

Dietary Analysis of Free-ranging Cats at Ka'ena Point, Hawai'i

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Abstract

Feral and free-ranging cats (*Felis catus*) are known to prey on a wide variety of native birds in Hawai'i. At Ka'ena Point Natural Area Reserve on O'ahu, cats were known to prey on nesting seabirds but the extent of predation by individual cats was unknown. We trapped nine cats immediately prior to the construction of a predator-proof fence during the Wedge-tailed Shearwater (*Puffinus pacificus*) nesting season at Ka'ena Point and analyzed their gut contents. Rodents and insects comprised the majority of prey for most cats, but three cats each contained the remains

of at least one Wedge-tailed Shearwater. We expect that the exclusion of cats from the area will increase the nest success and survival of native seabirds at Ka'ena Point.

Introduction

In Hawai'i, numerous studies have reported feral and free-ranging cats preying on native birds. These species include burrow-nesting seabirds such as Hawaiian Petrels (*Pterodroma sandwichensis*) (Richardson and Woodside 1954, Simons 1984, Hu et al. 1996), Newell's Shearwaters (*Puffinus newelli*) (Tenbruggencate 1982), and Wedge-tailed Shearwaters (*Puffinus pacificus*) (Smith et al. 2002, Winter 2003). The fossil record indicates that these and other Procellariiform birds were once abundant in the main Hawaiian Islands. These species are now almost entirely relegated to small offshore islets and steep

or remote areas of intact native habitat on the larger islands. Predation by introduced mammals is the main factor preventing colonies of native seabirds from recovering on the main Hawaiian Islands, and local extirpations of small colonies is often attributable to cat predation (Smith et al. 2002).

In 1991, following the exclusion of off-road vehicles from the area, a small colony of Laysan Albatross (*Phoebastria immutabilis*) began breeding at Ka'ena Point Natural Area Reserve. In 1994, Wedge-tailed Shearwaters began breeding in the area as well. Since then, the number of both species breeding at the site has grown – largely due to immigration from other areas (Young et al. 2009) – but observations of shearwater and albatross carcasses showing signs of cat predation

were common until the completion of a predator-proof fence in March 2011. As part of an effort to document effects of the fence on native and introduced wildlife populations, we dissected cats obtained from the area prior to construction of the fence and examined their gut contents to determine the extent to which cats were preying on seabirds at Ka'ena Point.

Methods

We obtained nine cat carcasses from USDA Wildlife Services that had been trapped at Ka'ena Point immediately prior to the construction of the predator-proof fence. These cats were trapped between 10/01/2010 and 12/15/2010, a period when Wedge-tailed Shearwater chicks were present in the area. All cat carcasses were frozen until dissection. To document and identify

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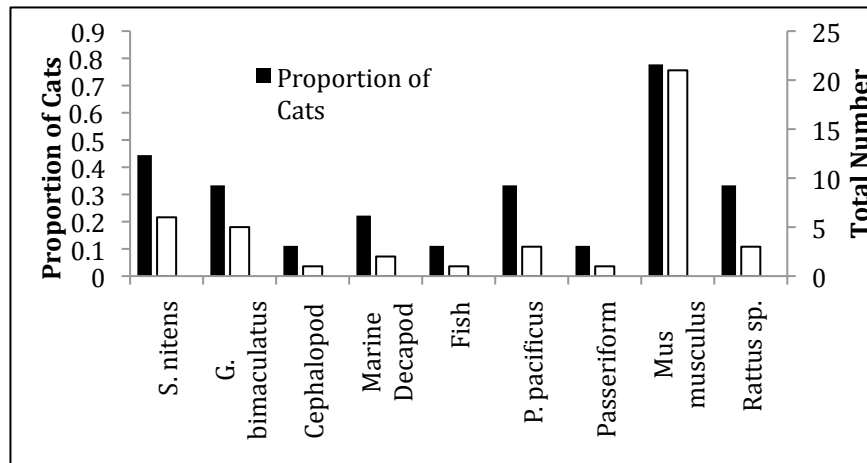


Figure 1. Proportional occurrence of prey items and total prey items documented in the digestive tracts of nine cats collected at Ka'ena Point, Hawai'i, USA.

