newell's shearwater include artificial nighttime lighting (Reed *et al.* 1985; Cooper and Day 1998), collisions with power infrastructure (Cooper and Day 1998; Podolsky *et al.* 1998), predation by introduced predators (Raine and Banfield 2015b, 2015c), and changes to breeding habitat due to introduced invasive plants (Troy *et al.* 2014). These threats to the Newell's shearwater have been steadily increasing.

Artificial light sources collectively are a significant mortality factor associated with Newell's shearwaters (Ainley *et al.* 2001; Troy *et al.* 2011). Upward projecting nighttime lighting interferes with the shearwaters ability to navigate to and from their breeding sites. Shearwaters, primarily fledglings and sub-adults are disoriented by nighttime lighting and will circle light sources until they become exhausted and fall to the ground, where these birds are vulnerable to being killed by feral cats, dogs, or vehicles (Travers *et al.* 2013, p. 81). They often fly into utility wires, poles, trees, and buildings and fall to the ground; this phenomenon is referred to as "fallout". Once these seabirds fall to the ground, they are unable to regain flight unless they have access to an area with sufficient take-off conditions to allow enough air to move under their wing to provide lift (Ainley *et al*. 2015, p.32). Since 1979, the DOFAW on Kaua'i with financial assistance from the Kaua'i Island Utility Cooperative (KIUC) (beginning in 2003) has supported the Save our Shearwaters (SOS) program to collect "downed" Newell's shearwaters and Hawaiian petrels (*i.e*., birds that have either collided with structures or fallen out, or have been injured or killed due to exhaustion caused by light attraction). Over a 37-year period (1979-2016), the SOS program documented a total of 30,552 Newell's shearwaters recovered, injured or killed due to artificial nighttime lighting (DOFAW 2018). In the 1980s through 1990s, an average of 1,247 Newell's shearwaters were processed by the SOS program each year, where carcasses were documented or injured birds were rehabilitated and released (DOFAW 2018).

Adults and sub-adults are subject to collisions with power lines while flying between their nesting colonies and at-sea foraging areas (Cooper and Day 1998, p. 18; Podolsky *et al.* 1998, p. 21). Nestlings are indirectly affected as they rely on provisioning from both parents in order to survive, thus the loss of either parent results in nestling fatality. In 1993, in a single breeding season Podolsky *et al.* (1998, p. 30) documented deaths of at least 70 breeding adults and 280 sub-adult shearwaters over the summer months, in addition to 340 fledgling deaths in the autumn months, all as a result of collisions with power lines on Kaua'i. However, this study covered only the eastern and southern portions of the island (Podolsky *et al*. 1998, p. 30).

Based upon recent information collected from passive acoustic song meters (n=51) by KIUC Underline Monitoring Program, the Service has conducted modeling to extrapolate the amount of documented take (i.e., collisions with power lines) to the entire power system on Kaua'i (USFWS 2017b). The Service estimates that 1,800 Newell's shearwater mortalities are occurring per year as a direct result of power line strikes under the KIUC Short-Term Habitat Conservation Plan (STHCP) and Incidental Take Permit (ITP), using the rounded average of 2014 and 2015 strikes from scenarios IV, VB, and VIA selected in the USFWS Newell's Shearwater Landscape Strategy Appendix 2 (2017b, p. 123)[4]. This number is substantially

[4] KIUC activities are also likely to cause take of Hawaiian petrels; however, updated estimates of annual petrel take levels are not described in this biological opinion.

greater than what was anticipated at the time the ITP was issued. The KIUC Short-Term Habitat Conservation Plan and Incidental Take Permit authorized the annual take of up to 162 Newell's shearwaters and 2 Hawaiian petrels (adults and sub-adults) from 2011 to 2016.

Introduced predators, particularly cats, rats, feral pigs, mongoose (*Herpestes auropunctatus*), and barn owls, are a severe threat to the continued existence of the Newell's shearwater. Adults, sub-adults, and young are susceptible to predation by these introduced predators (Raine and McFarland 2013; Raine and Banfield 2015a, p. 38). These non-native predators occur throughout the Hawaiian Islands, with the exception of the mongoose, which has not established a breeding or viable population on Kaua'i (KISC 2018).

Another threat to the Newell's shearwater is habitat loss due to invasive vegetation. Invasive plants alter the three-dimensional structure of Hawaiian forests (Asner *et al.* 2008) as well as disrupt other ecological processes. A vegetation shift in areas of Kaua'i away from native understory to invasive vegetation, including but not limited to strawberry guava (*Psidium cattleianum*) and ginger (*Hedychium gardnerianum*) has been associated with at least one abandoned Newell's shearwater colony on Kaua'i (Troy *et al.* 2014). Extreme weather events such as hurricanes 'Iniki (1992) and 'Iwa (1982) have caused significant disruptions in forest habitat and, coupled with colonization of invasive plants, have resulted in permanent habitat loss for forest birds (Pratt 1994). In addition, areas of degraded habitat have facilitated the spread of invasive mammalian predators (Raine *et al.* 2016b, 2016c, 2016d). For example, in a heavily degraded habitat Ainley *et al.* (2001) counted 30 dead Newell's shearwater sub-adults and adults due to predation in one season (Ainley *et al.* 2001, p. 121).

Other threats include climate change and its affects to both seabird adult survivorship and recruitment (Sandvik *et al.* 2012) by generally affecting food availability (Oro 2014). Research by Spear *et al.* (2007) and Ainley *et al.* (2014) also indicate that Newell's shearwaters forage readily with yellowfin tuna and may be vulnerable to fishery interactions.

*Survival and Recovery Needs*

For purposes of this biological opinion, the "survival condition" of the Newell's shearwater in the wild represents the level of reproduction, numbers, and distribution necessary to support a persistent population in the Hawaiian Archipelago that is fully protected by the ESA. For purposes of this biological opinion, the "recovery condition" of the Newell's shearwater is that where the threats to the species have been addressed such that the protections of the ESA are no longer necessary to insure the survival condition of the Newell's shearwater in the wild.

The recovery plan (USFWS 1983) for the Newell's shearwater does not contain recovery criteria; rather general goals are listed that require revision due to a substantial amount of new information. For example, the recovery plan (USFWS 1983, p. 22) calls generically for reducing annual SOS collected, lighting related fallout of Newell's shearwaters to less than 100 birds, and developing efficient predator control methods to protect nesting sites.

