

# **Saving Hawai‘i Island’s Remaining Forest Birds**

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TROPICAL CONSERVATION BIOLOGY AND ENVIRONMENTAL SCIENCE  
PROFESSIONAL INTERNSHIP TRACK

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## Abstract

This internship was in conjunction with the Hawai‘i Natural Area Reserve System (NARS) endangered forest bird team to assist with the 2019 Palila release at Pu‘u Mali Restoration Area and several other ongoing conservation projects. The Palila (*Loxioides bailleui*) is an endangered Hawaiian honeycreeper that is currently only found on the southwestern slope of Mauna Kea at elevations above 6,500 meters. Captive birds were released in the spring and summer of 2019 to the Pu‘u Mali Restoration Area, on the northern slope of Mauna Kea, with the end goal of creating a second sustainable population for the endangered Palila. Post release monitoring techniques and predator control methods were used to give the released birds the best shot at surviving in an area that has not housed Palila in roughly two decades. The Palila is just one of the many Hawaiian forest birds that are suffering extreme habitat and population loss in wake of global climate change. The work described in this report showcases a few of the conservation efforts and strategies that are currently ongoing to save the remaining native Hawaiian forest birds.

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**List of Abbreviations**

TCBES - Tropical Conservation Biology and Environmental Science

NARS - Natural Area Reserve System

MKFRP - Mauna Kea Forest Restoration Project

KBCC - Keauhou Bird Conservation Center

MBCC - Maui Bird Conservation Center

## Introduction

### *Background*

Hawai‘i is an island chain in the middle of the Pacific Ocean that is famous for its endemic honeycreepers. Millions of years ago a handful of terrestrial birds made it to the world’s most remote archipelago and radiated into the unique birds that can be found now and during initial colonization (Pratt 2005). Since the arrival of Polynesians and Europeans, a total of 95 bird species or subspecies have gone extinct due to human pressures (James & Olson 1991, Pratt 2009). Today there are 21 remaining native forest bird species that are experiencing greatly diminished populations and contracted ranges, with 12 being threatened or endangered (Paxton et al. 2018). The arrival of humans 1,500 years ago brought unintended challenges and dangers that all birds in Hawai‘i are struggling to rapidly adapt to.

The Palila (*Loxioides bailleui*) is an endangered finch-billed honeycreeper found only on the island of Hawai‘i. Historically found on the islands of Kaua‘i and O‘ahu, Palila are currently only found in subalpine, dry-forest habitats on the southwestern slopes of Mauna Kea (Banko et al. 2002). Although previous analysis shows that population numbers have fluctuated historically, they have shown a steady decline since 2003 (Genz et al. 2018). This niche species feeds almost exclusively on the unhardened seeds and flowers of the māmane tree (*Sophora chrysophylla*), which is only found in dry montane and subalpine habitats (Banko et al. 2013). Heavy reliance on a single food source has put the Palila at risk due to changes in māmane abundance.

The Palila, one of the rarest birds in the world with less than 1,500 individuals remaining, is at risk of extinction due to many factors influencing their population decline (Genz et al. 2018). Three current factors that are driving their numbers to extinction are habitat loss due to grazing of feral ungulates, introduced predators, and climatic changes such as drought and fire, all of which are being controlled for at the 2019 captive Palila release site, Pu‘u Mali.

Located on the northern slope of Mauna Kea, Pu‘u Mali falls within the Palila’s historic range (Figure 1). The 5,000-acre restoration site and surrounding mountain slopes are characterized by dry māmane-koa forest which is critical to Palila survival (Jacobi 1990). The northern side of Mauna Kea receives roughly 875 mm of rainfall annually, slightly higher than the core habitat on the southwestern slopes (Frayne 2007). The Pu‘u Mali release site was found to support abundant pod producing māmane trees with the potential to sustain a viable Palila population (Hess et al. 1999).

