

STUDENT PROJECT REPORT FOR THE
UNIVERSITY OF HAWAI'I AT HILO
MARINE OPTION PROGRAM

High Elevation Surveys for *'Ua'u* Burrows on Mauna Kea

Caden Christensen

Marine Science Department
University of Hawai'i at Hilo

Advisor

Lisa Parr
Marine Science Department
University of Hawai'i at Hilo

Project Supervisor

Patrick Hart
Biology Department
University of Hawai'i at Hilo

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ABSTRACT

Hawaiian Petrels (*Pterodroma sandwichensis*), or 'Ua'u, are endangered seabirds endemic to Hawai'i. They once flourished in the islands but have experienced drastic population decline with human activity. Introduced predators are a particular threat because 'Ua'u pairs nest in burrows, where they are defenseless against depredation. Little is known about 'Ua'u including current population estimates and trends. Maintaining accurate information about 'Ua'u population trends and locating their nesting sites are necessary to establish protocols to safeguard them. UH Hilo's bioacoustics lab reported possible Ua'u calls on Mauna Kea in 2019, where the bird had not been seen in decades. This project was to survey for inhabited 'Ua'u burrows on Mauna Kea, and assess the presence of predators in the area. After a forward looking infrared night survey and several ground survey days including days with assistance from dogs, 'Ua'u were confirmed to be burrowing on the Mauna with 7 total burrows found. A depredated 'Ua'u and a cat in a trap were found during the project showing the need for predator management in the area. Following the project, the state formalized a plan for a predator proof fence that has been approved. The known burrow locations now provide an opportunity for further research on 'Ua'u.

INTRODUCTION

The Hawaiian Petrel (*Pterodroma sandwichensis*), or 'Ua'u, is an endangered seabird that is endemic to Hawai'i (*Figure 1*). These birds can be identified by their countershading color, pink and black feet, 16 inch size, and 3 foot wingspan (National Park Service 2020, U.S. Fish & Wildlife Service 2006). 'Ua'u appear quite similar to

other Procellariidae birds such as the Newell's Shearwater (*Figure 2*), but can be distinguished by their bill and flight pattern; 'Ua'u bills are more stout and hooked, and they have a steeper, quicker, and smoother arced flight pattern (U.S. Fish & Wildlife Service 2006, Kaua'i Endangered Seabird Recovery Project 2018).



Figure 1. 'Ua'u flying at sea
sea



Figure 2. Newell's Shearwater flying at

'Ua'u were once found from summit to sea in the Hawaiian Islands (Waianecki 2008), but the bird's population has declined dramatically. In the Hawaiian Islands, human colonization marked the beginning of a period in which nearly 75% of endemic birds became extinct, and the population size and range of many additional species declined (Welch et al. 2012). 'Ua'u, along with other species, were heavily impacted by the pressures of introduced predators and disease, industrialized agriculture and fishing, and urbanization. When the Endangered Species Protection Act was enacted, 'Ua'u were one of the first species to be listed as Federally Endangered (Adams 2007). The last published population size estimate for Hawaiian Petrels was in 1995 and estimated 19,000 individuals \pm 8,000 and a total of 3750-4500 breeding pairs (Spear 1995). There has been little subsequent research on population trends, aside from a

2017 study on Kaua'i island, which reported a 78% decline in numbers with an average decline rate of ~6% per year (Raine et al. 2017).