prey items, we removed the entire digestive system from each cat and examined the contents. We cut the stomach along the concave surface and slit open the entire digestive tract to ensure that all contents were removed. Ingested material was placed on a 2mm x 2mm screen and gently sprayed with water and manipulated with forceps to reveal all undigested prey items. Identifiable remains were sorted by general taxon and placed in vials of denatured ethanol to be sorted into finer taxonomic groups later under a dissecting microscope. Minimum numbers of each taxon were calculated based on numbers of identifiable body parts (mouthparts, incisors, large bones, etc.). All anthropogenic material found in the digestive tracts was described and recorded. We also recorded the number of tapeworms recovered from digestive tracts and counted large ulcers present in the stomachs of some cats. Small amounts of

of clear plastic bag. All but one of the cat samples had at least two tapeworms present in their digestive tract (mean 6.56, maximum 22). Three cats had two large stomach ulcers each. These cats also had the largest numbers of tapeworms (22, 17, and 5 respectively). Red parasitic roundworms (Phylum Nematoda) were observed protruding from one of the ulcers in the stomach of the cat with 17 tapeworms.

Discussion

Documentation of three Wedge-tailed Shearwater chicks inside the stomachs of cats adds to the large and growing body of knowledge indicating that feral and free-ranging cats pose a significant threat to seabirds and their young (Smith et al.

Cat	Gray bird grasshopper	Med. Field cricket	Squid	Marine Decapod	Fish	Wedge-tailed Shearwater	Unidentified Passeriform	House mouse	Rattus sp.
1								2	
2	1	2		1		1			1
3					1			1	1
4	3							1	
5									
6		1	1			1		2	
7	1	2		1			1	9	
8						1		1	
9	1							5	1

Table 1. Minimum number of individuals present in the digestive tracts of nine cats collected at Ka'ena Point, Hawai'i, USA. All insect material was either Mediterranean field crickets (*Gryllus bimaculatus*) or gray bird grasshoppers (*Schistocerca nitens*).

unidentifiable fecal material were removed from the large intestines of all cats for future *Toxoplasma gondii* screening.

Results

Of the nine cat digestive tracts sampled, eight contained food items. House mice (*Mus musculus*) were the most common food item (minimum 21 individuals in total) and occurred in the highest proportion of cats (78%; Table 1, Figure 1). Rats (*Rattus sp.*) occurred less frequently (33%, three individuals in total). Insects were relatively common, occurring in 56% of samples. All insect material was identified as belonging to either Mediterranean field crickets (*Gryllus bimaculatus*) or gray bird grasshoppers (*Schistocerca nitens*), both of which are commonly observed at Ka'ena Point. Three cats (33%) contained the remains of Wedge-tailed Shearwaters. One cat also contained the remains of a small songbird, possibly a Japanese White-eye (*Zosterops japonicus*).

Surprisingly, remains of several marine species including at least one small fish, one squid, and two decapods were also observed (Table 1).

The digestive tract of two cats contained anthropogenic material. The first contained large portions of a white latex glove with the entire cuff intact. The second digestive tract contained a 10 cm loop of monofilament fishing line and a 1.5cm x 3cm piece

(2002, Bonnaud et al. 2010, Medina et al. 2011). With the completion of the Ka'ena Point predator-proof fence and the subsequent removal of cats and all other introduced mammalian predators, we expect to see increased nest success and survival of Wedge-tailed Shearwaters. Although we did not dissect any cats collected during the Laysan Albatross breeding season, we expect that this species will also experience increased nest success as there is evidence that cats also prey on the chicks and eggs of albatross.

Our finding that rodents were the most common prey items in free-ranging cats is consistent with similar studies in undeveloped areas across Hawai'i (Amarasekare 1994, Snetsinger et al. 1994, Mostello 1996, Smucker et al. 2000). Moreover, the large proportion of rodents in the cats' diets suggests that they had the potential to facilitate hyperpredation by cats on shearwaters at Ka'ena Point. In hyperpredation, the presence of a predation-adapted prey species with a high intrinsic rate of increase, such as rodents, can lead to increased abundance of an introduced predator species by providing a stable food source, thus increasing predation on naïve native prey species (Courchamp et al. 1999, Courchamp et al. 2000, Zhang et al. 2006).