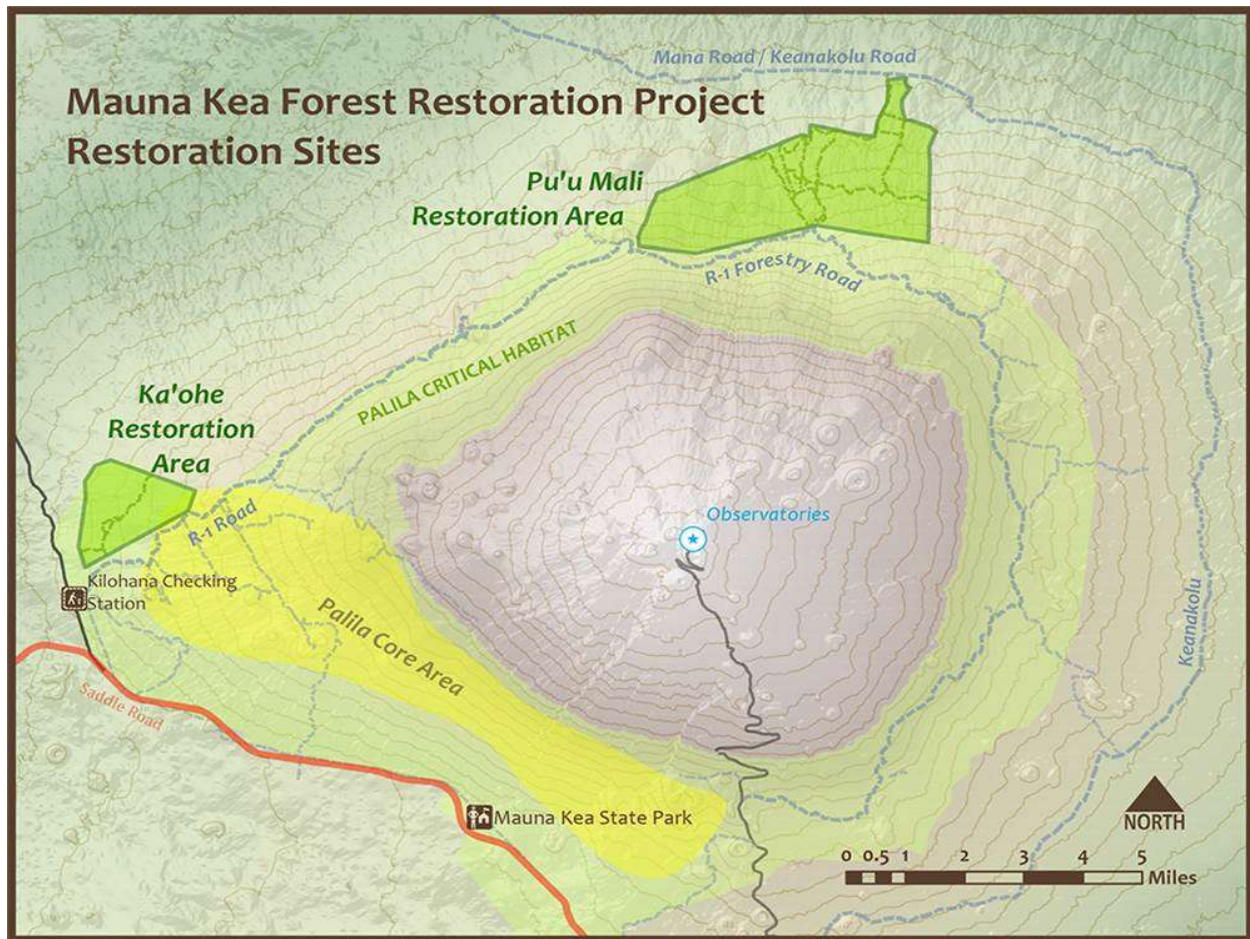


Figure 1. Map from the Department of Land and Natural Resources (Forest Restoration) showing restoration sites on Mauna Kea. The core Palila area where 99% of the remaining Palila can be found is shaded in yellow and the areas with critical habitat that can support Palila is shaded in green.

Captive breeding is an innovative tool that is used to save many species around the world (Philippart 1995). The newly improved habitat on the north slope of Mauna Kea was chosen for the release of captive bred Palila from Keauhou Bird Conservation Center (KBCC) and Maui Bird Conservation Center (MBCC) to create a second Palila population. The goal is to create a safeguard for the species in the case of a catastrophic climatic event. With new technology through captive breeding and increased conservation efforts from multiple organizations, there is hope that we can help the keystone species of the māmane forest for generations to come.

One of the organizations that are doing their part to help save the Palila is the Hawai‘i Natural Area Reserve System (NARS), who I worked with to complete my professional internship. The statewide system comprises 21 reserves with 7 of them being located on the island of Hawai‘i. The goal of these state lands is to preserve in perpetuity specific land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites (Natural Area Reserve System, 2015). The reserves are comprised of a

diverse range of ecosystems ranging from marine and coastal environments to lava flows, tropical rainforests, and even alpine deserts.

### *Purpose of Internship Project*

As the climate continues to rapidly change and Earth's ecosystems are forced to adapt or suffer, the need to study the resulting consequences increases. With this being said, Hawai'i is no different, and climate change is currently having major impacts on many of the native bird species. One of the impacts of rising temperatures is native bird habitat ranges are becoming isolated to higher elevations to avoid diseases spread by mosquitoes, who cannot survive in colder climates. To better understand how to help and solve many of the challenges faced by Hawai'i's native birds, more research on the declining populations is required. This is related to another major problem faced by the conservation field in the lack of funding and staffing. For the amount of work that needs to be done to better understand these changing ecosystems, there is a lack of money to support the necessary work force. This internship allowed me to assist with multiple projects that were in need of as much help as they could get and proved to be critical to their overall success. In return, I was able to develop the necessary skills to go forward and make future contributions to the conservation field.

