

5-YEAR STATUS REVIEW

Short Form Summary

Species Reviewed: ‘A‘o (Newell’s shearwater, *Puffinus newelli*)

Current Classification: Threatened

FR Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews for 77 Species in Oregon, Washington, Idaho, and Hawai‘i. Federal Register 86(120): 33726–33728, June 25, 2021.

Lead Region/Field Office:

Pacific Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer(s):

PIFWO

- Leila Nagatani, Fish and Wildlife Biologist, O‘ahu, Kaua‘i, Northwestern Hawaiian Islands, and American Samoa Island Geographic Team
- John Vetter, Animal Recovery Coordinator

Ecological Services, Pacific Regional Office

- Grant Canterbury, Fish and Wildlife Biologist
- David Leonard, Fish and Wildlife Biologist
- Carolyn Menke, Recovery Division Manager

Methodology used to complete this 5-year status review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) beginning in January 2023. It was based on a review of best available information since the last 5-year review for Newell’s shearwater (USFWS 2017). The evaluation by Leila Nagatani, Fish and Wildlife Biologist, was reviewed by the Animal Recovery Coordinator before submission to the Field Supervisor and Assistant Regional Director for approval.

Background:

For information regarding the species’ listing history and other facts, please refer to its species information page in our Environmental Conservation On-Line System (ECOS) database for threatened and endangered species (<https://ecos.fws.gov/ecp/species/2048>). The ‘a‘o (Newell’s shearwater) was originally listed as the Newell’s Townsend’s shearwater, *Puffinus auricularis newelli*, but in 2023 was changed to full species status following the current consensus of taxonomic authorities, based on its isolation and morphological and behavioral distinctiveness (USFWS 2023).

Review analysis:

The two previous 5-year status reviews ([USFWS 2011](#); [USFWS 2017](#)) have recommended uplisting of the species to Endangered status¹. A recommendation for uplisting also occurred in 2019 when the recovery criteria in the original 1983 recovery plan were amended (USFWS 2019). Now, in 2024, we still recommend a change in the status of ‘a‘o from Threatened to Endangered. Recent information and analyses indicate the species’ status continues to be worse than was previously understood when the species was listed as Threatened in 1975. The IUCN Red List of Threatened Species assessed it as Critically Endangered in 2019 (Birdlife International 2019).

The historical breeding distribution of ‘a‘o included the islands of Hawai‘i, Maui, Moloka‘i, O‘ahu, and Kaua‘i (USFWS 1983; Pyle and Pyle 2009). Now, that breeding range is constricted; an estimated 90 percent or more of the population breeds on Kaua‘i (Pyle and Pyle 2017, Ainley et al. 2020). Population indices began to decline steeply following Hurricane Iniki in 1992 (Ainley et al. 2017). On Kaua‘i radar surveys indicate a decline of 93 percent in ‘a‘o abundance between 1993 and 2020 (Raine et al. 2017; Raine and Rossiter 2020), with mean detections declining from 524 to 36 targets per hour over this period. ‘A‘o breeding has been confirmed on Hawai‘i and Maui in recent years, but there are currently no known breeding sites on O‘ahu or Moloka‘i.

New status information:

Survey data available include at-sea surveys, radar surveys, burrow monitoring, and auditory surveys, as well as data on recovery of fledglings after fallout (Table 1). At-sea surveys (Spear et al. 1995; Joyce 2013) provide a full population estimate; such at-sea estimates have been shown to strongly correlate with colony counts for other seabird species (Piatt and Ford 1993). Since the last 5-year status review in 2017, no new at-sea surveys have been conducted so there are no new population estimates. However, radar surveys have been regularly implemented on Kaua‘i from 1993 to the present. These data suggest the ‘a‘o population trend on Kaua‘i declined steeply in the 1990s and 2000s, and since about 2010 has continued at a population index that is lower than 10 percent of pre-decline levels. (Raine et al. 2017; Raine and Rossiter 2020; Sahin 2023). While ‘a‘o currently occur on the islands of Hawai‘i, Maui, Moloka‘i, O‘ahu, and Kaua‘i, to date breeding has been confirmed only on the islands of Hawai‘i, Maui, and Kaua‘i. New information regarding the species and its status is summarized below by island.

¹ Please refer to the 5-year status review for ‘a‘o, published on November 01, 2011, for a complete 5-factor analysis and a discussion on the species’ status (including biology and habitat), threats, and management efforts.

Table 1. Newell’s shearwater survey types.

Survey Type	Description
At-sea surveys	Utilizes strip transect methods over a grid of latitude-longitude blocks to provide repeatable estimates of seabird densities, distribution, and overall population. Surveys conducted from 1980-1994 (Spear et al. 1995) and 1998-2011(Joyce 2013)
Radar surveys	Nocturnal detection of birds transiting between upland breeding sites and ocean. Provides a repeatable long-term population index and trends for breeding birds (Gauthreaux and Belser 2003). Conducted on Kauai from 1993 to present, at 15 sites around most of the island’s perimeter (Raine et al. 2017a; Raine and Rossiter 2020; Sahin 2023); and in 2001 on Maui (Cooper and Day 2003). Indicates steep decline in population index during 1990s and 2000s.
Burrow monitoring	Site-specific monitoring of nests in actively managed breeding colonies. Provides information on local reproductive success within fenced areas. Conducted at 8 managed colonies on Kauai, as well as the Makamaka‘ole Seabird Mitigation Site on Maui.
Auditory surveys	Automated acoustic recording devices detect seabird vocalizations. Indicates species presence at a site and provides a rough index of use intensity but does not confirm breeding activity. Site-specific monitoring at locations on Kauai, Maui, Hawaii, Oahu, and Molokai.
Fledgling fallout recoveries	Data from Save Our Shearwaters on annual number of fledglings recovered after fallout from light attraction. Data collected from 1979 to present. Substantial long-term decline in number of fledgling recoveries generally reflects an overall population decline consistent with radar data, although lighting mitigation efforts in recent years may also have reduced vulnerability to light attraction.

HAWAII

On the island of Hawai‘i, automated acoustic recording devices (acoustic sensors) have detected ‘a‘o in two locations: one above Waimanu Valley (annually since 2016) and another in Honokane Nui Valley (in 2021) (Castello Branco et al. 2022; Wang 2023, in litt.). Low detection rates occur at both locations, suggesting that individuals are prospecting in the area or transiting between the ocean and an upland breeding area (Castello Branco et al. 2022). Within Hawai‘i Volcanoes National Park, ‘a‘o are known to nest in the rainforest within the East Rift Zone (Loh 2021, in litt.). In addition, there are incidental reports of ‘a‘o calling near the Kalapana Trail trailhead (Loh 2021, in litt.).

MAUI

On Maui, ‘a‘o occur at three locations, one of which is a known breeding colony. The first is within the West Maui mountains, where low calling rates of ‘a‘o have been detected at two sites (Roberts and McKown 2016). The second is Kīpahulu Valley within Haleakalā National Park, where staff continue to report vocalizations within the valley (Gates 2021, in litt.). The third is the Makamaka‘ole Seabird Mitigation Site in the western portion of Maui, containing two predator-proof fences each with 50 artificial burrows. In 2021, out of 11 burrows with reproductive activity, 16 eggs were laid (5 nests had 2 eggs each), and 1 chick hatched and fledged (Maui Nui Seabird Recovery Project 2022).

Little information about population trends on Maui exists. Recovery of downed fledglings in coastal areas of Maui ranged from 1 to 3 per year in the 1990s, declining to 0 to 1 per year from 2002 to 2016 (Ainley et al. 2020).

MOLOKA‘I

One ‘a‘o has been detected on Moloka‘i with acoustic sensors (Young and VanderWerf 2016), but no breeding has been confirmed. Since the last 5-year status review in 2017, no surveys for ‘a‘o have been conducted on Moloka‘i.

O‘AHU

Since the last 5-year status review in 2017, Pacific Rim Conservation has continued surveys in the northern Ko‘olau Mountains and near the summit of Mount Ka‘ala on O‘ahu (Young et al. 2019; Pacific Rim Conservation 2023). Three survey methods are used: acoustic sensors from 2016 to present; auditory seabird surveys (2018 to present); and ground searches (2022) (Pacific Rim Conservation 2023). Since 2016 there have been 265 auditory detections of ‘a‘o but no burrows have been located yet (Pacific Rim Conservation 2023). In 2021, an adult ‘a‘o was found in Wai‘anae, downslope from known auditory detections (Guerra 2022, in litt.). Although surveys have not confirmed breeding on O‘ahu, data available indicate that they may be prospecting and/or breeding.

KAUA‘I

A great deal of new information on Kaua‘i populations has become available since the previous 5-year status review. The great majority of the world’s ‘a‘o population breeds on Kaua‘i (roughly estimated at 97 percent by Pyle and Pyle [2017]), and most

information on the species comes from studies here. The following section highlights information on ornithological radar surveys, burrow monitoring, population estimates for managed colonies, reproductive success rate, ‘a‘o breeding phenology, nest site characteristics, and movement patterns. On Kaua‘i, ‘a‘o formerly bred in montane areas throughout the island but are now distributed predominantly in the northwestern portion of the island in remote and mostly inaccessible areas, with small pockets remaining at scattered locations around the rest of the island. No detailed islandwide map of colony distribution is available, but spatial modeling of ‘a‘o habitat (USFWS 2016) is indicative of this pattern, with extensive light impingement impacts throughout eastern and central Kaua‘i (Figure 1).

Radar Surveys

Ornithological radar surveys have been conducted since 1993 at 13 radar sites across Kaua‘i, and since 2006 at 15 sites, to monitor seabird breeding season movement patterns and distribution (Figure 2). These sites are established in vehicle-accessible coastal areas around much of the island’s perimeter, from Wainiha Valley clockwise around the island to Kekaha, excluding only the roadless Na Pali area on the northwest coast (Raine and Rossiter 2020; Sahin 2023). The surveys thus provide long-term population index trends for ‘a‘o transiting these coastal areas to montane breeding colonies across a large portion of Kaua‘i (Figure 3). The overall numbers of ‘a‘o detected in these surveys declined by 93 percent from 1993 through 2020 at 13 sites (Raine and Rossiter 2020). The overall mean number of ‘a‘o detected across these sites in 1993 was 523.7 targets/hour (hr) and in 2020 was 36.4 targets/hr. All 13 sites showed large declines in movement rates, with an average decline of 81 percent. Using radar data as a proxy for the breeding population of ‘a‘o on Kaua‘i, it declined at a mean annual rate of 7 percent between 1993 and 2020 (Raine and Rossiter 2020). Much of this decline occurred in the earlier portion of this period, and the population currently persists at a very low level, with no significant decrease or increase in the last decade (Raine and Rossiter 2020; Sahin 2023).