'Ua'u only come to land to nest and breed, and their preferred nesting environments vary greatly from island to island. They will nest in burrows along large rock outcrops, under cinder cones, or under old lichen-covered lava at elevations above 7,200 feet. The Hawaiian Petrel only flies to and from its burrow at night. On Hawai'i Island, *'Ua'u* come to their burrows around March, and leave around October. Fledglings can often be found in the burrows until November. It is thought that *'Ua'u* start visiting their breeding colonies at three years of age, but do not begin breeding until they are at least five or six years old (Kaua'i Endangered Seabird Recovery Project 2018). At approximately 6 years of age, breeding pairs will establish a nest site, attempt to nest, and then return to the same nest site annually for upwards of 40 years. As with other procellariidae species, *'Ua'u* can only produce a single chick a year, and this life history strategy can inhibit population growth and facilitate rapid population declines (Adams 2007). If a breeding pair does successfully lay and hatch a chick, juvenile birds can take up to 120 days to fledge, and the chicks are highly susceptible to depredation because the family's only real defense is invisibility (Waianecki 2008).

The primary cause for the observed population decline of *'Ua'u* has been depredation. *'Ua'u* are highly adapted to spend the majority of their life at sea, but they are clumsy and out of their element on land (Waianecki 2008), making them susceptible to depredation. More research is needed to quantitatively measure the degree to which predators are affecting the *'Ua'u*. Cats and mongoose are both of great concern in regards to *'Ua'u* depredation. Due to their small size, mongoose are more likely to enter

'*Ua'u* burrows to kill the birds or steal the eggs while cats usually cannot get into burrows but will ambush the birds outside the burrows (Duffy and Capece 2014). Raine et al. (2020) reported 309 depredations of '*Ua'u* on Kaua'i from 2011 to 2017, mostly by black rats (*Rattus rattus*) and cats. However, Raine also found that predator control for the seabirds showed promising results with an increase in reproductive success observed across the board once predator control operations were in place. This is compared to a 50 year rapid population decline trajectory at all observed sites if no predator control was present.

Much is still unknown about '*Ua'u*, and maintaining accurate information about '*Ua'u* population trends is critical to guiding effective management actions (Kaua'i Endangered Seabird Recovery Project 2018). Data on the location and population size of individual colonies in different nesting areas is needed. The most recent population estimates leave the nesting location of many breeding pairs unaccounted for, and it is important to locate these nesting areas so that protocols can be established to safeguard them (Waianeki 2008).

In 2019, the LOHE Bioacoustics Lab of UH Hilo heard and recorded '*Ua'u* calls on Mauna Kea where the bird once flourished but hadn't been seen for decades. The goal of this study was to survey for inhabited '*Ua'u* burrows on Mauna Kea, assess the presence of predators in the area, particularly cats & rats, and report burrows to the LOHE Bioacoustics Lab and the Division of Forestry and Wildlife for monitoring and protection. The research questions for this study were 1) How many, if any, '*Ua'u* are returning to using Mauna Kea for nesting? and 2) To what level are predators around the burrowing area affecting the '*Ua'u*? While this research started as an independent

research project, once ‘Ua‘u were visually spotted on Mauna Kea, the research expanded to include a UH graduate student, Bret Mossman; this allowed more effort to be put towards more extensive burrow surveys and led to a partnership with Conservation Dogs Hawai‘i.

METHODS

Study Area

The area on Mauna Kea most likely containing Ua‘u burrows was identified by the UH Hilo’s LOHE Bioacoustics lab. The area was approximately 2 kilometers by 1 kilometer between the cinder cones known as Pu‘u Ka‘iwi‘iwi and Pu‘u Kanakaleonui (Figure 3 & 4). The area is accessible by 4WD, 12 miles from the Mauna Kea access road.