### **Graduate Student Learning and Professional Development Objectives**

#### *The graduate student learning objectives:*

- Develop relationships with professionals and aspiring individuals in the conservation field
- Network with conservation professionals in Hawai'i
- Gather knowledge and experience working in a different environment and section of the world
- Improve professional and technical writing
- Improve oral communication and presentation skills
- Develop a professional Curriculum Vitae and cover letter

#### *The professional development learning objectives:*

- Gather experience working with endangered species
- Band birds
- Tracking birds with handheld radio telemetry
- Remote fieldwork and GPS utilization
- Navigate difficult terrain
- Operate and manage new app-based data collection software
- Develop outreach and education techniques
- Adhere to strict work protocols
- Conduct field work individually and in groups

## **Internship**

### *Role*

My role for this professional internship was to work with the NARS endangered bird team and partner agencies to gather experience working in Hawai'i's conservation field while providing much needed help on multiple ongoing projects related to studying and protecting Hawai'i's native bird species. The majority of the internship was focused on Palila conservation, working alongside NARS, the San Diego Zoo, and Mauna Kea Forest Restoration Project (MKFRP) to establish a breeding population of Palila in their former range on northern Mauna Kea. Project assistance consisted of but not limited to, Palila husbandry, post release monitoring via radio telemetry, and predator control. As a result of working with NARS I was also able to obtain experience working with other endangered avifauna, conducting count surveys and mist netting wild birds.

### *Responsibilities*

Throughout this internship I was tasked with many responsibilities that were related to my role within each project. Some of the major responsibilities that I was tasked with was tracking birds via radio telemetry, aviary husbandry, banding, and predator control. Some of these responsibilities were similar to the tasks assigned to other interns and employees while many of the responsibilities went beyond the standard duties. I was often assigned with entering and proofing data from weekly Palila tracking to ensure electronic data forms were recording properly and correctly. When new groups of volunteers came to the field, I was often tasked with training them how to track with radio telemetry gear, due to the knowledge and experience I gained throughout the internship.

## **Description of Deliverable and Requirements**

### Deliverable - 2019 Pu'u Mali Palila Release Summary

My deliverable was the creation of a post release report in collaboration with other staff members and project collaborators. It was created with the goals of informing people about the release process, giving detailed reports about each captive bird and informing agencies attempting any future releases. The idea to collaborate on a written report was chosen because I would be able to add important information due to the fact I was in the field every week and it would give me valuable scientific writing experience that would benefit me in the future.

### Requirements

#### *I will engage in meaningful and challenging work*

The TCBES professional internship program has allowed me to work with conservation professionals from all over the state working on numerous projects. The main project undertaking that I was able to assist with and collaborate on was the 2019 Palila release at Pu'u Mali. This project allowed me to gain hands on experience working with an endangered bird as well as professionals who have years of experience in the conservation field. At the end of the

project, a comprehensive report was created to aid in any future work with wild Palila or releases of captive birds.

*I will engage in a mentored experience*

Being able to intern with NARS and learn from experienced conservationists such as my mentor, Alex Wang has allowed me to watch and learn what it takes to be a professional in the conservation field. I was able to learn and absorb all the knowledge and skills that Alex had to offer, then apply it in the field through the different aspects of my internship.

*Parameters of the agency's purview*

Much of my internship was dependent on knowing laws and regulations since most of the species I was working with were endangered or captive. These strict rules and regulations made my work very detailed oriented and required me to follow unique protocols. I was also able to sit in on multiple Palila working group meetings that consisted of personnel from multiple agencies that discussed topics related to the current Palila release. This allowed me to experience the relationships that are required between multiple organizations to complete a conservation project such as the Pu'u Mali Palila release.

*Advocacy or outreach experience*

My internship has allowed me to have ample opportunities to teach and educate multiple groups about the endangered birds that I have gotten to work with. Much of my summer working with Palila consisted of teaching volunteers and groups that came to Pu'u Mali about the Palila and the different techniques we used to care for and study them. With the banding experience, I was able to assist Alex Wang as he taught a school group about the basics of banding birds and its importance. I was also able to present my field work with the 2019 Pu'u Mali Palila release at the 2019 TCBES Symposium.

## *Timeline*

	January - April 2019	May - July 2019	August - November 2019	December 2019- May 2020
Predator Control	X	X		
Native Bird Surveys	X			X
Aviary Husbandry		X		
Radio Telemetry		X	X	
Banding			X	X
Data Management		X	X	X
Plant Phenology		X		

Table 1. General timeline of major undertakings of internship project duration.

## **Approach**

### *Strategies and Methods for Each Major Undertaking of the Internship*

#### Pu‘u Mali Palila Release

##### *Aviary Husbandry*

Prior to the release of Palila at Pu‘u Mali, a soft release technique was used to allow birds proper time to acclimate to a new environment. A soft release is when animals are housed in a temporary enclosure prior to release in a new environment (Richardson et al. 2013). This was chosen over a hard release, where animals are brought to a new site and released immediately (Richardson et al. 2013) because captive Palila had been housed in Keauhou Bird Conservation Center (KBCC) and Maui Bird Conservation Center (MBCC) for upwards of ten years. The soft release acclimation period allowed Palila to familiarize to a new environment with different climatic factors such as weather and temperature. During the acclimation period, myself and San Diego Zoo staff members were tasked with maintaining Palila aviaries and completing daily observations. Each day, birds would need to be given fresh food and water as well as general

cleaning of the aviary. Food consumption was measured each day to determine how well the Palila were acclimating to the new environment. High food consumption levels were determined to be the best indicator of when Palila were ready to be released. Daily behavioral monitoring was also used to determine stress levels of birds and aid in determining when to release.