The high frequency of insect material we observed

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(56%) was similar to that in other cat diet studies in Hawai'i (Amarasekare 1994, 46%; Mostello 1996, 67%; Smucker et al. 2000, 68% and 47%; and Hess et al. 2007, ~45% and ~60%). This result reflects the fact that cats are obligate carnivores with high protein demands, and insects are often an abundant source of protein. However, our observed value was higher than that reported by Snetsinger et al. (1994) who found insects in only 17% of cat scats. This low number can be attributed to low insect abundance in areas above 2000m elevation where those samples were collected.

The presence of two marine decapods and squid sucker rings in cat stomachs is noteworthy. Smucker et al. (2000) also found remains of marine invertebrates in 5 of 28 cat scats collected on Kaho'olawe but did not indicate which taxa were found or address their origin. Hess et al. (2007) noted that on Kaho'olawe 86% of 15 cats sampled had invertebrate remains in their digestive tracts, some of which were marine invertebrates of suspected intertidal origin. In our study, the squid sucker rings and decapod tissues appeared to be of pelagic origin. The squid sucker rings and one of the decapods were found in digestive systems that also contained shearwater feathers and bones, suggesting that these items were initially ingested by shearwaters that were subsequently preyed upon by cats. Interestingly, one of the marine decapods did not occur in conjunction with shearwater remains. It is possible that the decapod remains were simply retained longer in the digestive tract than other material associated with shearwater predation because of the large size and relative resistance to digestion of the decapod exoskeleton. Alternately, the cat could have ingested the decapod while scavenging material regurgitated by a shearwater or discarded fishing bait. Scavenging on discarded anthropogenic materials has been documented in feral cats, and in some cases they are a major component of their diet (Hutchings 2003). It is unclear whether fish bones – which did not occur in conjunction with shearwater remains – indicate another shearwater kill, foraging in the intertidal zone, or scavenging of shearwater-regurgitated material or discarded fishing bait. Regardless, this appears to be the first record of fish in the diet of free-ranging cats in Hawai'i.

The presence of anthropogenic material in two digestive tracts was not surprising, as cats have been observed in close proximity to a dumpster near the northern access to Ka'ena Point. Additionally, fishing is common at Ka'ena Point and a cat could easily ingest discarded or lost fishing tackle along with residual bait. The ulcerous lesions observed in 3 of 9 cat stomachs and tapeworms found in 8 of 9 digestive tracts serve as additional indicators of the poor health of free-ranging cats in the area. Examination of fecal samples collected from these cats will provide further insights into their health and will help assess the potential risk they may have posed to native wildlife – including the endangered Hawaiian monk seal – as reservoirs of the parasite *Toxoplasma gondii*.

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RESEARCH NOTES: The Kipuka Project

Working to understand the threats to one of the most imperiled bird communities in the world

After a 45 minute drive from Hilo up the Saddle road that bisects Hawaii Island between its two largest volcanoes, Mauna Loa and Mauna Kea, we finally arrive at our field site. I look out across the striking landscape of black lava twisted and piled into impossible shapes, flecked with patches of tiny pink flowers and interrupted by large islands of green forest that the lava flow missed. Native Hawaiians call these naturally created forest patches “kipuka.” The sun is rising slowly above the heavy cloud layer below us, and as the clouds change color from pink to orange I am once again reminded why it is that I, certainly not a morning person, get up at 4:30 a.m. five days a week. Not everyone gets to work in such a unique and beautiful landscape, and with some of the most threatened birds in the world.

I am here in Hawaii as a postdoctoral researcher on a large, National Science Foundation-funded project obtained by Drs. Tadashi Fukumi of Stanford University, Christian Giardina of the Institute of Pacific Islands Forestry in Hilo, Dan Gruner of the University of Maryland, and David Flashpohler of Michigan Technological University. The project seeks to understand the impacts of forest fragmentation and invasive rats on native food webs. The kipuka were once part of a vast apron of forest, until eruptions in the mid-1800s sent fingers of lava down the volcano. When formerly contiguous forest is fragmented, the species that remain often face new challenges, such as obstacles to dispersal and movement, which can lead to reduced survival and reproductive success. In fact, habitat destruction, invasive species and disease are the three main threats to the remaining native Hawaiian flora and fauna. This kipuka landscape presents us with a great study system to examine two of those main threats: invasive species and habitat fragmentation.