Auditory Surveys

In addition, auditory surveys have been conducted in the following areas of northern Kaua‘i that are outside of the managed colonies: Nā Pali Coast; Waimea Canyon; on La‘au Ridge, and in Lumaha‘i, and Hanalei Valleys (Figure 2). These surveys indicate presence of ‘a‘o and may suggest potential breeding sites, but are only rough indicators of abundance. From 2014 through 2022, excluding 2017, 6 to 14 acoustic sensors were placed along the Nā Pali Coast and each detected ‘a‘o (Raine et al. 2018; American Bird Conservancy et al. 2023). For 14 sites monitored along the Nā Pali Coast in 2018, call rates ranged from 1.79 to 22.18 calls per minute (Raine et al. 2018). In 2019, a small stretch of powerlines owned by the State of Hawai‘i along the edge of Waimea Canyon was surveyed. These surveys detected low call rates for ‘a‘o, but the nightly calls recorded suggest there may be a few pairs breeding in the cliffs within the vicinity of the powerline (Raine et al. 2020d). In 2020, auditory surveys were conducted on La‘au Ridge, in Hanalei Valley, and in Lumaha‘i Valley, all located in the northern portion of the island. Within the steep portions of the surveyed areas there were high call rates on La‘au Ridge and in Hanalei Valley, and low to moderate call rates within Lumaha‘i Valley (Raine et al. 2020c).

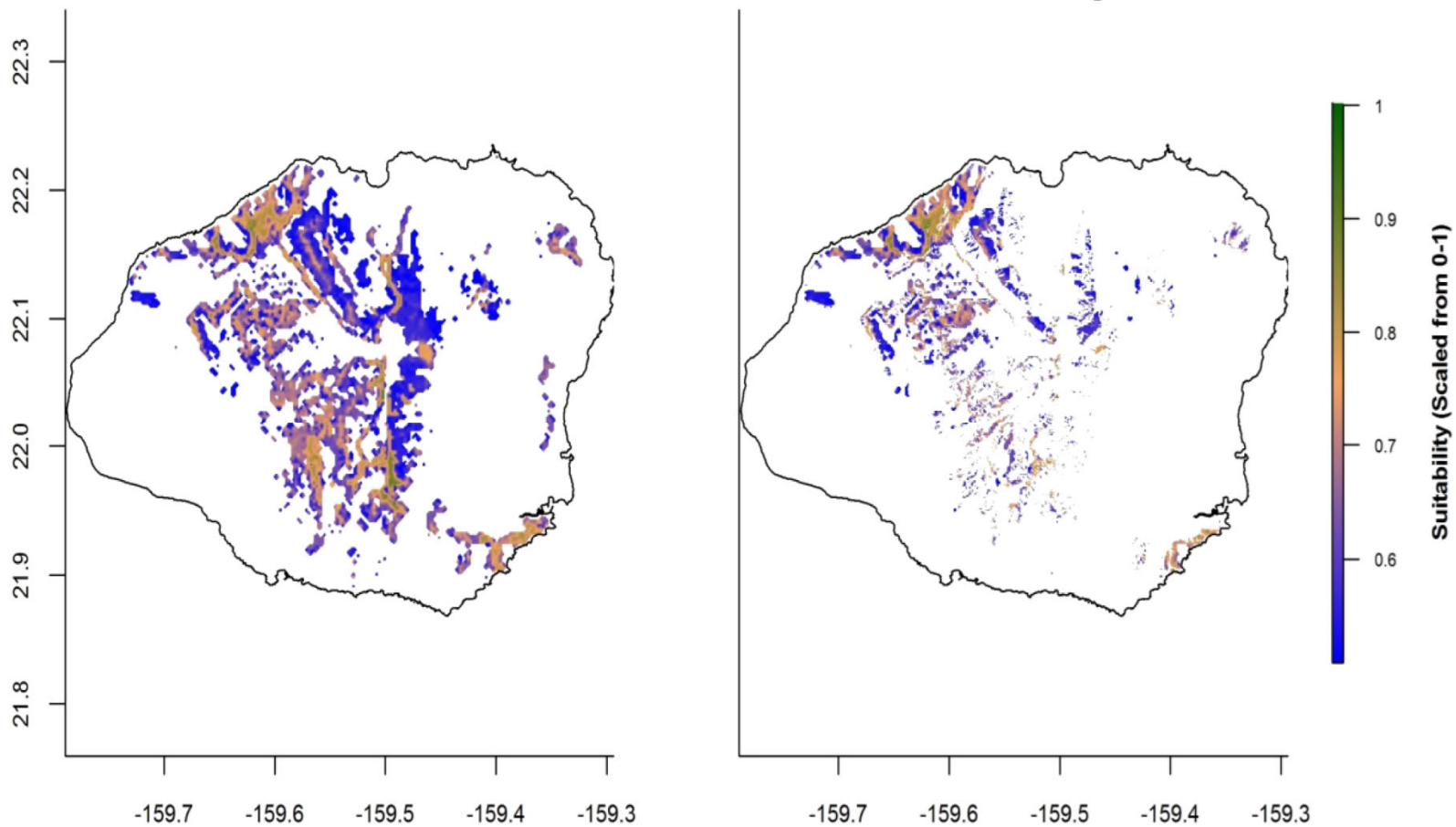


Figure 1. Modeled ‘a’o habitat on Kauai, showing spatial distribution of suitable habitat from ensemble niche models using topographic and climatic variables (left), and remaining habitat after excluding areas of artificial light impingement (right). Highest suitability areas, in green, are localized on the northwest coast. Reproduced from USFWS (2016).

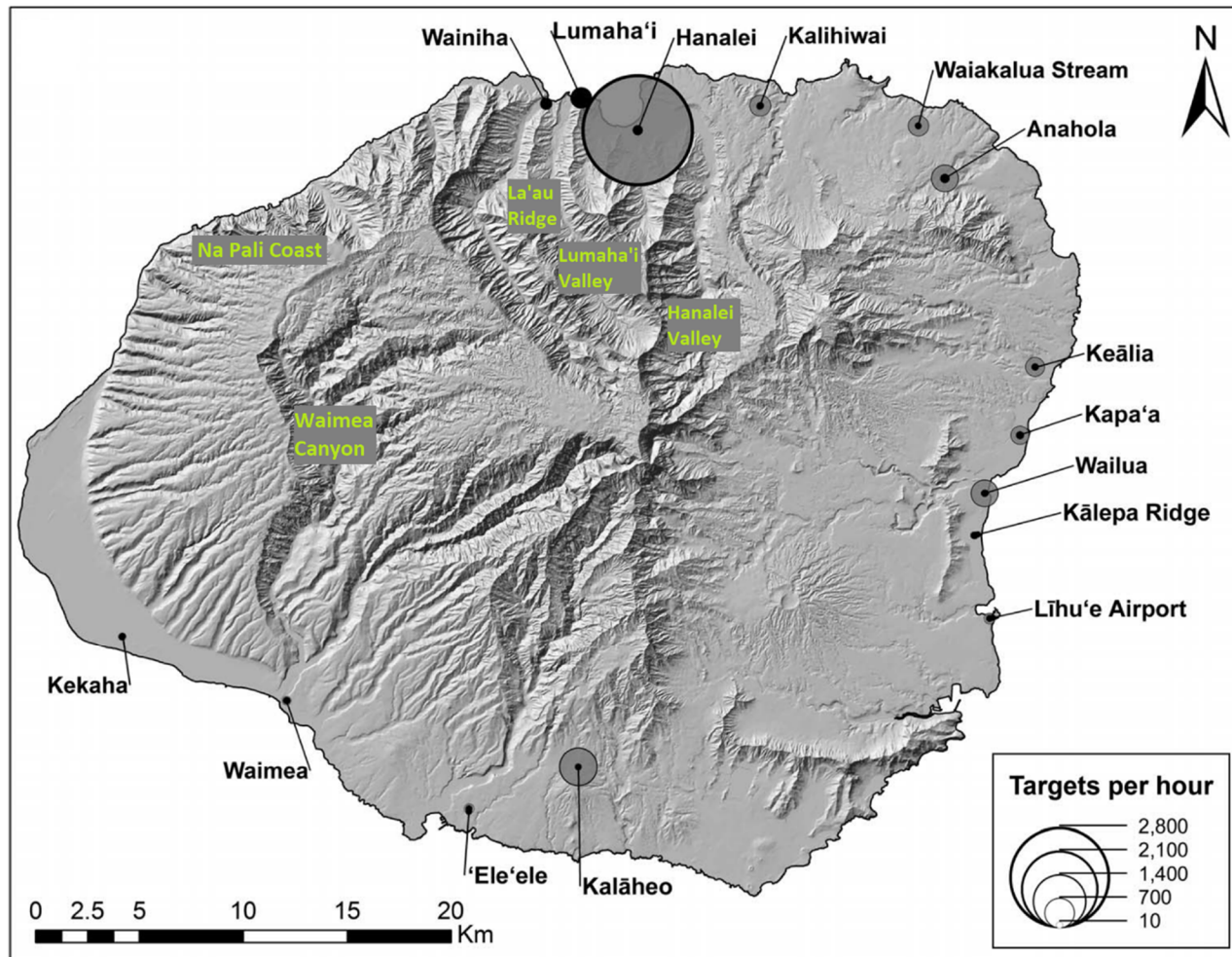


Figure 2. Map of radar survey sites and general locations of auditory surveys (green) on Kauai. Gray and black circles indicate 'a'o target detections per hour in 1993 and 2013 respectively. Modified from Raine et al. (2017a).