#### *Transmitter Attachment*

Prior to being released, each Palila was given one last in-hand examination after acclimating to the soft release aviaries. Each bird was weighed to ensure adequate health and determine if they were able to carry a backpack transmitter. After passing the examination, color bands were attached to identify each bird as well as the transmitter to track them post release. Transmitters weighed no more than 2 grams or 5% of the weight of each Palila (Figure 2). Each bird was then monitored for multiple days to ensure they were adjusting to the newly attached transmitter and ensuring it would stay on.

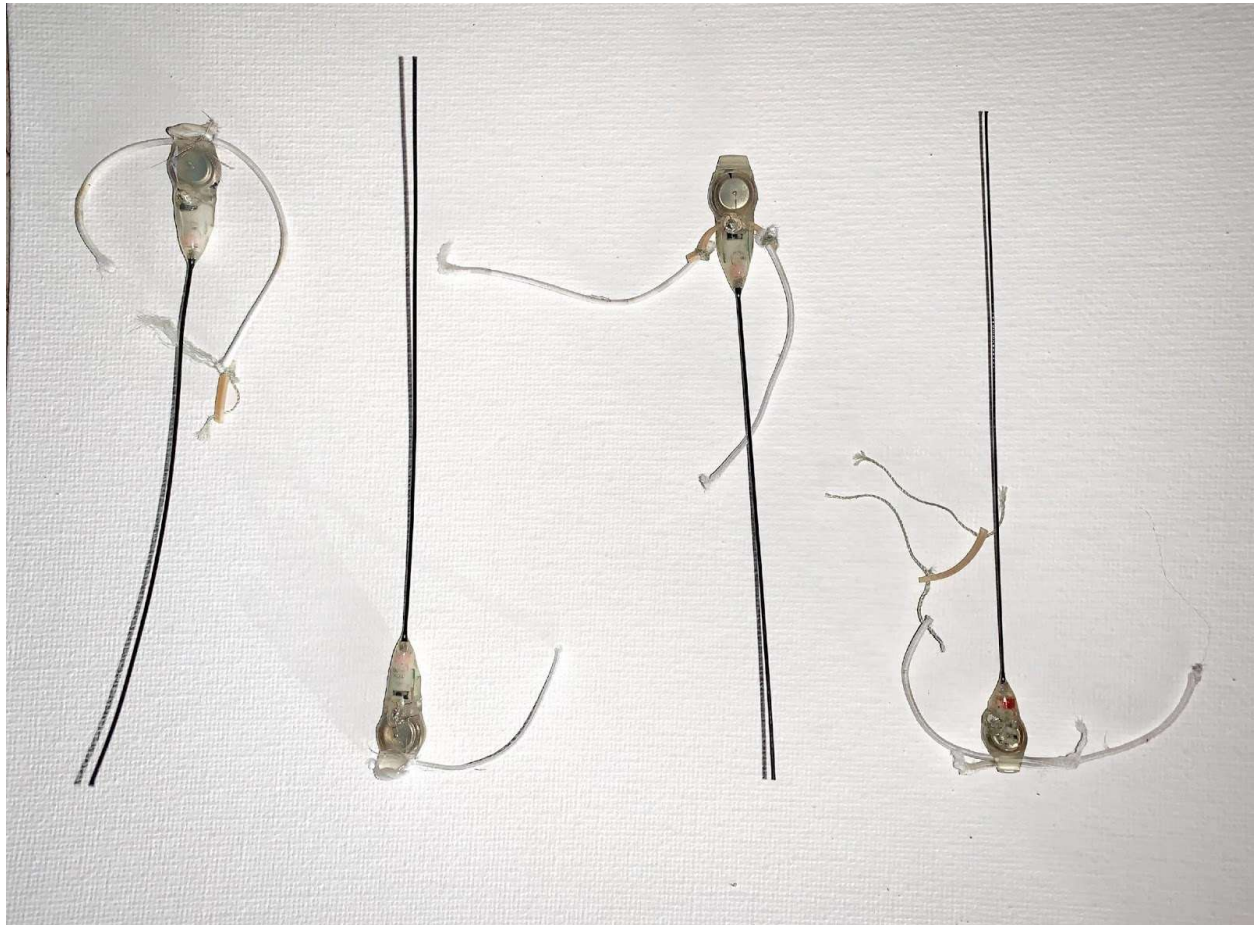


Figure 2. Multiple transmitter models of various weights that were attached to each Palila. Larger transmitters were used when for most birds due to extended battery life over smaller models.

### *Radio Telemetry*

The biggest undertaking of my internship was learning how to become an expert in tracking Palila with radio telemetry gear. Prior to the release, each Palila was outfitted with a transmitter that would emit a signal for several months. This would allow us to track their movements upon release. The small backpack harness was created to weigh 1-2 grams and ensure the extra weight would not inhibit their ability to survive. Upon release, a receiver with an antenna was used to obtain the signal from the transmitter and locate the bird. The distance from each bird is determined by the strength of the signal; the louder the beep, the closer the radio telemetry receiver is to the transmitter. The use of transmitters allowed us to find and observe released Palila each day, a task that would be almost impossible without this technology on the vast slopes of northern Mauna Kea. More information on each Palila and the findings from re-sighting observations can be found in the soon to be published report titled, Palila Release 2019 Summary.