Our 500 ha field site includes 34 kipuka ranging in size from 0.01 to 12 ha. During the summer of 2011, the first year of our work, non-native rats were trapped out of half of these kipuka using 25x25 m grids of baited snap-traps. These traps must be re-baited every two weeks for the duration of the five year project, allowing us to compare food-webs in the control (rats not removed) and removal kipuka. Since the kipuka are all roughly the same age, at the same elevation, made of up the same plant communities and surrounded by the same lava matrix, we can be confident that any differences we might observe in the food webs are due only to the factors we are interested in: kipuka size, isolation and rat presence.

“Food web” is just a fancy term for who eats whom in an ecosystem—in this landscape leaves in the forest canopy are eaten by arthropods such as caterpillars, which are eaten by other arthropods like spiders; birds eat both caterpillars and spiders as well as plant material like fruit and flower nectar. When a generalist predator like the black rat is introduced into this system, any and all levels of the food chain can be affected. Black rats eat seeds and seedlings, fruit and nectar, caterpillars and spiders, and will even eat the eggs and young of birds if they can find them. Each member of our team is tasked with determining what impact fragmentation



An `Iwi that the team captured in one of their mist-nets. Photo by Amanda Uowolo.

and invasive rats have on different parts of the food web. My advisor, Dr. David Flashpohler, and I are focusing on the native birds. In our field site the most common species are the `Apapane, `Iwi, Hawaii `Amakihi, and `Oma`o; although there are a few pairs of Hawaii `Elepaio and even several endangered `Akepa, Hawaii Creeper and `Akiapola`au.

Since we know that rats will eat birds' eggs and chicks if they find them, David and I hope to gain insight into the scale of rat impacts on the nest success of the native birds in the kipuka. We also want to know whether factors such as the size of the kipuka or the height of the nest influence nest success. Early work on the project by Dr. Tad Fukami and Devin Leopold revealed that although rats climb trees, they show up less often the higher you get in the canopy. Tad and Devin placed tracking tunnels baited with coconut on the ground and at 6 m and 12 m heights in trees in each kipuka. Each tunnel had an inkpad and white paper, so that if a rat went in for the bait, it would be forced to leave its footprints. The tracking tunnels on the ground and at 6 m showed a lot of rat activity, while the tunnels at 12 m had far less. This suggests that birds that place their nests high in the canopy of tall trees probably face less risk of predation from rats. Most of the native birds nest in the canopy, and larger kipuka generally have taller trees. Thus, we suspect that if rats are a main source of nest failure, nest success should be higher for higher nests and for nests in larger kipuka.

Rats could also be influencing native birds in a more indirect way. Although many endemic Hawaiian birds feed largely on the nectar of flowers, all of the native birds supplement their diet with arthropods. This is especially true

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during the birds' breeding season, which can last for up to six months of each year. During this time, the birds must increase their intake of arthropods to secure enough protein and fat for egg production and to feed to their fast-growing nestlings. Rats also eat arthropods and so might be competing with native birds for this key food resource. Drs. Erin Wilson and Dan Gruner, along with Devin Leopold, are using an elegant experiment to determine how much of an impact rats and birds have on the kipuka arthropods. Erin and Devin climbed multiple trees in each kipuka to secure bird-excluding netting around individual tree branches. The arthropods on the netted branches will be free from bird predation, and over time the arthropod abundances in these enclosures can be compared to control branches with no netting in both rat-removed and control kipuka.

Today, our tasks are to monitor some nests that we've already found, try to locate new nests, and capture birds in fine nylon mist-nets. I am fortunate to have an experienced crew of eight field technicians who are more than capable of carrying out all of these tasks. As we scatter across the landscape to our various duties, I set off for an 'I'iwi nest called "DR87" named for the initials of the crew member who found it and the number of the nest they were on. My GPS leads me deep within our largest kipuka, and I scramble over giant treefalls, around tree ferns four meters tall, up and down muddy slopes and through prickly aka plants before finally arriving at the pink flag marking the best spot from which to view the nest. The native birds camouflage their nests extremely well, weaving small sticks and tree fern hair into the leaves of ohia branches high in the canopy until the nest is nearly invisible. Only the most skilled of my field crew can find these nests, after hours of carefully watching the birds' behavior.