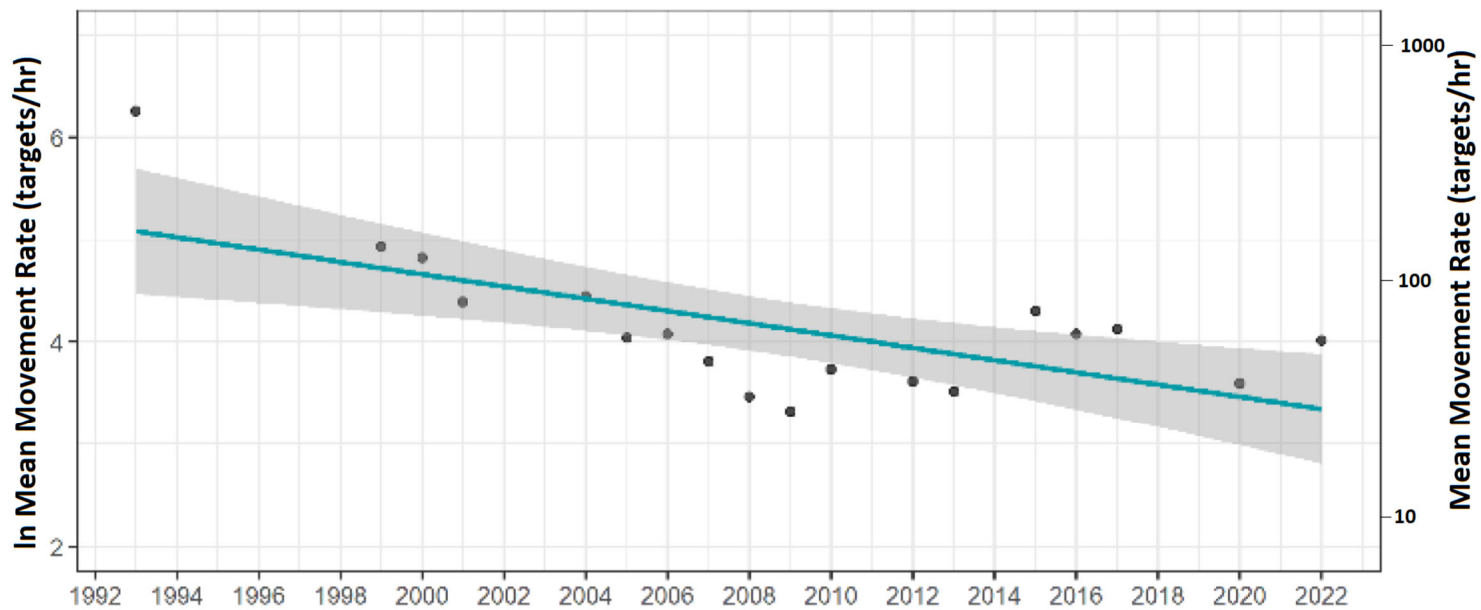


Figure 3. Graph of ‘a’o radar survey index trend on Kauai from 1993 to 2022 (adapted from Sahin 2023). Mean observed movement rate across radar stations for each year, plotted on logarithmic scale.

Fallout Recovery

On Kaua‘i numbers of fledglings recovered after fallout due to light attraction declined during the 1990s and 2000s in a pattern paralleling that seen in radar detections (Figure 4). Subsequently fledgling recovery numbers have continued at similarly low levels, with mean annual counts of 139 between 2018 and 2022 (Bache 2019; Bache 2020; Bache 2021; Bache 2022).

Managed Populations

Eight ‘a‘o colonies are currently being managed (managed colonies) in northwest Kaua‘i (Figure 5), with management actions including fencing (e.g., ungulate and cat exclusion), predator removal and control, and control of invasive plants. Currently available information regarding the total number of monitored burrows within these managed areas and the minimum and maximum population estimate for each colony, if known, is provided in Table 2.

Predator control is an established method for improving survival and reproduction of burrow nesting seabirds (Townsend et al. 2011), and has been shown to be the most effective tool to increase reproductive success of ‘a‘o (Raine et al. 2020b). Reproductive success has been monitored at several managed colonies with ongoing predator control. Table 3 provides reproductive success rates for seven of the eight managed colonies located in the northwestern portion of Kaua‘i. As shown in Table 3, reproductive success increased and is maintained at high levels where predator control is implemented. For example, reproductive success at Upper Limahuli Preserve in 2010, the year before predator control initiated, was 55 percent; subsequently from 2017 through 2022 it has ranged from 79 to 89 percent. Another example is Pōhākea, where the reproductive success started at 57 percent in 2013 and has subsequently varied from 85 percent to 100 percent. Causes of burrow failure other than predation include egg abandonment, issues during the hatching process, or other unknown causes (Kaua‘i Endangered Seabird Recovery Project 2021; Raine et al. 2022a).

Table 2. Number of monitored burrows and population estimates for managed ‘a‘o colonies on Kaua‘i in 2022.

Colony	Total number monitored burrows	Minimum Population Estimate	Maximum Population Estimate
Upper Limahuli Preserve ^a	195	518	624
Hanakapī‘ai ^{a, b}	23	140	140
Hanako ^{a, b}	2	50	82
Pōhākea ^{a, b}	59	289	458
North Bog ^{a, b}	3	70	83
Honopū ^c	7	Unknown	Unknown
Upper Mānoa Valley ^a	16	199	284
Kīlauea Point National Wildlife Refuge ^d	25	Unknown	Unknown

^a Source: Raine et al. 2023b

^b Unit within Hono O Nā Pali Natural Area Reserve

^c Source: Raine et al. 2023a

^d Source: Sahin and Shepherd 2022

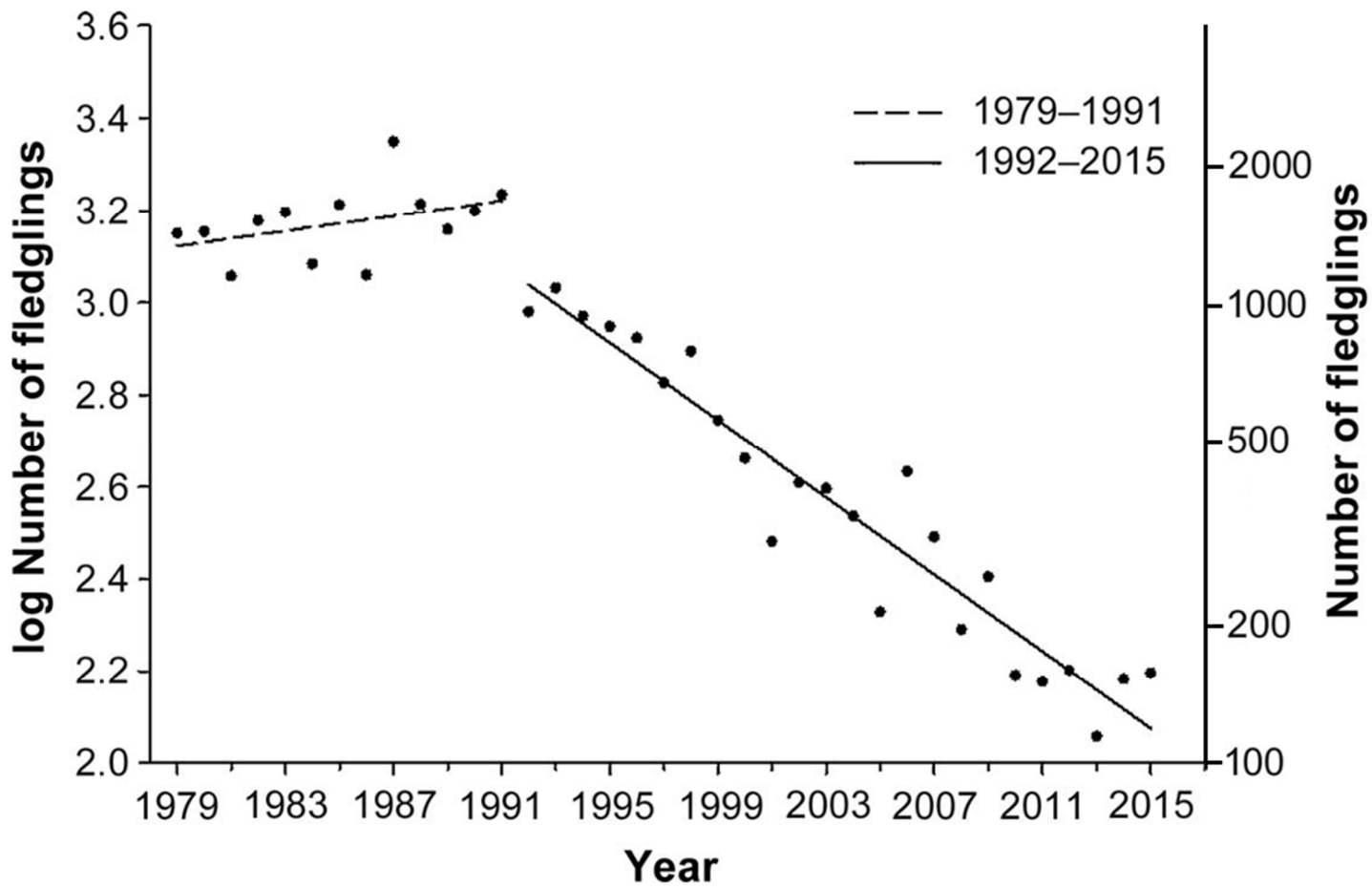


Figure 4. Annual numbers of fledgling 'a'o recovered by Save Our Shearwaters from 1979 to 2015, indicating trends before and after Hurricane Iniki in 1991. Adapted from Raine et al. (2017a).