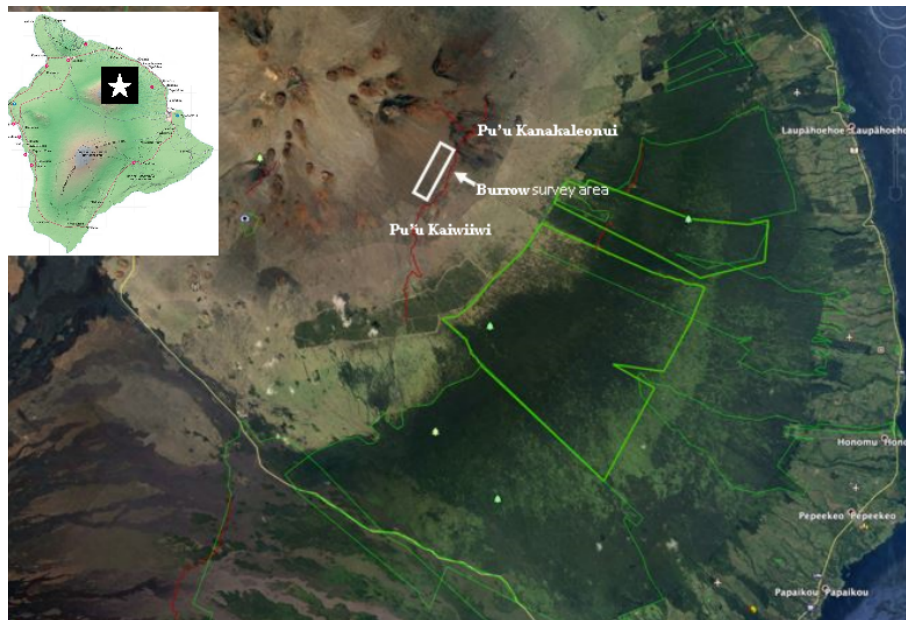


Figure 3. Map of North-Eastern portion of island of Hawai‘i with burrow survey area marked on Mauna Kea



Figure 4. Landscape in general area of survey for *Ua'u* burrows

Burrow Surveys

A preliminary overnight scouting survey was conducted to attempt to visually confirm the presence of *Ua'u* on the Mauna. The survey was done from 7 pm to 10 pm and 2 am - 5 am. These time frames have been observed to be the times *'Ua'u* tend to enter and leave their burrows at other nesting sites. A forward looking infrared (FLIR) camera was used to look out over the 2 *pu'u* of interest. *'Ua'u* were identified by their signature flying patterns to distinguish them from barn owls, the only other bird that would be spotted on Mauna Kea at night. When *'Ua'u* were spotted, they were counted, and then tracked until they were observed landing or flying away. Approximate landing locations were recorded as a high priority area to search for a burrow.

Surveys were conducted at least once a month from September through November, 2020-2021. Evidence of *'Ua'u* and a nearby burrow included guano, chick down, clippings of plants, and the distinct smell of *'Ua'u*. Areas most likely to possess

burrows including areas along hillsides with vegetation were prioritized. Straight transects were performed every 10 meters. GPS was used to mark burrow locations, and pictures were taken. Motion activated night cameras were supplied by the UH Hilo LOHE lab for monitoring burrows and predator presence.

A partnership was established with Conservation Dogs Hawaii to increase efforts with burrow surveys via a week long survey.

Predator Surveys

Signs of cats, such as paw prints and cat feces, were noted. Predator traps were deployed to catch and kill cats and mongooses. Depredated *'Ua'u* or other birds were recorded. Remnants of *'Ua'u* eggs found outside burrows were also noted.

RESULTS

During the preliminary night survey, 3 *'Ua'u* were spotted flying over Pu'u Kanakaleonui in the 7-10 pm time frame and zero were spotted in the 2 am to 5 am time frame. None were observed landing. Many possible burrows were found but few had signs of *'Ua'u*. A total of 7 burrows were identified; 2 burrows found by ground surveys and 5 by dogs. 1 had a chick inside. The 2 burrows found by ground survey were in close proximity to each other. The first was found with feathers around the entrance and a beehive inside, and after the beehive was removed, a video from a game camera confirmed the burrow as an active *'Ua'u* nest. A depredated *'Ua'u* was then found near the first burrow on a future survey day, and a second burrow was next to it. Game cam footage confirmed that the first bird was still alive and using its burrow while this second

burrow was vacant. Seven guano spots on the ground were spotted.. One cat was trapped.

