

The Wildlife Society Hawaii Chapter, 2006 annual workshop:  
**Seabird Conservation and Management in the Hawaiian Islands**  
October 26-27 at the Ko'olau golf course, Kaneohe, Hawaii.

### Introduction

The Wildlife Society, founded in 1937, is an international non-profit scientific and educational association dedicated to excellence in wildlife stewardship through science and education. Our mission is to enhance the ability of wildlife professionals to conserve diversity, sustain productivity, and ensure responsible use of wildlife resources for the benefit of society. The Wildlife Society encourages professional growth through certification, peer-review publications, and conferences.

Society members are dedicated to sustainable management of wildlife resources and their habitats. Ecology is the primary scientific discipline of the wildlife profession; therefore, the interests of the Society embrace the interactions of all organisms with their natural environments. The Society recognizes that humans, as other organisms, have a total dependency upon the environment. It is the Society's belief also that wildlife, in its myriad forms, is basic to the maintenance of a human culture that provides quality living. The Wildlife Society Hawaii Chapter organizes annual workshops that bring together managers and scientists to share information and discuss conservation of Hawaii's natural resources.



The Hawaiian archipelago is home to 22 species of breeding seabirds, three of which are endemic to the islands. Like many other Pacific Islands, Hawaii's seabird populations have been decimated by a wide range of anthropogenic impacts, including introduced vertebrate predators, nesting habitat destruction, avian diseases, and direct human interference. The 2006 workshop will directly address pressing conservation and management issues for seabirds in the Hawaiian Islands.




## Keynote Speaker: David Ainley Biography

David Ainley began his seabird research career as a National Science Foundation undergraduate research assistant studying Leach's Storm-petrels in the Bay of Fundy. He received a BS from Dickinson College and PhD from Johns Hopkins University. He worked at Point Reyes Bird Observatory, first as a volunteer, from 1972 to 1995, establishing and guiding the marine science program there, including the Farallon Island Research Station. His major projects have included studies of the marine ecology of birds in the Southern Ocean, the California Current and in the Eastern Equatorial Pacific; demographic studies of Adélie Penguins and South Polar Skuas; and life-history studies of birds on Ross Island and the Farallon Islands. In the process, he's written 175 peer-reviewed papers, 5 books and a dozen monographs, dealing with marine birds, mammals and sharks (top predators). Currently, he's trying to save the Ross Sea, it being the last remaining intact open-water marine ecosystem on earth. He's employed by H.T. Harvey & Associates, an ecological consulting group.



## Acknowledgements to sponsors

This workshop has been made possible by contributions from:

-  The US Fish and Wildlife Service Coastal Program
-  The Wildlife Society – Hawaii Chapter
-  Hawaii Department of Land and Natural Resources-Division of Forestry and Wildlife

## Organizing committee

David Smith, Christina McGuire, Jaap Eijzenga, Megan Laut: Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife; Holly Freifeld, US Fish and Wildlife Service; Lindsay Young, University of Hawaii.

## Illustrations

Cover photos and design: Heather Eijzenga, Illustrations in booklet: Naomi Swenson.

### **Field trip, October 28<sup>th</sup>: Kaena Point Wedge-tailed Shearwater census.**

On Saturday October 28, there will be a field trip to Kaena Point Natural Area Reserve, on the west side of Oahu. The Kaena Point Natural Area Reserve, which was created in 1983, protects 12 acres of one of the state's best examples of coastal lowland dune ecosystem. The reserve is refuge for the endangered Hawaiian monk seal, and threatened green sea turtles, that sometimes use the beach to bask. Seabirds, including Red-footed and Brown Boobies, and Brown Noddy are commonly observed at the point. In winter this area is used by nesting Laysan Albatross, and in summer Wedge-tailed Shearwaters breed here. After implementation of predator control the number of successful pairs of Shearwaters in the area has increased from about a dozen to over 600.

We will be conducting a population census of the Wedge-tailed Shearwaters, and invite you to participate. There will be a sign-up sheet at the registration table, and updated logistical details will be posted. We will re-group at the Mokuleia-side parking lot at the start of the four-wheel-drive trail, at 9am. If you need a ride, or if you have space available in your vehicle, please indicate this on the sign-up sheet. Plan to leave Honolulu at 7:30 am. Return time depends on the number of participants, but plan on a daylong activity. For questions please contact Jaap Eijzenga.

**Thursday October 26, 2006**

8:00 – 8:30	Registration	The Wildlife Society - Hawaii Chapter
8:30 – 9:00	Introduction	The Wildlife Society - Hawaii Chapter
9:00 - 10:00	Diet and foraging ecology of seabirds in the eastern tropical Pacific	David Ainley, H.T. Harvey and Associates
10:00 - 10:30	Conservation status and population trends of seabirds nesting in Hawaii	Beth Flint, U.S. Fish and Wildlife Service
10:30 - 11:00	Seabird research and management in the Hawaiian Islands	David Duffy, University of Hawaii
11:00 - 11:30	Historic range of seabirds in Hawaii and ecosystem effects	Heather Eijzenga, University of Hawaii
11:30 - 12:30	<b>LUNCH</b>	
12:30 - 1:00	Restoring seabird habitat on Lehua Island by removing rabbits	Brad Keitt, Island Conservation
1:00 – 1:30	Conservation genetics as a tool for managing seabird populations	Lindsay Young, University of Hawaii
1:30 – 2:00	'Ua'u on Lana'ihale; History and current status	Jay F. Penniman, DLNR/DOFAW/PCSU Fern Duvall, Hawaii DLNR/DOFAW
2:00 – 2:30	<b>BREAK</b>	
2:30 – 3:00	Protecting Uau from predation	Heidi Hansen, PACRC, UH Hilo
3:00 – 3:30	The effects of invasive ants on growth, condition, and fledging success of Wedge-tailed Shearwater chicks	Sheldon Plentovich, University of Hawaii
3:30 – 4:00	Are seabirds increasing or decreasing on your refuge – designing monitoring programs based on case studies from the Northwest Hawaiian Islands	Michelle Reynolds, USGS-BRD Nate Seavy, USGS-BRD
4:00 – 5:00	Poster Session/ Database Orientation	Beth Flint, USFWS