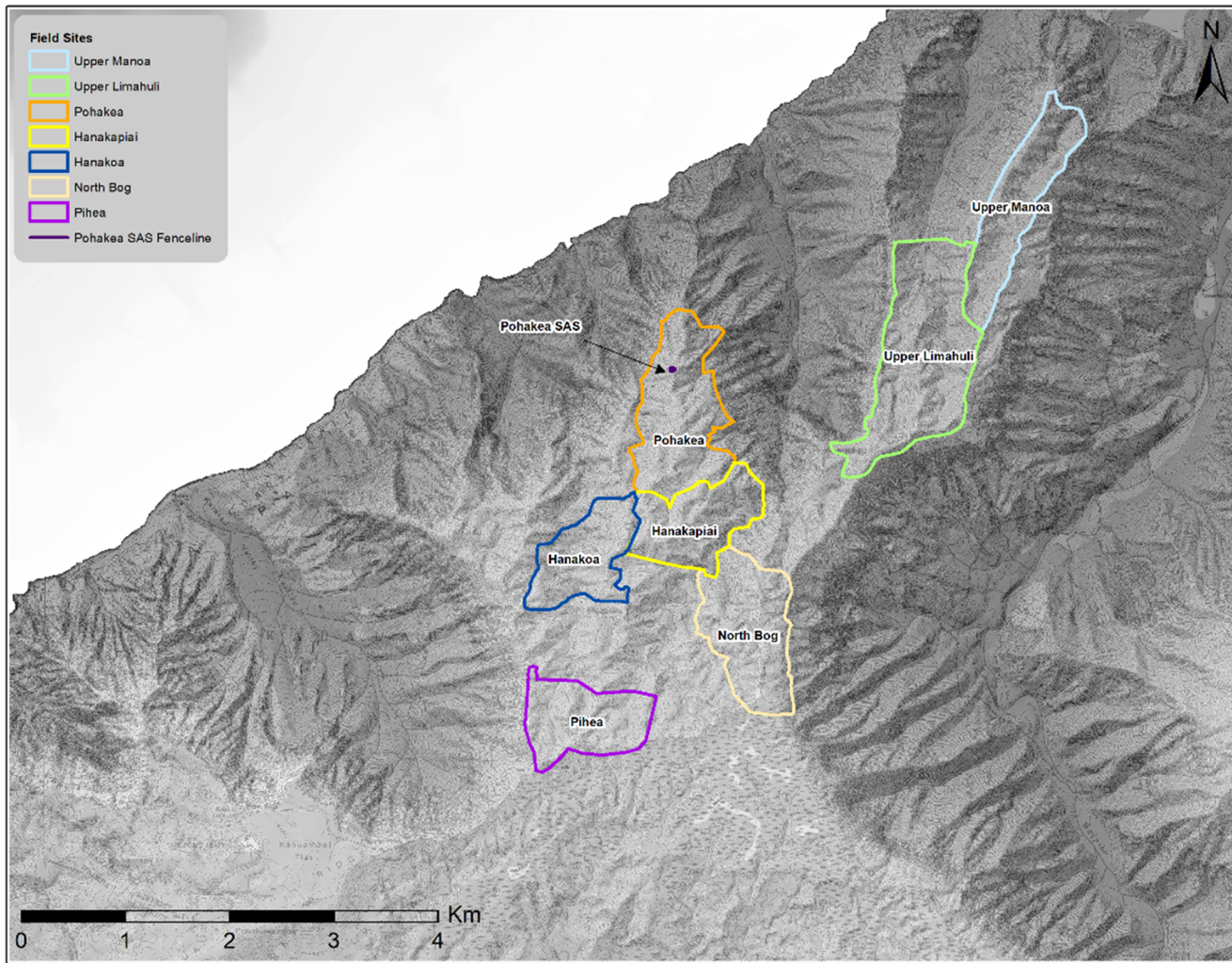


Figure 5. Map showing locations of eight actively managed seabird conservation sites on Kaua‘i. Reproduced from Raine et al. 2023b.

Table 3. Estimated reproductive success rates^a from 2017 through 2022 for managed ‘a‘o colonies on Kaua‘i (n = the number of burrows where breeding was confirmed and the final outcome determined, Not Applicable = colony not managed).

Colony	Predator Control Initiation Year	Initial monitoring year	2017	2018	2019	2020	2021	2022
Upper Limahuli Preserve ^{b, d}	2011	(2010) n = 11 55%	n = 94 89%	n = 100 79%	n = 99 89%	n = 105 86%	n = 132 86%	n = 151 88%
Hanakapī‘ai ^d	2017	Not applicable	n = 5 84%	n = 6 100%	n = 7 100%	n = 9 67%	n = 15 94%	n = 18 94%
Hanako ^d	2017	Not applicable	n = 2 50%	n = 1 100%	n = 2 100%	n = 2 100%	n = 2 100%	n = 2 100%
Pōhākea ^{c, d}	2012	(2013) n = 8 57%	n = 17 100%	n = 28 89%	n = 36 92%	n = 33 97%	n = 39 92%	n = 40 85%
North Bog ^d	2017	Not applicable	n = 0	n = 0	n = 0	n = 1 100%	n = 2 50%	n = 2 100%
Honopū ^d	2022	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	n = 4 100%
Upper Mānoa Valley ^d	2018	Not applicable	Not applicable	n = 4 25%	n = 5 80%	n = 8 75%	n = 9 89%	n = 13 85%

^a Reproductive success is calculated as the number of chicks fledged/the number of burrows where breeding was confirmed and the final outcome of the burrow was determined. This is likely an overestimate of reproductive success since there are an unknown number of monitored burrows in which breeding occurred and the burrow failed but breeding was not confirmed (these burrows were not included).

^b Seabird monitoring initiated 2010 (Raine and McFarland 2013) and predator control initiated 2011 (National Tropical Botanical Garden 2014).

^c Seabird monitoring initiated 2013 (Raine et al. 2015) and predator control initiated 2012 with limited capacity due to inaccessibility and limited resources (Zito 2013).

^d Source: Raine et al. 2023b.

New threats information:

The known threats to ‘a’o have remained the same since the 2017 5-year status review; however, our knowledge and understanding of the magnitude of those threats have continued to improve; new information is included in this section. Primary threats to ‘a’o continue to include powerline collisions, artificial nighttime lighting, predation by introduced predators (particularly feral cats [*Felis catus*], feral pigs [*Sus scrofa*], barn owls [*Tyto alba*], and black rats [*Rattus rattus*]), and changes to breeding habitat due to introduced invasive plants. Threats from powerlines, lighting, and predation have major population-level impacts on the species (Table 4). Predator control, fencing, and other measures are partially mitigating these threats, but have not been sufficient to allow populations to recover from their currently depressed levels. Recent data indicate powerline collisions are a more severe threat than previously understood. Secondary threats to ‘a’o, such as feral honey bees and plastic ingestion, also impact individuals; however, they do not rise to population-level impacts. Degree and significance of threats at sea and climate change impacts are not well understood. Best available information on the scope of impacts, where they have been measured, are included in Table 4, with greater detail provided in the sections below.

Table 4. Summary of reported estimated annual injury and mortality to ‘a’o from primary threats to the species.

Primary Threat	Measure of impact	Estimated Annual Injury	Estimated Annual Mortality	Reference
Powerline strikes	KIUC HCP (modeling; 2019 pre-minimization measures)	11,097	3,196	Travers et al. 2021; ICF 2023
Artificial lights	SOS Facility-fallout retrieval (2018-2022)	116.4 (582 birds over 5 years)	22.8 (114 birds over 5 years)	Anderson 2018; Bache 2019; Bache 2020; Bache 2021; Bache 2022
	KIUC HCP streetlights (estimates)	72	Unknown	ICF 2023
	Kaua’i Seabird HCP (2020-2022 reporting)	13.7 (41 birds over 3 years)	2 (6 birds over 3 years)	Young 2021; Young 2022; Young 2023
	Kaua’i Lagoons HCP (2012-2022 reporting)	>1 (8 birds over 10 years)	Unknown	David 2022

POWERLINE COLLISIONS

- As part of the Kaua‘i Island Utility Cooperative (KIUC) Short-Term Habitat Conservation Plan (HCP) and on-going development of a longer-term HCP, KIUC has been monitoring a subset of its powerlines using visual observations since 2012 (Travers et al. 2021) and acoustic sensors since 2013 (Travers et al. 2014). The acoustic sensors detect the sounds of birds colliding with powerlines, providing data that are calibrated with visual observations to document powerline collision rates. Modeling is used to extrapolate collisions across the entire powerline system. In 2019, prior to implementation of a significant amount of powerline collision minimization measures, ‘a‘o collisions with powerlines were estimated at 11,097 (Travers et al. 2020), and 3,196 of those (28.8 percent) resulted in mortality (Travers et al. 2021; ICF 2023).
- In 2022, the Hawaiian Electric Company Maui, in cooperation with the Maui Nui Seabird Recovery Project (MNSRP), State of Hawai‘i Department of Land and Natural Resources Division of Forestry and Wildlife, and USFWS, installed 20 acoustic sensors on power poles. These sensors documented 210 powerline collision sounds across 8 survey locations (Schlueter et al. 2022). Additional verification is needed to determine the portion of collision sounds which were from listed seabird species.

ARTIFICIAL NIGHTTIME LIGHTING

- SOS assists with the retrieval and release of ‘a‘o that fall out as a result of being attracted to artificial nighttime lights on Kaua‘i. From 2018 through the end of 2022, 696 ‘a‘o have been brought to SOS, of which 582 were released back into the wild and 114 resulted in mortality (due to injuries sustained or being dead on arrival) (Anderson 2018; Bache 2019; Bache 2020; Bache 2021; Bache 2022).
- KIUC owns and operates approximately 4,150 streetlights on the island and has 2 facilities (Port Allen Generating Station and Kapaia Generating Station) that maintain nighttime lighting. Existing streetlights and KIUC facility lights result in the fallout of approximately 72 ‘a‘o annually (actual amount per year varies), primarily fledglings, all of which result in injury or mortality (ICF 2023).
- In 2020, the approval and issuance of an Incidental Take Permit for the Kaua‘i Seabird HCP (KSHCP) authorized 7 participants a cumulative take (injury and mortality due to light attraction and fallout) of 2,272 ‘a‘o over a 30-year permit term (DOFAW 2020). As of the end of 2022, there have been 41 ‘a‘o found on participant properties, of which 35 were taken to SOS for release after stabilization and 6 resulted in mortality (Young 2021; Young 2022; Young 2023).
- In 2012, the Service issued an Incidental Take Permit for the Kaua‘i Lagoons HCP authorizing the total incidental take (injury or mortality) of 27 ‘a‘o fledglings as a result of disorientation from nighttime lighting. As of June 2022, there have been eight downed ‘a‘o found on the property (David 2022).

PREDATION

- Effects of introduced predators on ‘a‘o and ‘ua‘u (Hawaiian petrel - *Pterodroma sandwichensis*) were investigated at 6 of the managed colonies in northwestern Kaua‘i (Raine et al. 2020b). Over a 7-year time period, 309 depredations were recorded, of which 57 (18 percent) were ‘a‘o. Table 5 shows the percentage breakdown of the depredations by predator species and the age class depredated by each predator species. The most important predators are feral cats because they target breeding adults, mortality of which affects population trend more than any other age class. In addition to depredating seabirds, pigs destroy the entire burrow, preventing reuse of nesting sites. Population modeling based on these data projected that continuing predator control would allow population increase at all sites, in comparison to rapid population decline in the absence of predator control.

Table 5. Breakdown of depredations by predator species and percentage of each age class depredated by predator species (Raine et al. 2020b).