DISCUSSION

The first survey done was the night survey to look for *'Ua'u* rather than their burrows and this was the first visual confirmation of *'Ua'u* on Mauna Kea in decades, potentially indicating *'Ua'u* were coming back to using Mauna Kea as a burrowing location, but not 100% confirmation; sometimes these seabirds will only fly inland for prospecting purposes and not have a burrow in the area. Because the birds were spotted above Pu'u Kanakaleonui, surveys around that *pu'u* were prioritized. The study area as a whole could not be surveyed in one day due to the area's rough terrain and the time consumed accessing and traversing the area, but the entirety of the area was surveyed over the course of the project.

None of the possible burrows in the first few days had the signature signs of the birds outside the burrows, so they were ruled out because the odds of a burrow not having any signs of *'Ua'u* around it are low, and we did not have enough game cameras to be putting a cam in front of all these possible burrows. When the first burrow with signs of a bird around it (i.e. feathers) was found, a game cam was put outside of it and led to confirming the burrow as an inhabited *'Ua'u* burrow. This confirmed burrow was not on University of Hawai'i managed land like originally thought, so further surveying had to be postponed until a permit was gained; this permit granted legal permission to conduct research on DHHL land where the burrow was found. Once the permit was granted a few weeks later, surveying continued.

Thanks to the Conservation Hawai'i Dogs team, a handful of burrows were identified in the area beyond the initial 2 that gave more confidence to the fact that *'Ua'u* are using Mauna Kea to breed and attempting to establish a colony. Game cams were put at all of the burrows found by Conservation Dogs Hawai'i to confirm occupancy, and all were occupied with one of the burrows also having a chick. These burrows will need to be continually monitored and managed in order to obtain more information, and surveys for *'Ua'u* burrows using Conservation Dogs Hawai'i can be conducted in the area in the future to confirm if more *'Ua'u* come in the area.

The presence of a depredated *'Ua'u* and a cat found in a trap while surveying confirms the concern for predators being on Mauna Kea and negatively impacting *'Ua'u* populations as well as the birds ability to breed on the Mauna. This makes enacting protocols to protect the burrows in this area very important to provide the *'Ua'u* with the best chance for survival and breeding. The area seems to be an optimal burrowing location as long as measures can be taken in predator control. This can be said with confidence considering the area used to be filled with hundreds of burrows decades ago before the decline of *'Ua'u*. The next step is to build a predator proof fence for the area in order to protect the burrows. 3 plant species of interest were concurrently being surveyed for due to their rarity and need to be counted and managed. These plants included the critically endangered Hawaiian Plantago, the Hawaiian Iris, and another native Hawaiian plant in the carrot family. Excitingly, 3 Hawaiian Plantago plants and 6 Hawaiian Iris plants were found in the area in close proximity to the *'Ua'u* burrows which gave a higher priority for a fence around the area. Plans from the state for this fence have now already been formalized and permission granted.

CONCLUSION AND RECOMMENDATIONS

The *'Ua'u* is an endangered seabird that is special to Hawai'i, and while *'Ua'u* hadn't been recorded on the Mauna in decades, it has been found that some *'Ua'u* are again using Mauna Kea to nest. This was confirmed by use of a FLIR night survey to visually confirm *'Ua'u* on the Mauna, and daytime ground surveys performed by humans and dogs that found multiple burrows. Since these birds normally return to their burrow annually in an attempt to mate, these same birds can be expected next year. There was a cat in the area, and it is possible that more predators could be in the area. This was the justification for the predator proof fence, which will protect the *'Ua'u* burrows from outside predators as well as protect rare plant species in the same area as the burrows. This fence will be built over the coming months. Now that these burrow locations have been found, it provides an opportunity for research; satellite telemetry and GPS tagging could be used to track *'Ua'u*, as limited research has been done in that area. A last recommendation is to attempt to draw more *'Ua'u* into the area once the fence is built by using mating calls and lights.

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