### *Predator Control*

One of the main threats to high elevation Palila are introduced mammalian predators. Feral cats, mongoose, and rats have all been introduced to Hawai‘i island and have established a home on the slopes of Mauna Kea. No natural predators and an abundance of food has allowed populations to flourish and threaten native bird populations. To combat this, we used an array of traps to humanely control introduced predator populations at the release sites. The majority of trapping occurred with three different models that were aimed to control all three species. Larger predators such as cats and mongoose were targeted with Conibears and DOC 250 traps. Smaller predators such as rats were targeted with Good Nature traps (Figure 3). Spread out along various grids across the release site, weekly checks were required to remove anything caught and apply fresh bait.



Figure 3. Three different types of traps that were used to control non-native predators at the Pu‘u Mali release site. The left image shows a Good Nature that was used to target rats and mongoose.

The middle picture shows a Conibear which targeted larger mongoose and cats. The right image shows a DOC 250 trap that targeted rats and mongoose.

### *Native Bird Surveys*

Each year an annual survey is conducted on Mauna Kea in the core Palila habitat to record abundance and distribution data. This weeklong event is conducted by MKFRP and other partner organizations every winter around the beginning of February. The survey consists of dozens of people walking transects from the tree line at the top of Mauna Kea, 10,000 feet, to the end of the core habitat at roughly 7,000 feet. Each morning at sunrise groups of two people would walk the transect stopping at marked stations along the way to conduct 6-minute point counts. During each 6-minute count every bird that is detected is marked as well as its distance from the station. Each species observation and distance allow modeling to predict population abundance for the survey area.

### *Phenology Surveys*

Phenology surveys were also conducted on the main food source of the Palila, māmane. Phenology is a tool that is used to study the seasonal timing of life cycle events, such as the flowering and pod production of the māmane tree (Beaubien & Johnson 1994). This was an important task that needed to be completed both prior to the release and afterwards to ensure there was adequate food available at the release site. Marked transects with stations at different elevations were surveyed for the health of māmane trees, height, and number of pods and flowers on each tree.

### *Data Management*

One of the most important tasks from my internship was the daily data management that took place throughout the months of data collection. Upon release, data was collected each day on the Palila. The data needed to be proofed as soon as possible to fix any errors while everything was fresh on our mind. Using an electronic data collection app had its pros and cons as all you needed was a cell phone to record the necessary data. However, using electronics sometimes does not go as planned and gps coordinates can get thrown off due to cell service, therefore conducting data quality checks ensured that no mistakes that would be unfixable in the future. Regularly checking data forms also allowed us to make improvements to collection techniques to ensure we captured the best quality data as possible.

### *Release Summary*

A total of eight Palila were released into the wild over the course of the 2019 Pu‘u Mali Palila release, much lower than the originally proposed 30 individuals. The total number of released individuals was limited to eight, due to time constraints and many individual Palila not adapting to the release site. Of the released birds, two individuals survived for over two months with minimal human assistance showing that captive Palila can successfully survive in the wild. Through the use of tracking via radio telemetry, each bird was able to be re-sighted after release and observed to gather valuable data on dispersal and behavior. This information that was gathered is viewed as a major success and will go a long way to improving and learning from any future releases of Palila on Mauna Kea.

Throughout the release numerous challenges were experienced that were not originally anticipated to be a problem. The biggest problem encountered was a high predation rate on the released Palila. Of the 8 released Palila, we believe the cause of death for half of them was predation, mostly from native raptors. Numerous trap grids were set up throughout the release site to control for non-native predators such as rats, cats, and mongoose. However, during future releases a predator aversion training should be implemented to familiarize Palila that have been in captivity their whole life on how to avoid these dangers. Another challenge that was experienced was the large dispersal of Palila after release. The unforgiving terrain at Pu‘u Mali makes traveling large distances very difficult and slow going (Figure 4). This was experienced when trying to track and re-sight released Palila each day for the small field crew. Originally, supplemental feeding around the release aviaries was supposed to anchor the Palila and allow for easy re-sightings each day. This was found to not be the case as the Palila did not rely on any human assistance after being released and dispersed over several miles on the northern slopes of Mauna Kea. The last major challenge experienced was high stress levels by many Palila upon arriving at the Pu‘u Mali release site. Small passerine birds are known to exhibit high stress levels in captivity and Palila are no different. Of the 17 individual Palila that were brought up to Pu‘u Mali to be released, 9 had to be returned to KBCC due to exhibiting some sort of stress associated with the release process. In the future, this will be accounted for by reducing high stress situations by attaching transmitters during transportation process to reduce the number of times Palila need to be captured. Providing extra food during these high stress times can also be used in the future to increase comfort levels.



Figure 4. Image by Koa Matsuoka showing one of the many gulches and extreme lava rock terrain at the Pu‘u Mali release site.