Predator Species	Percentage of depredation	Age Classes		
		Adult	Adult	Egg
Feral cats	35.6	62.7%	37.3%	0%
Black rats	50.2	0%	79.4%	20.6%
Pigs	10.4	68.6%	3.1%	28.1%
Barn owls	3.9	100%	0%	0%

CLIMATE CHANGE AND THREATS AT SEA

- Impacts to seabirds due to climate change are not well understood. However, climate change directly impacts (e.g., via change in water temperature) the life cycle and distribution of their prey species. This may indirectly affect distribution and fitness of seabirds, particularly for those species that travel large distances between its foraging and breeding grounds (Pistorius et al. 2023).
- Threats at sea and overfishing of prey items are poorly understood for ‘a‘o. When foraging at sea ‘a‘o associate with schools of yellowfin tuna (*Thunnus albacares*), which drive smaller prey toward the surface where it is easier to capture; commercial overfishing of tuna could reduce foraging effectiveness (Ainsley et al. 2020).

SECONDARY THREATS

- On Kaua‘i there have been several interactions between feral honey bees (*Apis mellifera*) and ‘ua‘u in which bees took over the burrow and resulted in a failed reproductive season (burrows abandoned) or sometimes the mortality of a chick or adult(s) (Raine et al. 2022a). Although this occurrence is not widespread, has not been observed every year, and has not yet been observed to affect ‘a‘o, the number of bee swarms taking over burrows has increased over the last 3 years on Kaua‘i (Raine et al. 2022a).
- Kain et al. (2016) looked at plastic ingestion by ‘a‘o on Kaua‘i. Of the 30 individuals (fledglings) sampled, 50 percent contained plastics in the

proventriculus (first region of a bird's stomach) and gizzard (part of a bird's stomach for grinding food). No plastic was found in the intestinal tract, which suggests plastic is retained within the proventriculus and gizzard. Plastic retention times for seabirds is 40 days to 12 months with many species exhibiting little or no capacity to excrete large or indigestible plastic. During 'a'o and 'ua'u translocations to Nihoku, Kaua'i, both species cast boluses (indigestible material that is thrown up) that contained plastic however, this occurred more for the 'ua'u (Kohley in litt. 2022). Plastic ingestion in seabirds has been documented to block and occupy space in the digestive tract and contribute to dehydration and starvation (Spear et al. 1995). However, studies have not been conducted to assess how plastic ingestion impacts 'a'o.

New management actions:

Management for this species has ramped up considerably in the last 10 years. New colonies are being established in protected areas, existing and potential colonies are being protected, and efforts to minimize collisions with powerlines and to minimize fallout due to lighting are being implemented. These efforts are occurring across all the main Hawaiian Islands except for Moloka'i, with most being concentrated on Kauai.

KAUA'I

- As part of the development of a longer-term HCP, KIUC conducted extensive take minimization work from 2020 through 2023 by reconfiguring sections of powerlines, removing static wires, and installing bird flight diverters (reflective and LED) across many miles of powerlines. These actions are anticipated to reduce overall seabird powerline collisions by 65 percent on Kaua'i (ICF 2023).
- Since implementation of new lighting protocols at the Koke'e Air Force Station in 2016 following a high seabird fall out year (including over 100 'a'o) in 2015, there have only been a few downed seabirds detected. One downed 'a'o was detected in 2020 (Rossiter 2021) and none were again detected until 2023, when one was detected on a trail camera (Roberts 2023, in litt.).
- From 2016 to 2020, 84 'a'o chicks were translocated to the Nihoku Ecosystem Restoration Project site, a 7.4 acre (ac) (3 hectare [ha]) predator exclusion fence, within Kilauea Point National Wildlife Refuge on Kaua'i (Young et al. 2023). The goal is to establish a breeding colony within an area free from mammalian predators, as well as powerlines and light attraction. All 86 'a'o fledged from the site and a male 'a'o from the 2018 cohort returned to the site in 2022 (Young et al. 2023).
- 'A'o burrow monitoring and large-scale predator control have been ongoing within Hono O Nā Pali Natural Area Reserve (Pihea, North Bog, Pōhākea, Hanakapī'ai and Hanakoa), Upper Limahuli Preserve, and Upper Mānoa Valley site as part of the KIUC Short-Term HCP and development of the longer-term HCP. As of December 2022, the Upper Mānoa Valley site had been removed from the HCP and is to be replaced with another site. In 2023, KIUC took over the long-term management of the Honopū Seabird Conservation Initiative site. The short-term HCP Incidental Take Permit expired in 2016; however, the above actions continue and will be incorporated into the longer-term KIUC HCP. As of

the end of 2022, 289 ‘a‘o burrows have been located within the sites managed under this HCP (refer to Table 3 for the number of burrows per site).

- In 2022, the 3-ac (0.4-ha) predator exclusion fence and social attraction site for the Honopū Seabird Conservation Initiative on Kaua‘i was completed. Mammalian predator removal was initiated, 29 artificial burrows for ‘a‘o were installed, and a sound system for social attraction (broadcasting calls to attract seabirds to the fenced nesting location) was installed and began operating during the breeding season (U.S. Navy 2022). An ungulate fence protecting 239 ac (96.7 ha) surrounding the above predator exclusion fence is expected to be complete in 2023. As of 2022, there are six natural ‘a‘o burrows being monitored outside of the predator exclusion fence (Raine et al. 2023a).
- In 2021, the 3-ac (0.4-ha) predator exclusion fence was completed at the Pōhākea unit within the Hono O Nā Pali Natural Area Reserve on Kaua‘i and predator removal initiated. Social attraction was initiated in 2022. There have been ‘a‘o sightings within the fence via trail cameras.
- In 2021, the 4.94-ac (2-ha) predator exclusion fence was constructed at the Kahuama‘a Seabird Preserve as mitigation for the take authorized under the KSHCP. In addition, 100 artificial burrows and a sound system for social attraction were installed. Social attraction, predator and vegetation control, and auditory surveys and burrow monitoring are ongoing within the fence. As of December 2022, flight calls of ‘a‘o have been detected from this site at a high frequency (average of 58 calls per hour), indicating that they may be prospecting for nest sites in the vicinity, but no birds were observed on the ground and they have not started using the site for nesting (Young 2023).

HAWAII

- In 2015, a 2,471-ac (1,000-ha) ungulate fence was constructed in the Pu‘u o ‘Umi Natural Area Reserve (NAR) adjacent to Waimanu on Hawai‘i Island. Predator control and acoustic monitoring have been ongoing inside the fence since 2016. Large scale predator control and ‘a‘o burrow monitoring were initiated in 2019. DOFAW recently received funding from the National Fish and Wildlife Foundation (NFWF) to begin construction of a predator-proof fence in the Pu‘u o ‘Umi NAR.
- Construction of the 865-ac (350-ha) ungulate fence adjacent to the aforementioned fence at Pu‘u o ‘Umi NAR began in 2021.

MAUI

- The State of Hawai‘i Department of Transportation is continuing development of an HCP covering lighting impacts at airports and harbors on Maui.
- Two predator proof fences (each 4.4 ac [1.8 ha]) at Makamaka‘ole on Maui have been constructed, with a sound system broadcasting seabird calls to socially attract ‘a‘o and ‘ua‘u. Both sites have ‘a‘o, though in low numbers. However, neither site has attracted ‘ua‘u (Maui Nui Seabird Recovery Project 2022; Penniman 2023, in litt.).

O'AHU

- Predator control (i.e., mongoose, cats, rats, and mice) was initiated in 2021 during the seabird breeding season in areas of high seabird detections within the Ka'ala NAR on O'ahu (Pacific Rim Conservation 2023).

New biological information:

LIFE HISTORY

Since the previous 5-year status review, new information has become available regarding 'a'o breeding phenology, nest site characteristics, and movement patterns on Kaua'i. The timing of events during the 'a'o breeding season (phenology) is as follows: birds arrive in mid-April; pre-laying exodus occurs mid-May; incubation begins the end of May; hatching occurs mid-July; chicks emerge for the first time from their burrows in early October; and fledging begins mid to late October (Raine et al. 2022b). 'A'o nest site habitat has been characterized within montane wet forests in northwest Kaua'i where the largest known colonies of this species occur (Raine et al. 2021).

RADIO TELEMETRY

Radio telemetry and GPS tracking studies have tracked movements of adult and fledgling 'a'o (Raine et al. 2017, 2020a). Fifty fledglings were tagged with satellite radio transmitters, including 38 released by Save Our Shearwaters [SOS], a facility that rehabilitates native species, and 12 chicks that fledged naturally from the Upper Limahuli Preserve colony (Raine et al. 2020a). The purpose of the study was to determine post-release survival of fledglings after fallout (when birds flying over land become grounded due to light attraction, disorientation, and collision with structures) and recovery, rehabilitation, and release from SOS in comparison to wild fledglings. Results showed wild fledglings transmitted radio signals longer² than SOS birds. SOS birds with longer rehabilitation periods transmitted radio signals for a shorter duration than birds released immediately or rehabilitated for only one day. A portion of SOS birds survived and dispersed out to sea and surviving birds (wild and SOS) traveled over 1,200 miles (2,000 kilometers) southwest of Kaua'i, indicating that that region of ocean is an important area used by fledglings. Tracking data obtained with GPS tags for 15 breeding adult 'a'o from the Upper Limahuli Preserve colony showed that birds leaving the colony flew high out to sea in all directions between northeast and northwest and did not reach sea level until several miles away from land (Raine et al. 2017). On flights from the sea to the colony, birds flew close to the terrain, following a single path to the colony. The tracking information from these studies can be used to guide conservation efforts and direct future research regarding at-sea areas used by 'a'o. Post-release survival can be improved by holding birds rescued from fallout for one day to allow rehydration and completing a thorough inspection for potential injuries prior to release. Tracking information can also be used to address threats such as powerline collisions by improving understanding of the routes birds take to and from their colonies.

² Survival rate assessed via tag transmission duration since it wasn't possible to determine the actual fate of each bird at sea (Raine et al. 2020a).

Synthesis:

The population of ‘a‘o has declined dramatically in abundance and distribution since it was Federally listed as Threatened, and remains vulnerable to the primary threats of predation, powerline collisions, and light attraction. The degraded status of ‘a‘o is the result of decades of fatal collisions with powerlines by thousands of adult and sub-adult individuals annually (particularly on Kaua‘i); fallout of fledglings attracted to artificial lights; and depredation of adults, eggs, and juveniles at breeding sites by non-native predators, as well as short-term impacts from Hurricane Iniki in 1992. These threats continue to depress ‘a‘o populations, albeit at unknown levels, by causing sustained low levels of reproductive success and high levels of adult mortality in unmanaged colonies.