I have to use the compass direction given and the hand-drawn sketch of the nests' location to spot the nest, and then I sit down to wait and watch. The nests are usually too high to allow us to use a mirror on a pole to see into them, and so we must rely on parental behavior to determine what is going on at each nest. We check each nest every 3 to 5 days, waiting up to 1 hour to see if the adults visit to incubate or feed nestlings. We keep track of how long each nest has been active and how old the nestlings are, so that we can predict the date they will fledge from the nest. If they reach that stage and disperse from the nest, it is considered successful; if, however, we observe no activity three times in a row at a particular nest before the fledging date we assume that it has failed. I am lucky at this nest, and after only 10 minutes an adult 'I'iwi visits the nest quickly with food for the nestlings.

My next task is to meet the banders and help them to extract birds from the mist-nets, fine nylon nets that birds don't see as they move through the forest. When a bird hits a net, it falls gently into one of the pockets in the net, and hangs immobile until we take it out. We check the nets every 15 minutes to make sure no bird is in the net too long, and injuries are extremely rare. Once we have a bird, we place it in a cotton bag to reduce stress and take it back to the banding station. At the banding station, we place a metal numbered band and three

colored bands on the birds' legs, take measurements of the bill, wing and tarsus, and collect a tiny blood sample. The color band combination is unique for every bird we catch of a particular species, so that later we will be able to recognize the individual just by sighting it through binoculars. To date, we have banded roughly 1,500 birds over two breeding seasons. From the information we collect on individual birds and the locations in which we resight them, we can estimate annual survival and movement probabilities within the fragmented landscape.

Our mist-netting poles are made of galvanized electrical conduit pipe, which is very heavy, and the hardest days are when we have to sling these poles on our shoulders and move them across the jagged and sometimes slippery lava from one kipuka to another. We open the nets for two days in each kipuka and then move to the next one. Thankfully, today is not a moving day, and, unencumbered, I quickly traverse the lava matrix and meet up with the crew. Because most Hawaiian forest birds spend their time in the tall forest canopy, we use double- or even triple-high mist nets to reach a height of 25 feet. Once in the kipuka, we search for a natural net lane in the forest and two people work to thread the net over the poles and raise and secure the poles with guy ropes. A rope and pulley system is used to raise the net, and lower it when a bird is caught. I arrive just in time to find an 'I'iwi in one of the nets. As I gently remove it I admire its beautiful scarlet color and deeply decurved bill that evolved over time to exploit the nectar of several species of decurved lobelia flowers. As I walk to the banding station I take time to admire the majestic tree ferns and delicate lehua flowers, and am thankful once more that some native Hawaiian forest has been spared from development and agriculture.

Science gives us a systematic approach to gathering information about the natural world and helps us understand the complex details of living ecosystems. We hope that our research in the kipukas will yield new insights into how forest patch size and introduced rodents influence food webs and native birds. As conservation biologists, we also hope that this work will contribute to the conservation and even restoration of imperiled species and the ecosystems that support them. Like all scientists, we share what we learn in publications and talks at professional meetings. Yet, we recognize that science can only provide information and that the ultimate fate of Hawaii's native biodiversity will be determined by whether it is valued by broader society.

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Palila v. Department of Land & Natural Resources - An Update

By Linda Paul, HAS President

In 1978, plaintiffs *Palila*, the Hawaii Audubon Society, the National Audubon Society, the Sierra Club, and Alan Ziegler filed suit in federal district court to protect the Palila's habitat from browsing feral animals. Since 1950, the Department of Land and Natural Resources (DLNR) had maintained populations of feral sheep and goats within a State Game Management Area on the upper slopes of Mauna Kea for sport-hunting purposes. Feral sheep and goats were first introduced to the Island of Hawaii in the late 18th century by Captain Vancouver. Unfortunately, the Management Area included most of the Palila's critical habitat - the mamane forest. In 1960, the State also introduced mouflon, or Mediterranean big horn sheep into the forest. The Palila is totally dependent on mamane as a food source. In 1967 the Palila was listed as an endangered species.