With these challenges came many positive takeaways that will be used to aid future Palila releases and overall species knowledge. The first being that the infrastructure and framework for

future releases at Pu‘u Mali are in place. Three soft release aviaries were constructed and will be in place to use for many years as well as a guide made on the successes and failures that ensure success on future releases. A process to determine optimal time in soft release aviaries prior to release was found. Māmane consumption was found to be the best indicator that stress levels from transportation were minimal and Palila were becoming acclimated to the new environment. Lastly, an elastic transmitter harness was developed that could not be bitten off by the Palila. This new harness and knowledge learned from tracking Palila with telemetry gear will aid in data collection techniques of all captive avian releases in Hawai‘i.

## Pu‘u Maka‘ala

### *Banding*

Throughout the 18 months I was able to assist Alex and his staff with banding endangered forest birds in the Pu‘u Maka‘ala Natural Area Reserve. Located on the eastern slopes of Mauna Kea, Pu‘u Maka‘ala is one of the last places on the island that multiple endangered forest bird species can be found. The banding technique gathers information from different bird species using a series of mist nets to safely catch the birds and allow for safe removal. Nets range in sizes and heights to cover all parts of the forest and target different species. Measurements, weight, and blood samples are taken from native birds to better understand their morphology and test for diseases such as avian malaria and avian pox. Any endangered birds were then outfitted with transmitters that are used to better understand the movements and protect other individuals of the species.

### *Hawaiian Crow - ‘Alalā (Corvus hawaiiensis)*

Pu‘u Maka‘ala is also home to the release site for captive bred ‘Alalā into its native habitat. Due to my connections working with the San Diego Zoo Institute for Conservation Research on the Palila release, I was able to go out into the field a dozen times to gain experience working with one of the most endangered species in the world. I went out into the field with the field crew and worked alongside them with the daily routines of caring for this unique species. Tasks included tracking birds with telemetry devices, creating daily diets, observational data collection, and aviary construction for the 2019 release cohort. These tasks allowed me to build on many of the techniques I learned with the Palila release and gain a different perspective by practicing them with an extremely intelligent and complex bird species.

## Assessment Method to Evaluate Achievement

Assessment of internship was determined based on completion and effectiveness of tasks. Many of the responsibilities and duties given throughout the internship were difficult to attach an assessment method due to the variability and unpredictable nature of working with wild animals. The majority of evaluations were based on work ethic and eagerness to do what was needed to complete the day's work. Unpredictable work schedules and complications with daily work schedules often required long workdays from sunrise to sunset. The ability to adapt to any situation was critical to being able to work with other experienced staff members and complete many of the tasks that involved working with wild birds. A positive attitude and strong work ethic were key to working in a field where plans do not go according to plan.

Overall, the Pu‘u Mali Palila release, which made up the majority of my internship, should be thought of as a conservation success due to what we learned as a result. Even with the endeavor not going as planned and losing all the released birds, the data and information that was collected will be instrumental to the future conservation of wild Palila. With the passing of each bird and unpredictable movements of the released birds, plans were constantly shifting. My ability to adapt to the unpredictability that came along with working with animals was essential to the project's success. The only way to save the Palila and other endangered species is to push conventional boundaries and make difficult decisions. Without trying controversial methods such as releasing captive animals into new environments, we will not be able to learn and potentially save other species from extinction.

## **Outcomes**

### *Deliverables*

The main deliverable created for my internship was the 2019 Palila Report Summary with the help of other project collaborators. The creation of a project summary was intended to inform the public about the outcomes of the release and inform and aid organizations in the future about improvements that can be implemented. When working with endangered species that are at risk of extinction, every bit of information that can be used to aid future conservation is invaluable.

The report was written at the end of the project field work period to encompass each phase of the Palila release from time and behaviors in the aviaries to their well-being after being released. Detailed sections were created for each bird that was brought out to Pu‘u Mali and held in aviaries to note behaviors by birds that were relaxed and did well upon being released and those that seemed stressed and were unable to release. Observing details on birds' behaviors such as stress and food consumption levels was key to determining when birds were ready to be released. After being released each bird was tracked with a transmitter and monitored for at least 15 minutes each day the first week then every other day thereafter. This allowed us to gather locations for each bird every time they were seen. With this location information I created range maps for each bird to determine dispersal and possible interactions with other released Palila (Figures 5&6). The entirety of the report gives a detailed picture of the project process and offers suggestions on how to improve any similar projects in the future (the report will be available to the public once published and will be titled “Palila Release 2019 Summary”).