In 2017, the Service finalized the *Newell's Shearwater Landscape Strategy* (USFWS 2017a). that focuses on managing and enhancing extant colonies in areas with minimal light impacts,

mitigating threats at the colony, and those encountered while in transit to the colony, and creating new colonies through social attraction and translocation (USFWS 2017a).

This strategy expands on actions completed by KIUC under the STHCP, including a predator-exclusion fencing feasibility study (Young and VanderWerf 2014) and the 2013–2014 Kaua‘i island-wide auditory surveys to locate new shearwater and petrel colonies (Banfield *et al.* 2013; Raine and Banfield 2015b). The strategy describes general tools (i.e., manual predator control, ungulate and predator-exclusion fences) as well as translocation and social attraction activities to protect or augment existing breeding colonies and/or create new breeding colonies. Removing terrestrial predators (e.g. feral cats) that depress shearwater survival and establishing predator-free breeding habitat is required to successfully restore seabird colonies (Buxton *et al.* 2014; Jones and Kress 2012). On Kaua‘i, repeated access into the colony to conduct intensive predator control in open systems can degrade sensitive vegetation, while predator ingress and predation remains constant. In montane habitat, manual predator control should be conducted as an incremental step towards the goal of constructing a predator exclusion fence culminating with predator removal or eradication.

Predator fencing is the most effective tool against mammalian depredation at the colony, particularly for indigenous species that are highly sensitive to predation (Young *et al*. 2013; Norbury *et al*. 2014). Within the current range of Newell’s shearwater, topography, streams, and remoteness limit the number of sites and size of areas that can be protected with predator exclusion fences. Preliminary surveys of eight sites known to have Newell’s shearwater populations identified three as suitable for predator fencing; the other five were eliminated because of topography or streams (Young and VanderWerf 2014). The KESRP continues to survey areas for Newell’s shearwater activity so active sites suitable for predator fencing, in addition to those identified in the Newell’s Shearwater Landscape Strategy, could be identified in the coming years. At a minimum, the two sites recommended by Young and VanderWerf (2014) with identified Newell’s shearwater burrows should be fenced. The third site identified in this study was found to have only Hawaiian petrel burrows. Other sites located independently by KESRP and verified as occupied and suitable for fencing should be fenced. These sites should be protected using manual predator control until the fences are complete. To increase recruitment once fences are complete, social attraction should be a component of the project (see below).

The strategy prioritizes management efforts to occur in colonies already receiving conservation management actions under the existing KIUC STHCP, by relying on the concept of a ‘no light conservation zone’ or NLCZ to define an area which contains very little artificial nighttime lighting or light impingement. The NLCZ is based on the belief that artificial nighttime lighting is the primary factor constraining the distribution of Newell’s shearwater breeding colonies and therefore colonies located in the NLCZ are more viable and should receive conservation actions. The NLCZ encompasses the northwest corner of Kaua‘i and includes coastal areas as well as mountainous steep terrain with a relatively small human population, resulting in minimal artificial nighttime lighting in the area. The NLCZ contains very little nighttime lighting currently, unfortunately there are no county ordinances or other mechanisms to support or require the continued existence of an NLCZ into the future. The strategy also calls for generally minimizing the effects from artificial nighttime lights and power lines.

In addition to this isolated area there is a need to generally address light attraction. Many sources of lights have already been modified to minimize attraction of fledging Newell's shearwaters, but a standard island-wide study is needed at regular intervals to identify new locations of concern for light attraction and those that might be out of compliance. A study is also needed to test the various types of LED bulbs available against the existing low pressure sodium bulbs to assess which is most suitable for seabirds. The results of this study should be used to determine which lighting configuration has the least impact on Newell's shearwaters and inform future recommendations on retrofitting lights, targeting the highest impact lights first. In the interim, problematic lights should be removed, turned off during the fledging season, reduced in intensity, or fitted with shields to direct the light toward the ground to minimize impacts.

The strategy does not comment on any elements (e.g., habitat requirements, genetic representation, and population resiliency) that would contribute to and define the long-term health needs of the Newell's shearwater population.

Population viability modeling efforts conducted by the Service defined Newell's shearwater adult survivorship at 0.92, based on a boxplot assessment and linear regression of adult survivorship data from proxy Procellariformes (USFWS 2017b, p. 122). Because the Newell's reproductive strategy has evolved to have a high adult survivorship, adult mortality is particularly harmful to the population. Left unchecked low adult survivorship (or conversely high adult mortality) will serve to depress the colony population to unsustainable numbers thereby increasing the vulnerability of these populations to invasive predators and other stochastic events (e.g., hurricanes damaging breeding habitat or climate shifts altering food availability).

The survival and recovery needs of the Newell's shearwater are described in the succeeding paragraphs based on components from the recovery plan and landscape strategy documents highlighted above, as well as the best currently available scientific information. The survival condition of the Newell's shearwater is the biological factors necessary for a persistent population. The survival condition of the Newell's shearwater will need to include over a generation time (i.e., 7-8 years), an annual and stable breeding probability of 0.80 and consistently high reproductive success levels of at least 0.85 fledglings per breeding pair, per season. In order to achieve these biological factors, immediate actions need to be taken to protect occupied breeding habitat from invasive predators by constructing predator-exclusion fences and concurrently increasing predator removal efforts around the two extant and accessible breeding colonies on Kaua'i (Upper Limahuli and within Hono o Nā Pali). Once a predator exclusion fence is constructed and predators are eliminated within the fence, management efforts should incorporate social attraction techniques using acoustic and visual/olfactory cues (Buxton and Jones 2012) to lure prospecting non-breeders and sub-adults into the protected breeding habitat. Current telemetry data shows that the Hono o Nā Pali and Upper Limahuli colonies are minimally affected by power line collisions and artificial nighttime lighting based on actual flight paths (n = 9) to and from foraging areas and breeding habitat (Raine *et al*. 2016e, p. 24). The main land-based threats to the Hono o Nā Pali and Upper Limahuli colonies are introduced predators and invasive vegetation.