The severe declining trend of the 1990s and 2000s currently appears to have abated, but the population still remains at a greatly depressed level with no evidence of increase. The population of ‘a‘o on Kaua‘i, where at least 90 percent of this species occurs (Pyle and Pyle 2017, Ainley et al. 2020), declined by 93 percent between 1993 and 2020 with much of the decline occurring prior to 2009 (Raine and Rossiter 2020). Though current radar data shows population numbers on Kaua‘i are presently at a consistent level (possibly because the most vulnerable colonies have already been extirpated and increased management and minimization actions have been implemented), population size is greatly reduced compared to historical numbers (Raine and Rossiter 2020). The geographic distribution of colonies on Kaua‘i has contracted and is now largely restricted to remote montane localities in the northwestern part of the island; colonies on other islands are extremely small and isolated. On islands other than Kaua‘i, breeding colonies have not been identified or consist of only small numbers of individuals; however, efforts to protect potential colonies, attract birds to these areas, and establish colonies via translocation have been implemented or are being planned.

The small population size renders breeding populations vulnerable to stochastic variation in environmental conditions and demography, and colonies are often located in remote and rugged locations where surveys and protective management are difficult or impracticable but predation threats still exist. Thus, many of the individual colonies have low resilience and are vulnerable to extirpation, and a single catastrophic event, such as a hurricane impacting northwestern Kaua‘i, could severely affect a substantial portion of the species population.

Life history traits of ‘a‘o increase its vulnerability to threats. The K-selected demography of the species (long lifespan, delayed age at first breeding, and a typical clutch size of one) would render population increase from its current low levels and expansion of geographic distribution a slow process even in the absence of threats. Given the current low population size, a breeding range primarily restricted to a single island, ongoing vulnerability to a suite of difficult-to-manage threats including poorly understood threats at sea, and potential negative effects of climate change, substantial progress toward recovery of ‘a‘o will require continuing and expanded management efforts to address threats.

Despite logistical difficulties, considerable efforts are underway to protect this species, including measures to address light attraction and collisions, as well as intensive management of several small breeding areas to address threats. Progress has been made on: (1) refining survey techniques to yield better data for monitoring populations and trends; (2) implementing measures to reduce powerline collisions on Kaua‘i; (3) implementing measures to reduce fallout of fledglings due to attraction to artificial nighttime lights; (4) installing predator exclusion fences around existing colonies; (5) implementing predator control at several breeding sites; (6) development of HCPs that ultimately will provide significant funds for mitigation of incidental take; and (7) increasing public awareness of threats faced by the species and conservation efforts to address the threats. It is likely that the current steady population trend after years of severe decline is attributable to this enhanced level of management. As such, the species is strongly conservation reliant and would be extremely vulnerable to any disruption of management. However, to date none of these efforts has progressed sufficiently to abate threats, especially powerline collisions and depredation, to the degree that populations have rebounded or the status of the species has clearly progressed toward recovery. Thus, as described in Table 6 below, recovery criteria for the species have not been fully met. We will not know the success of the translocation and social attraction projects for several years. Conservation efforts must be increased in scope and scale in order to improve the status of the species.

At the time of listing, we found that the ‘a‘o met the definition of a threatened species (likely to become endangered within the foreseeable future throughout all or a significant portion of its range). In our 2011 and 2017 5-year status reviews, we analyzed threats to the species and concluded that, based on severe population declines, range contraction, and ongoing significant threats, ‘a‘o met the definition of an endangered species (in danger of extinction throughout all or a significant portion of its range). Current information indicates that threats continue to cause significant mortality while active management to address these threats has also been implemented and is being expanded. This management has apparently been adequate to abate population declines in recent years, but not to reverse them, so that the species continues at greatly reduced population levels and restricted geographic distribution with no evidence of population increases. Any disruption of management and/or impact of catastrophic events would likely cause renewed declines, starting from a now much smaller and less resilient population base. Thus, the species remains more immediately vulnerable to population declines putting it at short-term risk of extinction than it was prior to the 1990s. Based on the information in this 5-year status review, ‘a‘o meets the definition of endangered and we recommend a change in the status of ‘a‘o from threatened to endangered.

While this signed 5-year status review recommending a status change may lead to the species’ inclusion on the Service’s national Endangered Species Act classification workplan, that inclusion does not necessarily mean that the species will be reclassified as endangered as recommended herein. That determination would be made following an assessment of the species’ status, utilizing the full Species Status Assessment and Recommendation Team process, to determine whether it meets the definition of an endangered or threatened species.

Recommendations for Future Actions:

- Provide reliable funding sources for long-term management and protection of existing ‘a‘o breeding colonies.
- Identify existing ‘a‘o colonies or create new colonies in suitable habitat outside the northwest portion of Kaua‘i and on other islands. On each island other than Kaua‘i, at least one colony of sufficient size for management should be targeted for implementation of management actions such as fencing (e.g., ungulate and cat exclusion), predator removal and control, and control of invasive plants. Minimize or manage hazards from powerlines and light attraction as appropriate for each colony.
- Increase the number of colonies that are monitored and actively managed (e.g., predator control, invasive plant control).
- Continue ongoing monitoring programs to obtain updated population demographic information and life history parameters.
- Conduct predator control at ingress points to existing colonies.
- Support research and development of new techniques, methods, and traps to increase effectiveness of predator control for listed seabirds and share across conservation agencies.
- Conduct a follow-up to MNSRP’s pilot study to assess the extent of listed seabird powerline collisions on Maui. Utilize current/new technology developed to study this problem on Kaua‘i.
- Explore feasibility of on-the-ground powerlines instead of aboveground powerlines/poles on Haleakalā, which are prone to falling during heavy winter storms near the summit.
- Continue to support ornithological radar work to track ‘a‘o and other native seabird species at various locations on Maui.
- Conduct acoustic surveys within remote areas of Haleakalā National Park in southeastern Maui and East and West Maui to identify potential ‘a‘o breeding colonies and assess the relative colony population size, and manage those colonies.
- Maintain funding, monitoring, maintenance, predator control, and replace the two deteriorating predator exclusion fences (each 4.5 ac [1.8 ha]) at the Makamaka‘ole site in West Maui, constructed by First Wind, Inc. and currently maintained by MNSRP, to facilitate establishment of a new ‘a‘o breeding colony within a predator-free area on Maui.
- Conduct concerted awareness and outreach campaigns similar to “Birds, Not Mosquitoes” to help inform the public about the plight of native seabird species/threats to their survival, and generate support for recovery efforts. Haleakalā National Park and MNSRP recently co-hosted a well-attended Hawaiian Petrel Night/Dark Sky public outreach program.
- Support work to reduce light pollution on all islands. A county-wide dark sky/lighting ordinance similar to that instituted on the island of Hawai‘i for astronomy will benefit ‘a‘o and other native wildlife.

- Support collaborative climate change modelling and research to help guide future management actions for protection and recovery of ‘a‘o.
- Continue to work with KIUC to decrease powerline collisions (using techniques such as bird diverters and line re-configuration projects) and assess powerlines for collision threats on other islands. ‘A‘o flight tracking data should inform decisions about areas where powerline installation should be avoided or where to focus measures to reduce powerline collisions.
- Work to reduce the feral cat issue on Kaua‘i. Cats are a significant predator on ‘a‘o and other native seabirds and waterbirds. Educational campaigns to highlight the concept of keeping pet cats indoors and ending cat colony feeding are important elements to this, as well as supporting the Kaua‘i County in its efforts to remove cat colonies.

Table 6. Status of the ‘a‘o relative to downlisting criteria from the time of listing (1975) through the current 5-year status review.

Date	Number of adult wild individuals	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1975 (listing)	Estimated to be in the low thousands	No recovery plan developed	N/A
1983 (Recovery Plan, USFWS 1983)	No population estimate given	1. Preserve and maintain existing habitat	No
		2. Control direct mortalities from predation and light attraction, and implement disease control measures (as needed)	No
		3. Determine status and distribution	No
		4. Establish additional nesting colonies	No
		5. Develop a public awareness program	No
2011(5-year status review)	83,739 (95% CI 57,360–115,093) from at-sea surveys, 1984 to 1993 (Spear et al. 1995); but a decline of 75 percent in radar detections from 1993 to 2008 (Holmes, pers. comm. 2009)	1.Preserve and maintain existing habitat	No. Nesting habitat threatened by nonnative plant species.
		2.Control direct mortalities from predation and light attraction, and implement disease control measures (as needed)	No. Ongoing severe threats continue from predation and light attraction, despite localized predator control and some shielding of lights.

Date	Number of adult wild individuals	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
		3. Determine status and distribution	Partial. Range contraction documented on Kaua‘i and radar surveys indicated population declines.
		4. Establish additional nesting colonies	No
		5. Develop a public awareness program	Partial. The SOS program and island-wide HCP development have increased the public’s awareness about the status of ‘a‘o, but neither is primarily focused on outreach and public awareness.
2017 (5-year status review)	27,011 (95% CI 18,254–37,125) Joyce (2013) estimate from 2006 at-sea data	1. Preserve and maintain existing habitat	No
		2. Control direct mortalities from predation and light attraction, and implement disease control measures (as needed)	No. Some management at colonies, some minimization of light impacts, KIUC undergrounded a portion of powerlines adjacent to a colony due to high levels of collisions detected during monitoring of the powerlines.
		3. Determine status and distribution	Partial. Several survey sites on islands other than Kaua‘i to document presence. Improved data on distribution and on predation rates and breeding success at monitored colonies on Kaua‘i, which was funded by the KIUC Short-Term HCP. Analysis and publication of 20 years of radar surveys indicated a steep decline on Kaua‘i (Raine and Rossiter 2020).