The lawsuit was nationally historic for at least two reasons: 1) it was the first and last time a federal court decided a case in which one of the plaintiffs was a bird, and 2) it was the first time a federal judge ruled that destroying critical habitat amounted to a taking of an endangered species under the federal Endangered Species Act (ESA). In 1975, the U.S. Fish and Wildlife Service (FWS) named the Palila as one of the 10 "high priority species" whose "critical Habitat" should be determined "as rapidly as possible."

In 1977, the FWS designated the mamane-naio forest on Mauna Kea as the critical habitat of the Palila. By 1978, the mamane forest had been reduced to 10 percent of its historical range by browsing animals. The plaintiffs argued that maintaining a population of destructive feral animals in the Palila's habitat amounted to a "taking" of the Palila within the meaning of the ESA. Federal District Court Judge Samuel P. King agreed and ordered the State to adopt a program designed to eradicate the feral sheep and goats from the Palila's critical habitat and enjoined the State from taking any action which has the effect of increasing or

maintaining the existing population of feral sheep and goats in the Palila's critical habitat.

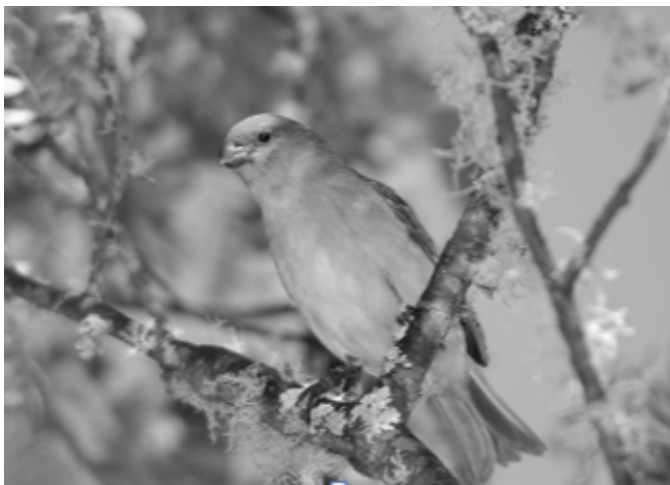
In 1986, the plaintiffs again filed suit because 1) the State had not eradicated the feral sheep and goats from the Palila's habitat, and 2) the State was maintaining a population of mouflon sheep in the mamane forest because it was not technically a feral animal and the plaintiffs wanted the court to amend its order to include mouflon. DLNR asserted that both mouflon sheep and Palila can coexist on Mauna Kea. Judge King found that the mamane is also the favorite food of the mouflon. ("The mamane is a legume and is therefore very tasty.") The Judge found that the ESA does not allow a "balancing" approach for multiple use considerations and further that multiple use poses problems in small fragile island ecosystems. The Judge required the State to eradicate mouflon from the Palila's habitat as well.

In 1998, the plaintiffs were back in court again because the State had still not complied with the court order to eradicate mouflon and feral sheep and goats from the Palila's critical habitat. This time the outcome was a federal consent decree and federal court Order that required the State to "conduct aerial-based hunts on a semi-annual basis to remove sheep and goats from the Palila's critical habitat."

In 2012, as a result of political pressure from the hunting community, the County of Hawaii adopted an ordinance prohibiting aerial eradication. Thereafter, the State suspended its aerial hunts for fear of county prosecution. On March 21, 2013, the plaintiffs joined the state's motion for declaratory and injunctive relief regarding Hawai'i County's ordinance prohibiting aerial eradication. On April 8, 2013, Federal Judge J. Michael Seabright, citing the Supremacy Clause of the United States Constitution, ruled that "an implemented consent decree and standing federal court Order applying a federal statutory mandate (here the Endangered Species Act, 16 U.S.C. § 1538(a)(1)(b) supercedes a city ordinance that prevents execution of that decree and court Order."

The court concluded that "if a person (such as a State Department of Land and Natural Resources employee, or a contractor working under specific direction of such a State employee) is specifically engaged in complying with the terms of the 1998 Stipulated Order, they cannot be prosecuted under (1) Hawaii County Code §§ 14-111, -112, & 1-10(a) or (2) HRS § 263-10." Judge Seabright ordered the State to comply with the 1998 Stipulated Order.

(See also *Elepaio*, Volume 68, Number 4, May 2008. Recent Surveys Indicate Rapid Decline of Palila Population, by David L. Leonard, Jr. Paul C. Banko, Kevin W. Brinck, Chris Farmer, and Richard J. Camp.)