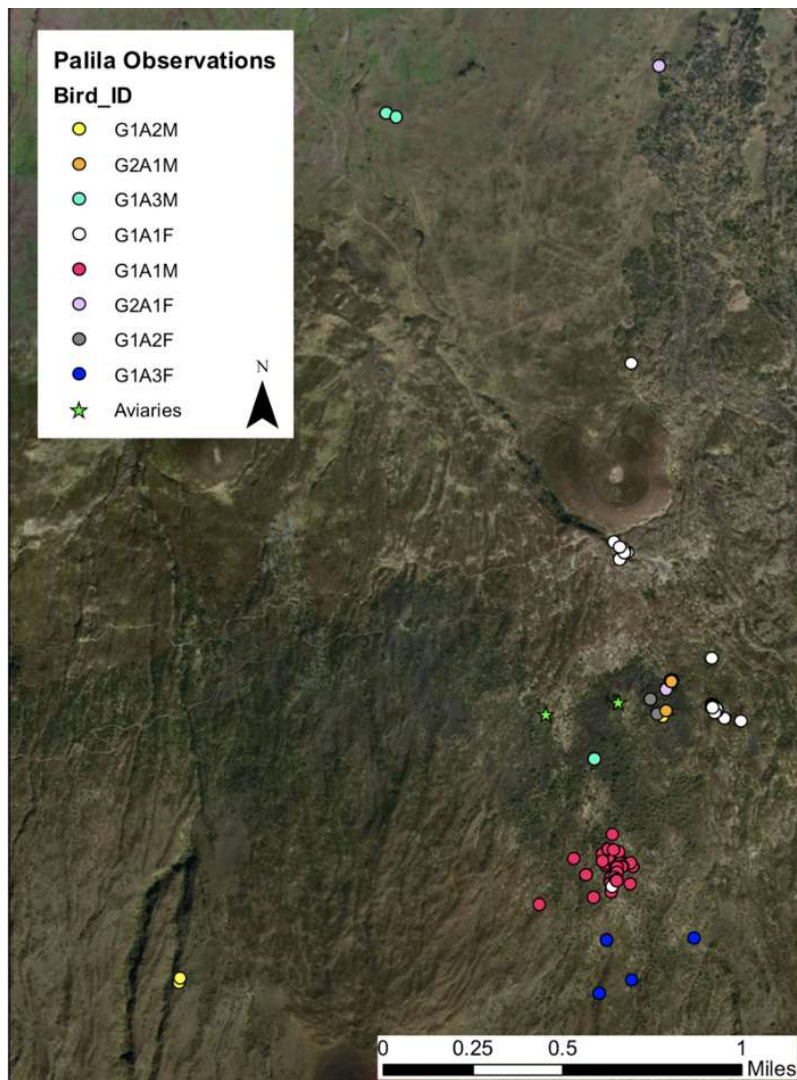


Figure 5. Map created to show re-sightings of each released Palila. Each released Palila is given a unique color identifier and is labeled with release cohort number, aviary number, and sex. Map can be used to determine dispersal distance from aviaries and possible interactions with other released birds.