Maintaining the ecological life-support systems (i.e., habitat requirements) for the two largest Newell's shearwater breeding colonies is critical to the long-term survival. Management of breeding habitat within predator exclusion fences should include invasive vegetation control during the non-breeding season to support a native understory and canopy and biosecurity measures to prevent introductions of invasive flora and fauna. The size of the predator exclusion fences in montane forested habitat will be dictated to some extent by the terrain, however each exclusion fence should contain the extant colony, anticipate and minimize erosion, and be large enough (≥10 ha) to encompass enough breeding habitat to sustain at least 1,500 active breeding pairs and small enough to be adequately maintained in perpetuity. Given these habitat requirements, the minimum "range-restricted" population necessary to retain the species potential for recovery is 3,000 breeding pairs (two colonies with 1,500 pairs each).

Survival of the Newell's shearwater cannot be predicated solely on the existence of two neighboring breeding colonies on a single island. The survival needs of the Newell's shearwater include reducing adult mortality occurring range wide due to the attraction to artificial lights and collisions with power lines. The data gathered from Travers *et al*. (2014) and Travers *et al*. (2015) have vastly improved our knowledge of the scope of the impact of power line collisions and have identified the power line segments, of those surveyed, that have the greatest impact on seabirds. Lines along Power Line Trail in the north central region of the island were responsible for 75 percent of the documented strikes in 2014 (Travers *et al*. 2015). This stretch of lines should be prioritized to be buried, lowered in height, modified such that the top lines are removed, re-directed after appropriate studies to assess minimization effectiveness, or made visible in some manner (e.g., through the use of lasers or bird diverters, both of which are being tested by KESRP). As additional stretches of lines are monitored each year, other high-impact zones will be identified and appropriate avoidance or minimization methods should be implemented. Reducing the impact of power lines is critically important to ensuring the continued existence of Newell's shearwater on Kaua'i.

The SOS program on Kaua'i is designed to reduce mortality of fledglings and adults that have been grounded (i.e., unable to regain flight) due to the attraction to artificial lights or collisions with power lines. The continuation of the SOS program is a clear step to reduce adult mortality.

In summary, the recovery condition of the Newell's shearwater is the necessary survival condition plus specific measures to adequately address the specific threats contributing to the species range-wide endangerment. Specific measures needed to achieve a recovery condition include the elimination or minimization of all three high collision-risk power lines (the Power Line Trail, Kīlauea, and the Central Region segments) on the island of Kaua'i. The recovery condition will need to include the creation or active management of at least two additional healthy shearwater colonies on Kaua'i and two healthy shearwater colonies on Maui. For example, the two additional colonies on Kaua'i could be any of those identified by Young and VanderWerf (2014), or other colonies located independently by KESRP. For the purposes of this biological opinion, a healthy Newell's shearwater breeding colony is defined as containing a: (1) minimum of 1,500 breeding pairs or active burrows, based on long-term monitoring data on the Manx shearwater (Fraser *et al*. 2013; Brooke 1990; BirdLife International 2016b); (2) suitable breeding habitat, including predator-free or low levels of predator presence adequate to sustain in perpetuity a minimum of 1,500 breeding pairs; (3) flyway corridors to and from the colony

where there are none or minimal artificial lighting and power line threats; and (4) a colony-population growth rate, λ equal to or greater than one, sustained over at least a generation. Protecting and augmenting any existing Newell's shearwater colonies on Maui will ensure genetic representation and redundancy, allowing the Newell's shearwater to maintain an adaptability and evolutionary capacity over time.

New management actions that have occurred in the last five years include:

- Completion of the 3-hectare predator exclusion fence in 2015, at the Nihoku conservation unit within Kīlauea Point National Wildlife Refuge. Newell's shearwater nestling translocations began in 2016 and will continue over four years with the goal of establishing a new Newell's shearwater breeding colony within a fully protected predator-free area on Kaua'i;
- Predator control efforts to benefit Newell's shearwaters that began in June 2016 and are expected to continue for 2-4 years, within a discrete area (≤ 1 hectare) in Hono o Nā Pali Natural Area Reserve, funded by the American Bird Conservancy; and
- Construction of two 1.8-hectare predator-exclusion fences (one each for Newell's shearwater and Hawaiian petrels) in West Maui to protect unoccupied Newell's shearwater breeding habitat. Upon completion of the fence in 2013, social attraction techniques including installation of artificial burrows, decoys, and auditory broadcasts calls have been implemented at the site, along with native vegetation restoration efforts. In June 2016, two prospecting Newell's shearwater adults were recorded on remote cameras (Craig 2016, p. 28).

Recommendations for Future Actions:

- Maintain support and oversight of the two 1.8-hectare Makamaka'ole Seabird Predator-Proof Fences in West Maui, constructed by First Wind, Inc. and maintained by Kaheawa Wind Power LLC, specifically to create a new Newell's shearwater breeding colony within a predator-free area on Maui. Efforts at this site should be focused on restoring native montane habitat, since this site was previously used for agricultural purposes;
- Conduct additional acoustic surveys within remote areas of Haleakalā National Park in southeast Maui, to identify the areas of Newell's breeding habitat and the relative colony population size;
- Construct a predator exclusion fence to fully enclose the entirety of Upper Limahuli colony, followed by efforts to eradicate terrestrial predators and control barn owls;
- Construct a predator exclusion fence to protect the Pōhākea colony within Hono o Nā Pali NAR; followed by eradication of terrestrial predators within the fence, efforts to reduce barn owl predation, and social attraction techniques to expand the colony;
- Construct a predator exclusion fence along the ridgeline surrounding the Upper Mānoa Valley colony, followed by eradication of terrestrial predators within the fence, efforts to reduce barn owl predation, and social attraction techniques to expand the colony;
- Construct an ungulate exclusion fence to protect the Honopū seabird colony to manage depredation by pigs and habitat damage from pigs and goats. The area of Honopū where the ungulate fence would be installed is located within the DLNR State Parks in northwestern Kaua'i;

- Construct a predator exclusion fence along the edge of the Kalalau Valley, followed by eradication of terrestrial predators within the fence, efforts to reduce barn owl predation, and social attraction techniques;
- Implement erosion control measures, best management practices (e.g., area closures) and native vegetation restoration to prevent damage to sensitive montane habitat, caused by continual access into seabird colonies; and
- Reduce impacts of high collision rate power line segments at the Power Line Trail, the Waimea Canyon, the Kīlauea area, and line segments within the Central region including Līhuʻe to Kilohana Crater to Power Line Trail.