A recent federal court decision ordered DLNR to resume aerial hunts to remove sheep and goats from critical habitat of the Palila, pictured above. Photo by Tom Dove.

Upcoming Field Trips, Volunteer Opportunities & Events

OAHU:

Paiko Lagoon Low Tide Reef Walk
Saturday, May 25th from 8:30 – 10:30am
& Saturday, June 22nd from 8am – 10am

Check out birds, limu, and sea creatures that may be at Paiko Lagoon! Meet at Kuli'ou'ou Road. Please RSVP to Alice with your name and phone number at 808-864-8122.

Goat Island Habitat Restoration

Saturday, June 8th from 8am – 1pm

Spend the day off the coast of Malaekahana Beach Park removing invasive species and planting natives to restore habitat for nesting seabirds. We will be walking to Goat Island from shore, so please wear reef safe shoes and clothing. Please RSVP to hiaudsoc@pixi.com or call 808-528-1432.

3rd Annual Shearwater Soiree

July--Specific date and location to be announced.

BIG ISLAND:

Seed Collecting and Palila Viewing

Sunday, May 19th at 9am
& Saturday, June 22nd at 9am

Join the Mauna Kea Forest Restoration Project and Hawai'i Nei Art Contest for an inspiring day collecting seeds for restoration efforts, bird watching, and sketching. Please note that a \$10 donation to the Contest is required for the afternoon guided Palila hike. Please RSVP to hiaudsoc@pixi.com.

MAUI:

Maui's Native Birds Presentation

Friday, May 31st from 8 – 9am

Join the Upcountry Rotary Club at their monthly meeting at Casanovas Restaurant in Makawao for a presentation on Maui's native forest birds, their ecology, the threats they face, and the research that is occurring in order to help them.

Presentation at the Hawaiian Islands Humpback Whale National Marine Sanctuary

Tuesday, July 9th from 6 – 7 pm

Learn more about native birds from this presentation by Laura Berthold, ornithologist for Maui Forest Bird Recovery Project. Location is just off of South Kihei Rd.

Pint Night at the Maui Brewing Company

Friday, June 28th from 6pm – midnight

Enjoy a pint and half the proceeds will go to help fund bird research. Located at 4405 Honoapiilani Hwy, at the Kahana Gateway Shopping Center, north of Lahaina.

Waikamoi Preserve Tour

Saturday, June 15th from 8am – 2pm

Waikamoi Preserve Tour with Maui Forest Bird Recovery Project. Meet at Hosmer's Grove in Haleakala National Park. Please bring lunch, plenty of water, binoculars, and hiking poles (if needed). Wear layers, rain gear, and good hiking footwear. Please RSVP to hiaudsoc@pixi.com or call 808-528-1432.

Hawai'i Audubon Society Membership Renewal/Donation Form

- \$25 Regular Member
- \$15 Student Member
- \$40 Family Membership
- \$100 Supporting Member

International Membership:

- \$28 Canada & Mexico
- \$33 Other

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Donations are tax-deductable and greatly appreciated.

Name: _____

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Phone: _____ Email: _____

- E-mail me the 'Elepaio Mail me the 'Elepaio E-mail me volunteer opportunities, updates, & field trips.

Thank you for your concern and commitment to protecting Hawaii's native wildlife and ecosystems.

Pay by credit/debit card at www.hawaii-audubon.org.

Please make checks payable to **Hawai'i Audubon Society**

Mail form and payment to 850 Richards St., Suite 505, Honolulu, HI 96813



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ELEPAIO - 73:3 - MAY/JUNE 2013

Calendar of Events

Sunday, May 19th & Saturday, June 22nd
Mauna Kea Seed Collecting and Palila Viewing

Saturday, May 25th & Saturday, June 22nd
Paiko Lagoon Low Tide Reef Walk

Friday, May 31st & Tuesday, July 9th
Presentation on Maui's Native Birds

Saturday, June 8th
Goat Island Habitat Restoration

Saturday, June 15th
Waikamoi Preserve Tour

July - Date to be announced
3rd Annual Shearwater Soiree

Tuesday, July 9th
Pint Night at the Maui Brewing Company

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