Date	Number of adult wild individuals	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
		4. Establish additional nesting colonies	Partial. Two predator-proof fences have been installed, one of Kaua‘i and one on Maui. Social attraction is being used to establish populations at these fenced sites and translocations are being done at the Kaua‘i site. The success of these efforts will not be known for several years.
		5. Develop a public awareness program	Partial. The SOS program and island - wide HCP development has increased the public’s awareness about the status of ‘a‘o on Kaua‘i, but neither is focused on outreach and public awareness.
2023 (5-year status review)	No new population estimate	1. Viable Newell’s shearwater metapopulations that represent the ecological, morphological, behavioral and genetic diversity of the species occur within their current and historical distribution on seven of the eight main Hawaiian Islands.	No.
		2. Quantitative surveys show that the population trend at locally monitored sites on each island has been stable or increasing over a period of at least 15 consecutive years, or demographic monitoring shows that each island metapopulation exhibits an average intrinsic growth rate not less than 1.0 over a period of at least 30 consecutive years.	No. Ongoing analysis and publication of 30 years of radar surveys indicate a steep population decline leading into a constant, but low level decline on Kaua‘i (Raine and Rossiter 2020). Long-term population studies on other islands still in early stages.
		3. Newell’s shearwater breeding sites throughout the current and historical distribution of the species are effectively protected and managed (e.g., ungulate/predator-proof fencing, intensive control of small mammals and avian predators) over an area sufficient to achieve Criteria 1 and 2 above.	Partial. Six predator exclusion fences have been built (four on Kauai, two on Maui) and another two are in the planning stage on Kauai. Social attraction is part of each of the fenced areas and translocation has only

Date	Number of adult wild individuals	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
			been used for one site to date. The success of these efforts will not be known for several years.
		4. The threats responsible for the decline of Newell's shearwaters have been sufficiently managed to achieve Criteria 1 and 2 above, and the needed threat management will be in place for the foreseeable future.	Partial. Predator control is occurring at nine sites (eight on Kaua'i and one on Maui). On Kaua'i KIUC has implemented significant powerline minimization measures that will reduce powerline collisions and minimized lighting impacts. KSHCP participants have implemented measures to minimize impacts due to artificial nighttime lights.

Table 7. Status of threats to the ‘a‘o from the time of listing (1975) through the current 5-year status review.

Threat	Listing Factor	Current Status	Conservation/Management Efforts
Light attraction and fallout	E	Ongoing	Light minimization occurring on Kaua‘i, HCP development for projects pertaining to artificial nighttime lighting during the seabird fallout season. In addition, permitted wildlife rehabilitators (e.g., SOS and Hawaii Wildlife Center) treat and release downed seabirds. Research on-going regarding ‘a‘o vision.
Predation by pigs, rats, cats, barn owls, mongoose, feral bees	C	Ongoing	Predator management and fencing at several colonies; four predator exclusion fences exist on Kaua‘i and two on Maui. Two more predator exclusion fences are planned on Kaua‘i. Protection is limited to a small proportion of the population.
Powerline collision	E	Ongoing	Powerline collision monitoring across Kaua‘i is on-going. On Kaua‘i significant minimization measures such as line reconfiguration, removal of static wire, and installation of reflective and LED diverters implemented from 2019 through 2023.
Habitat modification	A	Ongoing	Portions of the Hono o Nā Pali NAR are fenced to exclude ungulates and an ungulate fence surrounds the Honopū predator exclusion fence. The colony in Upper Limahuli Preserve is managed through ungulate fencing and predator removal. Each of the predator exclusion fences and Upper Limahuli Preserve on Kaua‘i has an invasive plant control program.
Climate change	A, E	Ongoing	None

References

See previous 5-year status reviews (USFWS 2011; USFWS 2017) for a full list of references. Only references for new information are provided below.

- Ainley, D.G., T.C. Telfer, and M.H. Reynolds, and A.F. Raine. 2020. Newell's Shearwater (*Puffinus newelli*), The Birds of the World (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology. Retrieved from the Birds of the World: <https://birdsoftheworld.org/bow/species/towshe2>.
- American Bird Conservancy, Hallux Ecosystem Restoration, LLC, and Archipelago Research and Conservation. 2023. Seabird monitoring and predator control at Kōke'e Air Force Station 2022 Annual Report. United States Air Force Pacific Regional Support Center, 611 Civil Engineer Squadron, Kaua'i. 81 pp.
- Anderson, T. 2018. Save Our Shearwaters Program 2018 Annual Report. Kaua'i Island Utility Cooperative, Līhu'e, Hawai'i. 56 pp.
- Bache, M. 2019. Save Our Shearwaters Program 2019 Annual Report. Kaua'i Island Utility Cooperative, Līhu'e, Hawai'i. 60 pp.
- Bache, M. 2020. Save Our Shearwaters Program 2020 Annual Report. Kaua'i Island Utility Cooperative, Līhu'e, Hawai'i. 58 pp.
- Bache, M. 2021. Save Our Shearwaters Program 2021 Annual Report. Kaua'i Island Utility Cooperative, Līhu'e, Hawai'i. 74 pp.
- Bache, M. 2022. Save Our Shearwaters Program 2022 Annual Report. Kaua'i Island Utility Cooperative, Līhu'e, Hawai'i. 41 pp.
- BirdLife International. 2019. *Puffinus newelli*. The IUCN Red List of Threatened Species 2019: e.T132467692A152723568. <https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T132467692A152723568.en>.
- Castello Branco, D., Z. Gustafson, and J. Schlueter. 2022. Automated acoustic surveys for Hawaiian petrel, Band-rumped storm-petrel, and Newell's shearwater on Hawai'i – 2021 and 2022. Conservation Metrics, Inc. 33 pp.
- Cooper, B. A., and R. H. Day. 2003. Movement of the Hawaiian Petrel to inland breeding sites on Maui island, Hawai'i. *Waterbirds* 26:62-71.
- David, R. 2022. Draft Hōkūala Habitat Conservation Plan Annual Report: July 1, 2021–June 30, 2022. Rana Biological Consulting, Kailua-Kona, Hawai'i. 29 pp.
- Division of Forestry and Wildlife (DOFAW). 2020. Kaua'i Seabird Habitat Conservation Plan. State of Hawai'i Department of Land and Natural Resources. 131 pp.

- Gauthreux, S.A. Jr. and C. G. Belser. 2004. Radar ornithology and biological conservation. *Auk* 120:266-277.
- ICF. 2023. Draft Kaua‘i Island Utility Cooperative Habitat Conservation Plan, Island of Kaua‘i, Hawai‘i. Kaua‘i Island Utility Cooperative. 847 pp.
- Joyce, T.W. 2013. Abundance estimates of the Hawaiian Petrel (*Pterodroma sandwichensis*) and Newell’s Shearwater (*Puffinus newelli*) based on data collected at sea, 1998-2011. Scripps Institution of Oceanography, La Jolla, California. 31 pp.
- Kain, E.C., J.L. Lavers, C.J. Berg, A.F. Raine, and A.L. Bond. 2016. Plastic ingestion by Newell’s (*Puffinus newelli*) and wedge-tailed shearwaters (*Ardenna pacifica*) in Hawaii. *Environmental Science and Pollution Research*. 8 pp.
- Kaua‘i Endangered Seabird Recovery Project. 2021. Monitoring of endangered seabirds on Kaua‘i Annual Report 2020. Kaua‘i Endangered Seabird Recovery Project, Pacific Cooperative Studies Unit, University of Hawai‘i, and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 86 pp.
- Maui Nui Seabird Recovery Project. 2022. Makamaka‘ole Seabird Mitigation Area 2020 Annual Report. Appendix 8 *In* Kaheawa Wind Power Habitat Conservation Plan FY 2021 Annual Report, Tetra Tech, Inc., Honolulu, Hawai‘i. 100 pp.
- National Tropical Botanical Garden. 2014. 2014 Predator control work plan. National Tropical Botanical Garden, Upper Limahuli Preserve, Hawai‘i. 26 pp.
- Pacific Rim Conservation. 2023. 2022 Hawaiian petrel and Newell’s shearwater O‘ahu Work Final Report. Pacific Rim Conservation, Honolulu, Hawai‘i. 10 pp.
- Piatt, J.F. and R.G. Ford. 1993. Distribution and abundance of Marbled Murrelets in Alaska. *Condor* 95:662-669.
- Pyle, R.L., and P. Pyle. 2017. The birds of the Hawaiian Islands: Occurrence, history, distribution, and status. Version 2. <http://hbs.bishopmuseum.org/birds/rlp-monograph/>
- Pistorius, P.A., W.J. Sydeman, Y. Watanuki, S.A. Thompson, and F. Orgeret. 2023. Climate change: The ecological backdrop of seabird conservation. Pages 245–276. *In* Conservation of Marine Birds. L. Young and E. VanderWerf (Eds.). Academic Press, Elsevier Inc. San Diego, CA.
- Raine, A.F. and B. McFarland. 2013. Monitoring of endangered seabirds in Upper Limahuli Preserve Annual Report 2012. Kaua‘i Endangered Seabird Recovery Project, Pacific Cooperative Studies Unit, University of Hawai‘i, and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 36 pp.

- Raine, A.F. and Rossiter, S. 2020. 2020 Annual Radar Monitoring Report. Kaua‘i Endangered Seabird Recovery Project, joint project between Pacific Cooperative Studies Unit, University of Hawai‘i and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 30 pp.
- Raine, A.F., N. D. Holmes, M. Travers, B.A. Cooper, and R.H. Day. 2017a. Declining population trends of Hawaiian Petrel and Newell’s Shearwater on the island of Kaua‘i, Hawaii, USA. *Condor* 119:405-415.
- Raine, A.F., M. Vynne, S. Driskill, M. Travers, J. Felis, and J. Adams. 2017b. Study of daily movement patterns of NESH and HAPE in relation to power line collisions, Year Three. 2017. Kaua‘i Endangered Seabird Recovery Project, Pacific Cooperative Studies Unit, University of Hawai‘i and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 64 pp.
- Raine, A.F., M. Vynne, J. Rothe, and S. Driskill. 2018. Seabird Monitoring at Kōke‘e Air Force Station—2018 Annual Report. Kaua‘i Endangered Seabird Recovery Project, Pacific Cooperative Studies Unit, University of Hawai‘i and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 48 pp.
- Raine, A.F., T. Anderson, M. Vynne, S. Driskill, H. Raine, and J. Adams. 2020a. Post-release survival of fallout Newell’s shearwater fledglings from a rescue and rehabilitation program on Kaua‘i, Hawai‘i. *Endangered Species Research* 43: 39-50.
- Raine, A.F., S. Driskill, M. Vynne, D. Harvey, and K. Pias. 2020b. Managing the effects of introduced predators on Hawaiian endangered seabirds. *Journal of Wildlife Management* 84: 425–435.
- Raine, A.F., J. Rothe, and S. Driskill. 2020c. Exploratory surveys for endangered seabirds on Kaua‘i—2020. Kaua‘i Endangered Seabird Recovery Project, Pacific Cooperative Studies Unit, University of Hawai‘i and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 11 pp.
- Raine, A.F., M. Travers, J. Rothe, and S. Driskill. 2020d. Exploratory surveys for endangered seabirds in Waimea Canyon. Kaua‘i Endangered Seabird Recovery Project, Pacific Cooperative Studies Unit, University of Hawai‘i and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 12 pp.
- Raine, A.F., S. Driskill, J. Rothe, and M. Vynne. 2021. Nest site characteristics of two endangered seabirds in montane wet forests on the island of Kaua‘i, Hawai‘i. *Waterbirds* 44(4): 472-482.