## ENVIRONMENTAL BASELINE FOR THE NEWELL'S SHEARWATER

This section describes the following for the affected listed species: the relationship of the population in the action area to the range-wide population; current status of the species in the action area and the factors influencing that condition; and the role of the action area in its survival and recovery.

The Newell's shearwater population within the action area is estimated to comprise 90% of the global population of the species (see Status of Species section). While there is strong evidence of fragmented breeding activity on the island of Maui, there are no identified breeding colonies outside of the action area. The number of Newell's shearwater breeding pairs on Kauaʻi has not been systematically determined, however based on a 2006 at-sea population estimate (Joyce 2013) adjusted using current threat levels, the Service estimates the current breeding population within the action area may consist of about 7,500 Newell's shearwater pairs (see Status of Species section).

The threats to the entire population of Newell's shearwater, described in the Status of the Species sections, are also factors which effect the condition of these species' populations in the action area: artificial nighttime lighting, collisions with power lines, predation by introduced predators, and changes to breeding habitat due to introduced invasive plants. Fledgling Newell's shearwaters fly through the action area, importantly, Līhuʻe and Hanapēpē where County-operated football facilities are located, on their first trip to the sea (see below). Power lines are present in the lowland coastal and mountainous areas of the action area. The power lines obstruct seabird flyway corridors to and from montane breeding colonies, presenting a risk of collision to transiting seabirds. Predation by non-native predators such as feral cats, barn owls, and rats has been regularly observed in extant breeding colonies in the action area, even in the most remote locations, including the Nā Pali Coast (Banfield *et al.* 2013).

Artificial light sources collectively are a significant mortality factor associated with Newell's shearwaters (Ainley *et al.* 2001; Troy *et al.* 2011). Nighttime lighting interferes with the shearwater's ability to navigate. Newell's shearwaters become attracted to artificial lighting and will circle light sources until exhausted, fall to the ground or collide with structures. Concentrated artificial nighttime lighting, used commonly in areas of human habitation, is a persistent stressor for all listed species addressed in this BO.

Over a 37-year period the SOS program documented a total of 30,552 individuals of Newell's shearwaters recovered, injured or killed due to artificial nighttime lighting (DOFAW 2018).

Since 1993, radar has been used to monitor the summer movement patterns of Newell's shearwaters and provide an accurate estimate of birds as they transit through the detection area at 13 sites throughout the island (Day and Cooper 1995; Raine *et al.* 2017). Based on visual observations and marked differences in the timing of petrel and shearwater movements, radar data analysis (Day and Cooper 1995; Raine *et al.* 2017) has shown an appreciable reduction in the number of shearwaters transiting to and from montane breeding colonies from 1993 to 2013 (below). Radar surveys were conducted in coastal areas of known seabird flyways in May through mid-July, during the incubation and early chick-rearing stage. Therefore, radar data are a conservative index of breeding activity.

The overall mean for shearwaters across all 13 radar sites surveyed in 1993 was 524 ± 207 targets/h and in 2013 was 34 ± 9 targets/h, representing a mean decrease of 94% between the two periods ($t = 2.37$, $P = 0.03$; Raine *et al.* 2017). All of the 13 sites showed a large decrease in movement rates over the entire period, with movement rates at 12 (84.6%) out of 13 sites showing statistically significant declines (Raine *et al.* 2017). Based on the radar data (Raine *et al.* 2017) as a proxy for the breeding population, the Newell's shearwater population within the action area declined at a mean annual rate of 12.5 percent over the 20-year period. This updated rate of decline of the Newell's shearwater population is comparable to the mean annual rate of -11.2 percent between 1993 and 2001 reported by Day *et al.* (2003, p. 673).

The populations of Newell's shearwaters using the action area are demographically significant, as discussed above. Safe passage of shearwaters across the action area as they transit to and from breeding areas is essential to the survival and recovery of these species.

## EFFECTS OF THE ACTION

Exposure Analysis Approach

The Service has developed an analysis framework for section 7 consultations that incorporates the general structure, primary concepts, and nomenclature of the U.S. Environmental Protection Agency's ecological risk assessment framework (USFWS 2005). Factors causing adverse effects are referred to as "stressors" and factors causing beneficial effects are referred to as "benefits". Under this approach, the Service determines the effects of the action on listed species and critical habitat by evaluating the location, timing, duration, frequency, and intensity of listed species or critical habitat exposure to each stressor and benefit, and the likely effects of such exposure on the reproduction, numbers, and distribution of the listed species and on the recovery support function of critical habitat.

The proposed action's stressors and benefits may include the following actions within the action area:

- County operated lighting at football facilities
- Mitigation

Each stressor and benefit is expected to have direct or indirect effects to the species. Direct effects are effects that are caused by the action affecting species at the time and location of exposure. Indirect effects are effects that are caused by the action but occur later in time or at a different location. The effects of each are explained in relation to the Newell's shearwater, below.

Effects of County Football Facility Lighting on Newell's shearwater

While Newell's shearwaters do not nest at County-operated football facilities, they fly over the property when traversing between breeding colonies in the mountains (i.e., inland areas) and the ocean. Activities that may affect shearwaters at football facilities, located in coastal areas near the ocean, include nighttime operations of the stadium lighting and building lighting.

Under the MOU, a maximum of three Newell's shearwaters (mortality or injury) are anticipated to be taken, directly, by operations over the three games scheduled. The estimate accounts for the maximum number of birds that could be observed to be downed, and those that are not anticipated to correspond with any observed apparent downing. It does not assume any additional take due to potentially unobserved (i.e., undiscovered) downing, because monitoring and confirming the potential of that additional take is not practicable under the provisions of the MOU.