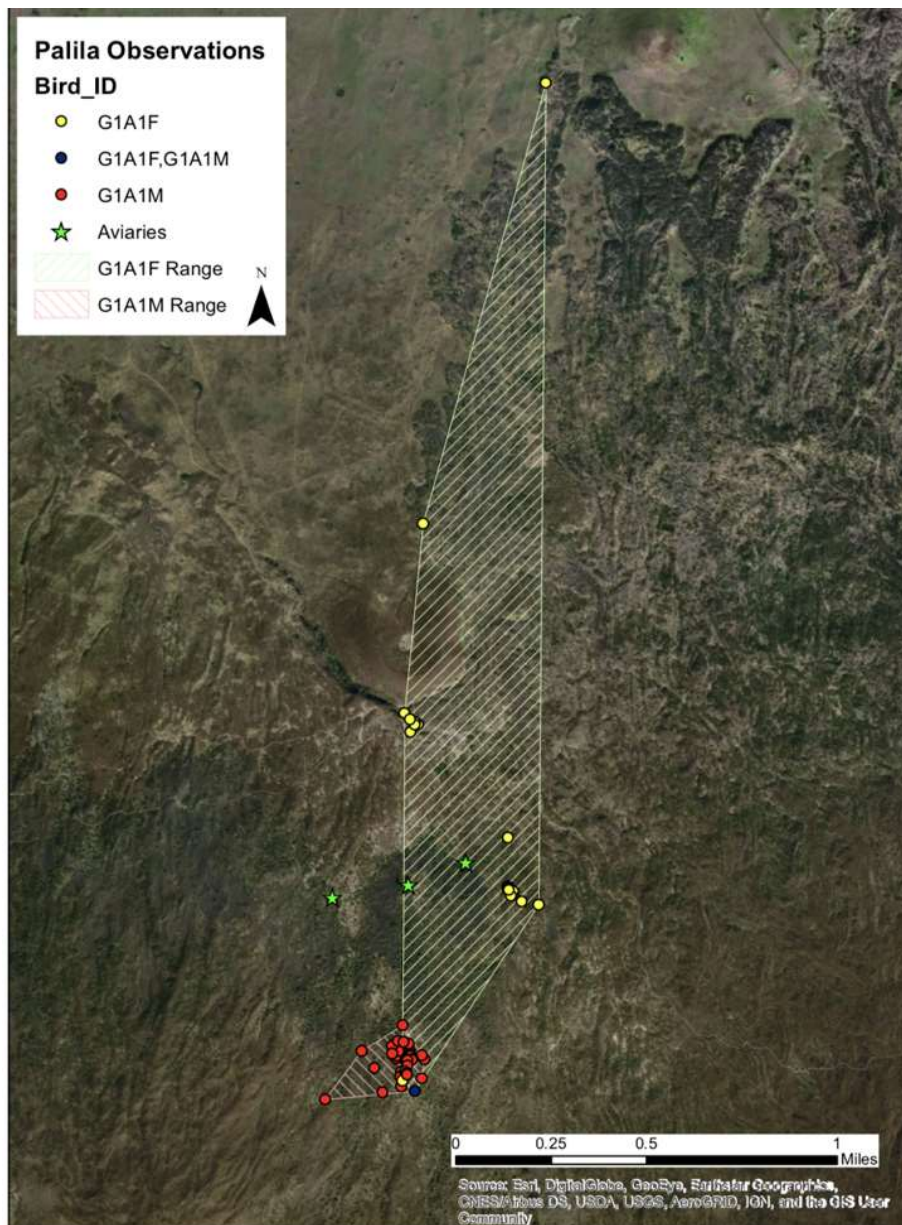


Figure 6. Map showing dispersal and approximate home ranges for aviary one pair that survived in wild for over two months. Aviary one male showed a strong site retention and did not venture far once establishing a territory. Aviary one female showed the opposite and was seen over multiple miles of the mountain side. After roughly two months apart post release, the female was observed interacting with the male in his established territory.

### *Evaluation*

Upon completion of writing the majority of the report with other staff members who spent the summer in the field working with the Palila, partner organizations were able to make changes, revisions, and recommendations for improvements. Their past experiences working with similar releases of different species and general knowledge of the endangered species in Hawai‘i

allowed us to make the report as descriptive and informative as possible. By getting the stamp of approval from numerous professionals who worked on previous projects that were focused on Palila research, I took it as the report was well constructed and ready to be circulated to anyone looking for information.

One of the goals of creating the report was to aid in planning future releases of the remaining Palila in captivity, whether at Pu‘u Mali or within the core population on southwest Mauna Kea. Using what we learned from the 2019 release and pairing it with the previous releases in the early 2000s, the idea was to generate the best possible plan to successfully release the last captive birds and give them the best chance to survive. With this document, the numerous agencies working with Palila conservation will be able to decide the best time and strategy to release the remaining captive Palila into the wild.

## **Discussion**

### *Benefits to NARS*

The professional internship track in the TCBES program is very beneficial to both the student and host organization. Students work alongside an established organization and learn what it takes to be a professional in the conservation field, while the host organization gets a hardworking, motivated graduate student. The partnership offers a unique opportunity to gain experience working with an agency on an established project and learn what it takes to become a professional in the conservation field. I believe my partnership with Alex Wang and NARS has opened the door for future TCBES students looking to work with birds in some of Hawai‘i Island’s untouched natural areas in the future.

Perhaps the most beneficial part of this partnership with the mentor organization was the 600 hours I was able to dedicate to the numerous projects I undertook throughout my internship, especially the 2019 Pu‘u Mali Palila Release. My time spent throughout the entire summer made the field work period run much smoother as the project had a tight budget and was understaffed. By being able to spend 40 hours each week up there took the pressure off other staff members having to spend longer weeks in the field or even leaving the birds alone for any period of time. This extra hand I was able to offer was very valuable in all aspects of my internship from the Palila release to the process of banding wild forest birds. Being able to offer my time to help out with multiple projects in general made them run smoother by taking pressure off other people with the help I could offer.

The last major benefit to the mentor organization was the outreach aspect I was able to provide. One of the greatest challenges that Hawai‘i Island’s native birds face is the lack of information that people have available. By spreading the word about our native birds and some of the amazing projects that are going on to save them is a major step in the right direction to gather support for their conservation. I was able to present at the 2019 TCBES Symposium at the University of Hawai‘i Hilo on the 2019 Pu‘u Mali Palila release to inform the public about something that isn’t shared too much outside of the conservation field. By sharing this project and the processes that were used during it helps garner interest and awareness for the protection of this endangered species.

## Conclusion

Throughout my two years in the TCBES program I have gotten the chance to broaden my horizons and realize my passions and future goals. By working in a different part of the globe, I was able to gain a new perspective on environmental conservation and the urgency that needs to be taken to protect our natural resources and everything that is part of it. Being able to work with numerous endangered avifauna has also allowed me to develop a passion for studying and working to conserve these imperiled species. Spending so much time around such rare species has made me develop a passion and future goal of working to protect declining species that are facing extinction during this time of climatic instability.

Working with Alex Wang and the whole NARS organization has cemented my passion for working with birds that I began to develop during my years of undergraduate studies at Juniata College. Being able to work so hands on with different species such as Palila, ‘Alalā and many of the native forest birds has allowed me to develop new skills such as radio telemetry and animal husbandry that will be critical for future use with endangered species throughout the globe. I was also able to practice existing skills in a new area such as banding and point surveys that will only enhance my current knowledge by practicing in a new area and learning from a different perspective. Working with NARS and many other partner organizations that work so hard to protect Hawai‘i Island’s declining native habitats and species has only motivated me more to use everything I have learned throughout my time in the TCBES program to protect declining avian populations and the ecosystems that they rely on.

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