- Raine, A.F., S. Driskill, and J. Rothe. 2022a. Monitoring of endangered seabirds on Kaua‘i Annual Report 2021. Archipelago Research and Conservation, Hanapēpē, Hawai‘i. 100 pp.
- Raine, A.F., S. Driskill, J. Rothe, and M.S. Travers. 2022b. Evaluating the breeding phenology of the endangered ‘a‘o (Newell’s shearwater *Puffinus newelli*) on Kaua‘i to better focus conservation actions and management decisions. Bird Conservation International, 1-11.
- Raine, A.F., B. Brittingham, S. Driskill, J. Rothe, and H. Raine. 2023a. Honopū Seabird Conservation Initiative —2022 Report. Archipelago Research & Conservation, Hanapēpē, Hawai‘i. 22 pp.
- Raine, A.F., S. Driskill, and J. Rothe. 2023b. Kaua‘i Island Utility Co-Operative Habitat Conservation Plan, Monitoring of endangered seabirds on Kaua‘i, Annual Report 2022. Archipelago Research & Conservation, Hanapēpē, Hawai‘i. 43 pp.
- Roberts, P. and M. McKown. 2016. Acoustic surveys for Hawaiian Petrel, Newell’s Shearwater, Band-rumped storm-petrel, and barn owl at exploratory sites on West Maui. Final Report. Conservation Metrics, Inc. 15 pp.
- Rossiter, S. 2021. Seabird monitoring at Kōke‘e Air Force Station 2020 Annual Report. Kaua‘i Endangered Seabird Recovery Project, joint project between Pacific Cooperative Studies Unit, University of Hawai‘i and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 51 pp.
- Sahin, D. 2023. 2022 Annual Radar Monitoring Report. Kaua‘i Endangered Seabird Recovery Project, joint project between Pacific Cooperative Studies Unit, University of Hawai‘i and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 11 pp.
- Sahin, D. and J. Shepherd. 2022. 2022 Annual Report on Monitoring of Newell’s shearwater at Kīlauea Point National Wildlife Refuge, Kaua‘i. Kaua‘i Endangered Seabird Recovery Project, joint project between Pacific Cooperative Studies Unit, University of Hawai‘i and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 12 pp.
- Schlueter, J., A. Fleishman, and D. Castello Branco. 2022 Acoustic detection of collision sounds under powerlines on Maui; 2022 seabird breeding season. Conservation Metrics, Inc. 16 pp.
- 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.
- Towns, D.R., G.V. Byrd, H.P. Jones, and M. Rauzon. 2011. Impacts of introduced predators on seabirds. Chapter 3 *in*: C.P.H. Mulder, W.B. Anderson, D.R. Towns,

- and P.J. Bellingham, Editors. Seabird islands: Ecology, invasion, and Restoration. .Oxford University Press.
- Travers, M., A. Shipley, M. Dusch, and A.F. Raine. 2014. Underline Monitoring Project Draft Annual Report—2013 Field Season. Kaua‘i Endangered Seabird Recovery Project, Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources and Pacific Cooperative Studies Unit, University of Hawai‘i, Hawai‘i. 91 pp.
- Travers, M., T. Tinker, S. Driskill, and A.F. Raine. 2020. Underline Monitoring Project Review Draft—Bayesian Acoustic Strike Model. Kaua‘i. Kaua‘i Endangered Seabird Recovery Project, joint project between Pacific Cooperative Studies Unit, University of Hawai‘i and the Division of Forestry and Wildlife, State of Hawai‘i Department of Land and Natural Resources, Hawai‘i. 41 pp.
- Travers, M.S., S. Driskill, A. Stemen, T. Geelhoed, D. Golden, S. Koike, A.A. Shipley, H.E. Moon, T. Anderson, M. Bache, and A.F. Raine. 2021. Post-collision impacts, crippling bias, and environmental bias in a study of Newell's Shearwater and Hawaiian petrel powerline collisions. *Avian Conservation and Ecology*. 16(1): 15.
- [USFWS] U.S. Fish and Wildlife Service. 2011. Newell’s Shearwater (*Puffinus auricularis newelli*) 5-year review summary and evaluation. September 27, 2011. Available at: https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/1806.pdf
- [USFWS] U.S. Fish and Wildlife Service. 2016. Newell’s Shearwater landscape strategy. Pacific Island Fish and Wildlife Office, Honolulu, Hawaii. 298 pp.
- [USFWS] U.S. Fish and Wildlife Service. 2017. 5-Year review: Short form summary. Newell’s Shearwater (*Puffinus auricularis newelli*). November 1, 2017. Available at: https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2528.pdf
- [USFWS] U.S. Fish and Wildlife Service. 2019. Amendment to the Hawaiian dark-rumped petrel and Newell’s manx shearwater recovery plan. Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i. 13 pp.
- [USFWS] U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Technical Corrections for 62 Wildlife and Plant Species on the Lists of Endangered and Threatened Wildlife and Plants. Federal Register 86 FR 7134 7134-7177. <https://www.federalregister.gov/documents/2023/02/02/2023-01025/endangered-and-threatened-wildlife-and-plants-technical-corrections-for-62-wildlife-and-plant>
- U.S. Navy. 2022. NFWF – Navy PMRF Pacific Seabird Partnership N40192-18-2-8006 2022 Annual Report. U.S. Navy Pacific Missile Range Facility and National Fish and Wildlife Foundation. 11 pp.

- Young, L. 2021. 2020 KSHCP Annual Report. Pacific Rim Conservation, Hawai‘i. 43 pp.
- Young, L. 2022. 2021 KSHCP Annual Report. Pacific Rim Conservation, Hawai‘i. 48 pp.
- Young, L. 2023. 2022 KSHCP Annual Report. Pacific Rim Conservation, Hawai‘i. 47 pp.
- Young, L., and E. VanderWerf. 2016. Habitat suitability assessment for listed seabirds in the main Hawaiian Islands. Report to the U.S. Fish and Wildlife Service. 44 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 Oahu, Hawaii. *The Condor: Ornithological Applications* 121: 1-7.
- Young, L.C., C.R. Kohley, E.A. VanderWerf, L. Fowlke, D. Casillas, M. Dalton, M. Knight, A. Pesque, E.M. Dittmar, A.F. Raine, and M. Vynne. 2023. Successful translocation of Newell’s shearwaters and Hawaiian petrels to create a new, predator free breeding colony. *Frontiers in Conservation Science*. 11 pp.
- Zito, J. 2013. Hono o Nā Pali predator control Annual Report—2012. Division of Forestry and Wildlife Natural Area Reserve System Kaua‘i. 32 pp.

Personal Communications and *In Litt.* References

- Elliott, L. 2023. Email communication between Juan Carlos Guerra, Hawai‘i Wildlife Center and Leila Nagatani, U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office regarding a Newell’s shearwater brought to Hawai‘i Wildlife Center. July 12, 2023. 2 pp.
- Gates, N. 2021. Letter from Natalie B. Gates, National Park Service, Haleakalā National Park to U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office with comments on the 5-Year Status Reviews for 77 Species in Oregon, Washington, Idaho, and Hawai‘i. August 19, 2021. 8 pp.
- Guerra, J.C. 2022. Email communication between Juan Carlos Guerra, Hawaii Wildlife Center and Michelle Bogardus, U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office regarding a Newell’s shearwater found on O‘ahu. June 23, 2022. 2 pp.
- Holmes, N. 2009. Personal communication. May 12, 2009.
- Kohley, R. 2022. Email communication between Robbie Kohley, Director of Aviculture at Pacific Rim Conservation and Leila Nagatani, U.S. Fish and Wildlife Service,

- Pacific Islands Fish and Wildlife Office regarding plastics in Newell's shearwaters and Hawaiian petrels. July 13, 2022. 2 pp.
- Loh, R. 2021. Letter from Rhonda Loh, Superintendent, National Park Service, Hawai'i Volcanoes National Park to U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office with comments on the 5-Year Status Reviews for 77 Species in Oregon, Washington, Idaho, and Hawai'i. August 20, 2021. 3 pp.
- Nagendra, U. 2023. Email correspondence from Uma Nagendra, National Tropical Botanical Garden to Leila Nagatani, U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office regarding data on listed seabirds being caught in traps used for predator control. June 5, 2023. 2 pp.
- Penniman, J. 2023. Email correspondence from Jay Penniman, Maui Nui Seabird Recovery Project to Leila Nagatani, U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office regarding information for 'a'o on Maui. June 18 and 28, 2023.
- Pias, K. 2023. Email correspondence from Kyle Pias, Hallux Ecosystem Restoration LLC to Leila Nagatani, U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office regarding data on listed seabirds being caught in traps used for predator control. June 22, 2023. 3 pp.
- Roberts, K. 2023. Email correspondence from Keith Roberts, Natural Resources Program Manager, 611th Civil Engineer Squadron, Joint Base Pearl Harbor-Hickam, Hawai'i to James Kwon, Biologist at U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office regarding a downed 'a'o at Kōke'e AFS. June 9, 2023. 2 pp.
- Wang, A. 2023. Email communication between Alex Wang, Biologist at State of Hawaii Division of Forestry and Wildlife and Leila Nagatani, Biologist at U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office regarding information for 'a'o on the island of Hawai'i. June 28, 2023. 4 pp.

U.S. FISH AND WILDLIFE SERVICE

SIGNATURE PAGE for 5-YEAR STATUS REVIEW of ‘A‘o
(Newell’s shearwater, *Puffinus newelli*)

Recommendation resulting from the 5-year status review:

- Delisting
- Reclassify from Endangered to Threatened status
- Reclassify from Threatened to Endangered status
- No Change in listing status

Name of Reviewer(s):

PIFWO

- Leila Nagatani, Fish and Wildlife Biologist, O‘ahu, Kaua‘i, Northwestern Hawaiian Islands, and American Samoa Island Geographic Team
- John Vetter, Animal Recovery Coordinator

Ecological Services, Pacific Regional Office

- Grant Canterbury, Fish and Wildlife Biologist
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