The anticipated take of three Newell's shearwaters due to nighttime use of lighting at three football games, scheduled to account for moon schedule and timing of fledging season, is based on the following analysis of SOS records. In order to identify a maximum take estimate, the Service compiled records on the number of downed Newell's shearwaters recovered by the SOS program on dates over the past five years (2014-2018) that correspond with the proposed 2019 dates the County will operate football facility lighting at nighttime. Because Newell's shearwater fallout across a fledging season are significantly influenced by the moon schedule (Telfer *et al.* 1987) and moon schedule changes year to year, we reviewed fallout over this five year period for the date range corresponding 2019 proposed action. The numbers of Newell's shearwaters recovered by SOS are shown in Table 2 for the following date range; September 20 to October 4. The total numbers recovered over these date ranges were separated by pick up location, including the town of Līhuʻe, town of Hanapēpē, or all other locations to further inform risk assessment. The risk of fallout occurring in Hanapēpē-Port Allen area appears higher than Līhuʻe, consistent with the island-wide fallout over the entire season during the 2014, 2015, and 2016 fallout seasons (KHS 2015, 2016, 2017).

**Table 2.** Number of Newell's shearwaters recovered by the SOS program 2014-2018 over specific dates within fallout season.

| | **September 20 to October 4** |
|---|---|
| **Total over date range** | |
| *Town of Līhu'e* | 3 |
| *Towns of Hanapēpē and Port Allen* | 9 |
| *Other Kaua'i locations* | 12 |
| *All Kaua'i* | 24 |
| **Average per year over date range for Līhu'e and Hanapēpē-Port Allen** | 2.4 |

According to this analysis, we anticipate a low level of Newell's shearwater fallout is likely to occur during operation of nighttime lighting at County football facilities on September 20, September 27, and/or October 4. Because games may be played at either Vidinha Stadium Complex or Hanapēpē and moon schedule is not consistent across years, the average fallout per year over the date range for these locations, a total of one Newell's shearwater, was used to estimate the maximum take of the proposed action for each game. Although the football facilities are not representative of all lighting in the town of Līhu'e or towns of Hanapēpē and Port Allen, the height and intensity of the shielded lighting at the football facilities will likely pose a risk of disorienting any shearwater attracted to lighting in the vicinity of the facilities.

Adults and sub-adults are occasionally attracted to bright lights; approximately five percent (34 out of a total of 745 individuals) of the Newell's shearwaters recovered by the SOS program in 2012-2016 were adults (SOS Program 2013, 2014, 2015, 2016, 2017). Based on this information and the total take of shearwaters that will likely occur (above), adult seabird disorientation due to nighttime lighting from the project is not measurable and therefore insignificant.

Based on the above, we anticipate that up to three fledgling Newell's shearwaters could be taken in the form of injury or death as a result of the proposed action. In the Kaua'i population of Newell's shearwater, the mortality of three fledglings represents 0.09% of the total fledglings produced, 3,065 fledglings [given the reproductive rates as described above and an adult population of 15,485 birds (Status of Species section)].

<u>Effects of Mitigation</u>

Actions funded by the County are anticipated to address one or more of the major threats to the recovery of the affected species, such as: 1) introduced predators (mainly cats), which prey on adults, eggs, and fledglings; or 2) feral ungulates (mainly pigs), which degrade habitat and may trample burrows. Potential management and/or research efforts that may be implemented through the funding provided to a qualified entity by the County includes but is not limited to: habitat management and predator control efforts at known colonies; refining methods to identify new colonies; developing techniques to establish new colonies; improving predator control and habitat management techniques; and improving population monitoring techniques.

It is anticipated that projects implemented through the funding will benefit the Newell's shearwater because the research for or the management conducted will contribute to the knowledge of the species, improve its habitat, or address one of threats to recovery for the species.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur within the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Future state, local, or private actions that are reasonably certain to occur in the action area are listed below.

- KIUC submitted a permit renewal request to the Service for its STHCP and ITP, prior to its expiration in May of 2016, to cover the period until the Service renders a decision on their Long-term HCP, which is currently under development. In the interim, the Service estimates that 1,800 Newell's shearwater mortalities are occurring per year as a direct result of power line strikes under the KIUC STHCP and ITP, using the rounded average of 2014 and 2015 strikes from scenarios IV, VB, and VIA selected in the USFWS Newell's Shearwater Landscape Strategy Appendix 2 (2017b, p. 123). Based on coordination with KIUC in February 2018, the Service anticipates receiving a revised draft Long-term HCP by the end of 2020 that will propose minimization and mitigation measures to address these take impacts.

- State and local governmental entities together with other private entities have applied for a State incidental take license and a Federal incidental take permit in 2019, to address ongoing and future take of Newell's shearwaters within the action area caused by the use of artificial nighttime lighting. The state-sponsored Kaua'i Seabird HCP is anticipated to seek authorization for an approximate annual *lethal* take of up to 30 shearwaters and *non-lethal* take of 45 shearwaters. This state-sponsored HCP is being developed to address a stressor responsible for an aspect of the environmental baseline conditions for Newell's shearwaters within the action area.

## CONCLUSION

The use of stadium lighting used during fledgling season when seabird fallout occurs will likely act as an attractive nuisance to Newell's shearwater and result in downed birds. While the yearly average number of downed Newell's shearwater for those locations on Kaua'i is 2.4, due to the circumstances described in the Effects section, it is anticipated that up to three birds will be drawn in by the lights and succumb to fallout. Observers will be trained and participate in all scheduled night games and searches for downed birds will occur nightly after the games, prior to lights being shut off. Any birds found will be turned into SOS, cared for and rehabilitated. The searches for and treatment of birds will reduce the likelihood of Newell's shearwater being

injured or dying as a result of fallout caused by the lighting. Any downed birds not found will likely be subject to predation resulting in injury or death to the bird. Funds will be provided to offset negative impacts from any injury or loss of birds to benefit Newell's shearwater overall.

The loss of three individuals from activities is not likely to cause a downward trend in population numbers, overall reproduction, or reduced distribution of Newell's shearwater.

After reviewing the current status, the Environmental Baseline, the Effects of the Action, and the Cumulative Effects, it is the Service's Biological Opinion that the proposed nighttime operations of lighting at County football facilities discussed herein is not likely to jeopardize the continued existence of the Newell's shearwater. As stated in the Effects section above, the adverse effects result in anticipated take in the form of injury and death for up to three Newell's shearwater fledglings as a result of the proposed action. The beneficial effects of the seabird mitigation will offset the loss of these fledglings. Overall, taken all these effects together, there will not be a significant change in the reproduction, numbers, or distribution of the Newell's shearwater that will reduce appreciably the likelihood of both the survival and recovery of these species in the wild.

## INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations promulgated pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing behavior patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the County as signatory to the subject MOU so that they become binding conditions for the exemption in section 7(o)(2) to apply. If the County (1) fails to assume and implement the terms and conditions or (2) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the County must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement and reporting requirements below [50 CFR §402.14(i)(3)].

**AMOUNT OR EXTENT OF TAKE**

Based on our analysis presented in this Biological Opinion, the Service anticipates the following take may occur:

- Up to three (3) Newell's shearwater fledglings over the duration of the project.

**Effect of the Take**
In this Biological Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of the Newell's shearwater based on the information provided in this document.

**Reasonable and Prudent Measures**
The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the effect of take on the Newell's shearwater.

1. The County shall minimize the potential for death or injury of the Newell's shearwater due to operation of lighting at nighttime at County football facilities.

**Terms and Conditions**
In order to be exempt from the prohibitions of section 9 of the Act, the County must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary.

In order to implement the reasonable and prudent measure #1 above, the following terms and conditions apply:

1. The County shall investigate and consider ways to turn off non-essential perimeter and exterior building lights (i.e., low intensity lighting) at football facilities over the life of the project.
2. The County shall monitor and report on the levels of take that occur over the life of the project:
    a. Documentation of number, species, timing, height and flight patterns of observed seabirds;
    b. The number of apparently downed seabirds that were searched for and in fact found to be downed;
    c. The number of apparently downed seabirds that were searched for and not found;
    d. The number of apparently downed seabirds that were not searched for with an explanation of why a search was not conducted;
    e. The number of seabirds found downed that did not correspond to an observed apparent downing; and
    f. Information on the condition of any recovered downed seabirds. Such monitoring will further include, immediately upon conclusion of any game and before the lights are turned off, a search of the facility grounds for any downed seabirds.

g. The County will maintain records of the location, times, dates, and personnel (including volunteers utilized) involved, as well as the location, condition, identification, in situ photographs, and fate of each recovered bird.
h. Any seabird encountered during such monitoring will be reported by the County via telephone or email to the Service, Pacific Islands Fish and Wildlife Office (PIFWO) and the Service, Office of Law Enforcement (OLE) within 48 hours.
i. Unless otherwise directed by the OLE, all retrieved seabirds will be transferred to the Save Our Shearwaters program in conformance with recommendations of that program, along with all associated location and photographic data for each bird.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs all Federal agencies to use their authority to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term "conservation recommendations" has been defined as suggestions from the Service regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's 7(a)(1) responsibility for the species.

The process of developing the MOU between the County and the Service incorporated this approach into the process. The Service intends to continue to provide technical assistance to the County on steps to minimize the impacts of its activities on endangered and threatened seabirds.

The Service recommends that the County undertake the following conservation measure:

- Participate in the KSHCP, currently in the public review process by DOFAW, including all of the County's facilities in its application for a federal incidental take permit (ITP) and state incidental take license (ITL), associated with the KSHCP, to address take of the band-rumped storm-petrel, Hawaiian petrel, and Newell's shearwater.

## REINITIATION-CLOSING STATEMENT

This concludes formal consultation on the action(s) outlined in this biological opinion. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) if the amount or extent of taking specified in the incidental take statement is exceeded; (2) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action.

**LITERATURE CITED**

Ainley, D.G., T.C. Telfer, and M.H. Reynolds. 1997. Townsend's and Newell's shearwater *Puffinus auricularis*. *In* The Birds of North America, No. 297. (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Ainley, D. G., R. Podolsky, L. DeForest, G. Spencer, and N. Nur. 2001. The status and population trends of the Newell's shearwater on Kaua'i: insights from modeling. *Studies in Avian Biology* 22: 108-123.

Ainley, D.G., Walker, W.A., Spencer, G.C., and N.D. Holmes. 2014. The prey of Newell's shearwater *Puffinus newelli* in Hawaiian waters. Marine Ornithology 44: 69-72.

Ainley, D.G., E. Porzig, D. Zajanc, and L.B. Spear. 2015. Seabird flight behavior and height in response to altered wind strength and direction. *Marine Ornithology* 43: 25–36.

Asner, G.P., R.F. Hughs, P.M. Vitousek, D.E. Knapp, T. Kennedy-Bowdoin, J. Boardman, R.E. Martin, M. Eastwood, and R.O. Green. 2008. Invasive plants transform the three-dimensional structure of rain forests. Proceedings of the National Academy of Sciences 105:4519–4523.

Banfield, N.K., A.F. Raine, and B. McFarland. 2013. Auditory Surveys for Endangered Seabirds on Kaua'i. Annual Report 2012. Kaua'i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai'i, and Division of Forestry and Wildlife, State of Hawai'i, Department of Land and Natural Resources, Hawai'i, USA.

Berger, A. 1972. Hawaiian birdlife. University of Hawai'i Press, Honolulu, Hawai'i.

BirdLife International. 2016a. Species factsheet: *Pterodroma sandwichensis*. Downloaded from http://www.birdlife.org on 19/08/2016, accessed 1 AUG 2016.

BirdLife International 2016b. Species factsheet: *Puffinus puffinus*. Downloaded from http://www.birdlife.org on 19/08/2016, accessed 1 AUG 2016.

Bried, J., D. Pontier, and P. Jouventin. 2003. Mate fidelity in monogamous birds: a re-examination of the Procellariiformes. *Animal Behaviour* 65: 235–246.

Brooke, M. 1990. *The Manx Shearwater*. London: A & C Black Publishers Ltd. 264 pp.

Buxton, R. T., and I. L. Jones. 2012. An Experimental Study of Social Attraction in Two Species of Storm Petrel by Acoustic and Olfactory Cues. *The Condor* 114: 733-743.

Buxton, R.T, C. Jones, H. Moller, and D.R. Towns. 2014. Drivers of Seabird Population Recovery on New Zealand Islands after Predator Eradication. *Conservation Biology* 28: 333–344.

Cooper, B. A., and R. H. Day. 1998. Summer Behavior and Mortality of Dark-Rumped Petrels and Newell's Shearwaters at Power Lines on Kaua'i. *Colonial Waterbirds* 21(1): 11–19.

Cooper, B.A., M.G. Raphael, and D.E. Mack. 2001. Radar-Based Monitoring of Marbled Murrelets. *The Condor* 103(2): 219–229.

County of Kaua'i. 2016a. Hanapēpē Stadium fact sheet. Attachment B. County of Kaua'i Pre-application draft Participant Inclusion Plan for the Kaua'i Seabird Habitat Conservation Plan.

County of Kaua'i 2016b. Vidinha Stadium complex fact sheet. Attachment B. County of Kaua'i Pre-application draft Participant Inclusion Plan for the Kaua'i Seabird Habitat Conservation Plan.

Craig, M. 2016. Kaheawa Wind Power I Habitat Conservation Plan, Annual Report: FY 2016. Kaheawa Wind Power I, LLC. Wailuku, Hawai'i. 50 pp.

Day, R.H. and B.A. Cooper. 1995. Patterns of movement of dark-rumped petrels and Newell's shearwaters on Kaua'i. *Condor* 97:1011-1027.

Day, R.H., B.A. Cooper, and R.J. Blaha. 2003. Movement patterns of Hawaiian petrels and Newell's shearwaters on the island of Hawai'i. *Pacific Science* 57: 147-159.

Fraser, G. S., J. Russell, G. J. Robertson, R. Bryant, and D. A. Fifield. 2013. Prospects for the Manx Shearwater Colony on Middle Lawn Island, Newfoundland, Canada. *Marine Ornithology* 41: 137–140.

Gill, F. and D. Donsker (eds.). 2016. "Loons, penguins, petrels" at World Bird List Version 6.3. International Ornithologists' Union. http://www.worldbirdnames.org/bow/loons/, accessed 1 AUG 2016.

Griesemer, A.M. and N.D. Holmes. 2011. Newell's shearwater population modeling for Habitat Conservation Plan and Recovery Planning. Technical Report No. 176. The Hawai'i-Pacific Islands Cooperative Ecosystem Studies Unit & Pacific Cooperative Studies Unit, University of Hawai'i, Honolulu, Hawai'i. 68 pp.

[DOFAW] Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife. 2018. Kaua'i Save Our Shearwater data 1979-2017. Summarized by Service Pacific Islands Fish and Wildlife Office, Honolulu, HI.

Jones, H. P. and S. W. Kress. 2012. A Review of the World's Active Seabird Restoration Projects. *The Journal of Wildlife Management* 76: 2–9.

Joyce, T. W. 2013. Abundance estimates of the Hawaiian petrel (*Pterodroma sanwichensis*) and Newell's shearwater (*Puffinus newelli*) based on data collected at sea, 1998 – 2011. Scripps Institution of Oceanography, La Jolla, California.

[KESRP] Kaua‘i Endangered Seabird Recovery Project. 2017. Newell’s shearwater factsheet. Retrieved from http://kauaiseabirdproject.org/index.php/the-birds/nesh-fact-sheet/, accessed 1 August 2016.

[KESRP] Kaua‘i Endangered Seabird Recovery Project. 2019. KESRP Risk Predictor - Night Football Games 2019. Unpublished data.

[KHS] Kaua‘i Humane Society. 2013. Save Our Shearwaters Program 2012, Annual Report. Līhu‘e, Hawai‘i.

[KHS] Kaua‘i Humane Society. 2014. Save Our Shearwaters Program 2013, Annual Report. Līhu‘e, Hawai‘i.

[KHS] Kaua‘i Humane Society. 2015. Save Our Shearwaters Program 2014, Annual Report. Līhu‘e, Hawai‘i.

[KHS] Kaua‘i Humane Society. 2016. Save Our Shearwaters Program 2015, Annual Report. Līhu‘e, Hawai‘i.

[KHS] Kaua‘i Humane Society. 2017. Save Our Shearwaters Program 2016, Annual Report. Līhu‘e, Hawai‘i.

[KHS] Kaua‘i Humane Society. 2018. Save Our Shearwaters Program 2017, Annual Report. Līhu‘e, Hawai‘i.

[KISC] Kaua‘i Invasive Species Committee. 2018. Kaua‘i Mongoose Population Status Assessment Report. 7 pp.

King, W. B., and P. J. Gould. 1967. The status of Newell’s race of the manx shearwater. *The Living Bird* 6: 163-186

Martíinez-Gómez, J. E., N. Matías-Ferrer, R. N. M. Sehgal, and P. Escalante. 2015. Phylogenetic placement of the critically endangered Townsend’s Shearwater (*Puffinus auricularis auricularis*): evidence for its conspecific status with Newell’s Shearwater (*Puffinus a. newelli*) and a mismatch between genetic and phenotypic differentiation. *Journal of Ornithology* 156: 1025–1034.

McKown, M., and D. Savage. 2015. Exploratory Acoustic Surveys for Hawaiian Petrel, Newell’s Shearwater, and Barn Owl in East Maui, Hawai‘i. Conservation Metrics Inc. *prepared for* Maui Nui Seabird Recovery Project. 25 pp.

[NPS] National Park Service. 2012. Information for Programmatic Section 7 Consultation, Haleakalā National Park. Makawao, Maui, Hawai‘i. 171 pp.

Norbury, G., A. Hutcheon, J. Reardon, and A. Daigneault. 2014. Pest fencing or pest trapping: A bio-economic analysis of cost-effectiveness. *Austral Ecology* 39: 795-807.

Oro, D. 2014. Seabirds and climate: knowledge, pitfalls, and opportunities. *Frontiers in Ecology and Evolution* 2(79): 1–12.

Podolsky, R., D. G. Ainley, G. Spencer, L. Deforest, and N. Nur. 1998. Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kaua‘i. *Colonial Waterbirds* 21(1): 20–34.

Pratt, H. D. 1994. Avifaunal change in the Hawaiian Islands, 1983-1993. Studies in Avian Biology No. 15: 103–118. Cooper Ornithological Society, Camarillo, California.

Pyle, R. L. and P. Pyle. 2009. The birds of the Hawaiian Islands: occurrence, history, distribution, and status. B. P. Bishop Museum, Honolulu, Hawai‘i.

Raine, A. F., and B. McFarland. 2013. Monitoring of Endangered Seabirds in Hono o Nā Pali Natural Area Reserve, Annual Report 2012. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Raine, A. and N. Banfield. 2015a. Monitoring of Endangered Seabirds in Upper Limahuli Preserve Annual Report 2014. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Raine, A. F., and N. Banfield. 2015b. Auditory Surveys for Endangered Seabirds on Kaua‘i, Annual Report 2014. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Raine, A. F., and N. Banfield. 2015c. Monitoring of Endangered Seabirds in Hono o Nā Pali Natural Area Reserve II : Pōhākea, Annual Report 2014. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Raine, A., Vynne, M., McFarlin, M., and M. Massie. 2016a. Monitoring of Endangered Seabirds in Upper Limahuli Preserve Annual Report 2015. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Raine, A. F., M. Vynne, M. McFarlin, and M. Massie. 2016b. Monitoring of Endangered Seabirds in Hono o Nā Pali Natural Area Reserve (Part I): Pihea, Annual Report 2015.

Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Raine, A. F., M. Vynne, M. McFarlin, and M. Massie. 2016c. Monitoring of Endangered Seabirds in Hono o Nā Pali Natural Area Reserve (Part II): Pōhākea, Annual Report 2015. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Raine, A. F., M. Vynne, M. McFarlin, and M. Massie. 2016d. Monitoring of Endangered Seabirds in Hono o Nā Pali Natural Area Reserve (Part III): North Bog, Annual Report 2015. Kaua‘i Endangered Seabird Recovery Project. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA

Raine A.F., J. Adams, M. Boone, M. Vynne, M. McFarlin, and M. Travers 2016e. Study of daily movement patterns of NESH and HAPE in relation to power line collisions (Draft Report). Kaua‘i Endangered Seabird Recovery Project, Hanapēpē, Hawai‘i. 33 pp.

Raine, A.F., N.D. Holmes, M. Travers, B.A. Cooper, and R.H. Day. 2017. Declining population trends of Hawaiian petrel and Newell’s shearwater on the island of Kaua‘i, Hawai‘i, USA. *Condor* 119: 405-415.

Reed, J.R., J.L. Sincock, and J.P. Hailman. 1985. Light attraction in endangered procellariiform birds: Reduction by shielding upward radiation. *The Auk* 102: 377-383.

Reynolds, M. H., and G. L. Ritchotte. 1997. Evidence of Newell’s Shearwater Breeding in Puna District, Hawai‘i. Journal of Field Ornithology 68(1): 26–32.

Sandvik, H., K. E. Erikstad, and B. Saether. 2012. Climate affects seabird population dynamics both via reproduction and adult survival. *Marine Ecology Progress Series* 454: 273–284.

Sincock, J. L., and G. E. Swedberg. 1969. Rediscovery of the nesting grounds of the Newell’s manx shearwater (*Puffinus puffinus newelli*) with initial observations. *Condor* 7: 69–71.

Spear, L.B., D.G. Ainley, N. Nur, and S. N. G. Howell. 1995. Population size and factors affecting at-sea distributions of four endangered Procellariids in the tropical Pacific. *Condor* 97: 613-638.

Telfer, T. C., J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian Seabirds to Lights: Conservation Efforts and Effects of Moon Phase. *Wildlife Society Bulletin* 15: 406–413.

Travers, M., Theis, S., and A.F. Raine. 2013. Underline Monitoring Project Annual Report 2012. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Travers, M., Shipley, A., Dusch, M., and A.F. Raine. 2014. Underline Monitoring Project Annual Report – 2013 Field Season. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Travers, M., Shipley, A., Harris, M., Golden, D., Galase, N., and A.F. Raine. 2015. Underline Monitoring Project Annual Report – 2014 Field Season. Kaua‘i Endangered Seabird Recovery Project. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Travers, M., D. Golden, A. Stemen, and A. F. Raine. 2016. Underline Monitoring Project Annual Report – 2015 Field Season. Kaua‘i Endangered Seabird Recovery Project. 48 pp. Pacific Cooperative Studies Unit, University of Hawai‘i, and Division of Forestry and Wildlife, State of Hawai‘i, Department of Land and Natural Resources, Hawai‘i, USA.

Troy, J. R., N. D. Holmes, and M. C. Green. 2011. Modeling artificial light viewed by fledgling seabirds. *Ecosphere* 2(10):109.

Troy, J. R., N. D. Holmes, J. A.Veech, A. F. Raine, and M. C. Green. 2014. Habitat suitability modeling for the Newell’s shearwater on Kaua‘i. *Journal of Fish and Wildlife Management* 5(2):315–329.

[USFWS] U.S. Fish and Wildlife Service. 1983. Hawaiian Dark-rumped Petrel and Newell's Manx Shearwater Recovery Plan. Portland, Oregon. 57 pp.

[USFWS] U.S. Fish and Wildlife Service. 2005. Study guide for the analytical framework, Section 6: in Advanced Interagency Consultation for Endangered Species, unpublished course notebook, National Conservation Training Center, Shepherdstown, West Virginia.

[USFWS] U.S. Fish and Wildlife Service. 2017a. Newell’s Shearwater Landscape Strategy. Portland, Oregon. 25 pp.

[USFWS] U.S. Fish and Wildlife Service. 2017b. Appendix II. Modelling Methods and Results used to Inform the Newell’s Shearwater Landscape Strategy. Portland, Oregon.

Warham, J. 1977. Wing loadings, wing shapes, and flight capabilities of Procellariiformes. *New Zealand Journal of Zoology* 4: 73–83.

Warham, J. 1996. The Behaviour, Population Biology and Physiology of the Petrels. San Diego: Academic Press Inc.

Young, L. and E. VanderWerf. 2014. Feasibility assessment of predator exclusion fencing to protect Newell's shearwater and Hawaiian petrel nesting locations on Kaua'i. Pacific Rim Conservation. Honolulu, Hawai'i. 38 pp.

Young, L.C., E.A. VanderWerf, M. McKown, P. Roberts, J. Schlueter, A. Vorsino, and D. Sischo. 2019. Evidence of Newell's Shearwaters and Hawaiian Petrels on O'ahu, Hawai'i. The Condor: Ornithological Applications 121: 1-7.

Young, L.C, E.A. VanderWerf, M.T. Lohr, C.J. Miller, A.J. Titmus, D. Peters, and L. Wilson. 2013. Multi-species predator eradication within a predator-proof fence at Ka'ena Point, Hawai'i. *Biological Invasions* 15: 2627–2638.