**Friday October 27, 2005**

8:00 - 8:45	Conservation of New Zealand's endangered seabird species: recent successes and future priorities	Graeme Taylor, New Zealand DOC
8:45 - 9:30	Restoring burrow-nesting seabirds to islands: translocation as a means to restore ecosystems	Colin Miskelly, New Zealand DOC
9:30 - 10:00	Pest exclusion technology for conservation management: experiences from New Zealand	Tim Day, X-cluder Fences
10:00 - 10:30	<b>BREAK</b>	
10:30 - 11:00	Ornithological radar and endangered seabirds on Kauai: methodology and planning for long-term population monitoring	Nick Holmes, DLNR-DOFAW
11:00 - 11:30	At sea movements and marine habitat use of Black-footed and Laysan Albatrosses during the non-breeding season	Karen Fischer, USGS, Oregon Cooperative Fish and Wildlife Research Unit
11:30 - 12:30	<b>LUNCH</b>	
12:30 - 1:00	Conserving Hawaii's seabirds through federal law enforcement	Keith Swindle, USFWS Office of Law Enforcement
1:00 – 1:30	Seabird rehabilitation and response facilities in Hawaii	Linda Elliot, Hawaii's Wildlife Center
1:30 - 2:00	Moving and rearing chicks to support Short-tailed Albatross recovery: lessons learned	Judy Jacobs, USFWS
2:00 – 2:30	<b>BREAK</b>	
2:30 -4:00	Seabird Management in the Main Hawaiian Islands (Panel discussion)	David Smith (moderator), Cathleen Bailey, Darcy Hu, Brenda Zaun, Keith Swindle, Fern Duvall, Jay Penniman, Nick Holmes

**Abstracts for plenary, contributed talks, and posters.****SUMMER MOVEMENTS OF ʻUAʻU (HAWAIIAN DARK-RUMPED PETREL *PTERODROMA PHAEOPYGIA SANDWICHENSIS*) NESTING ON HALEAKALĀ AND LĀNAʻI: CAN WE USE SATELLITE TRACKING TO GAIN NEW INFORMATION AND ADVISE CONSERVATION MANAGEMENT?**

POSTER

**Josh Adams**<sup>1</sup>, David G. Ainley<sup>2</sup>, Holly Freifeld<sup>3</sup>, Jay F. Penniman<sup>4</sup>, Fern Duvall<sup>4</sup>, Joy Tamayose<sup>5</sup>, Cathleen Bailey<sup>5</sup>, Nick Holmes<sup>4</sup>, Megan E. Laut<sup>4</sup>, Greg Spencer<sup>6</sup>; <sup>1</sup> US Geological Survey, Western Ecological Research Center, Moss Landing Marine Labs, Moss Landing, CA, 95039 USA, [josh\\_adams@usgs.gov](mailto:josh_adams@usgs.gov); <sup>2</sup> H.T. Harvey & Associates, San Jose, CA; <sup>3</sup> USFWS, Honolulu, HI; <sup>4</sup> Hawaii Department of Land & Natural Resources, DOFAW; <sup>5</sup> NPS, Haleakalā National Park, Maui, HI; <sup>6</sup> UPC Wind Management, LLC, Kaheawa Pastures Wind Energy, Maui

Predation and habitat degradation by non-native species are principal threats to endangered Hawaiian Petrel (*ʻUaʻu*, *Pterodroma phaeopygia sandwichensis*) petrel and threatened Newell's shearwater (*Puffinus auricularis newelli*). High priority recovery actions for these seabirds include predator control, habitat restoration, and population monitoring. *Required prerequisites for conservation actions include* (1) obtaining precise locations of remote, montane nesting areas, (2) refining techniques for population assessment, and (3) identifying at-sea habitat and evaluating potential threats. Here we report on an ongoing pilot effort to evaluate our ability to use satellite telemetry to track the movements of ʻUaʻu medium-sized (~400 to 600-g) petrels and shearwaters to help meet these prerequisites for conservation. To date we have tracked the fine scale movements of 4 petrels: two individuals from separate nest sites provisioning chicks on Lanaʻi and one parent provisioning a chick and one failed breeder from nest sites on Haleakalā, Maui. Two transmitters were removed after parents completed long (approximately three weeks), clockwise looping foraging trips throughout a broad area of the north Pacific (individual trips can exceed 10,000 km); we continue to track the movements for the remaining two petrels since outfitting them in mid August 2006. We discuss the foraging movements of individuals and relate these to what little is known about the at-sea distribution of ʻUaʻu. Tests on Haleakalā, indicate the feasibility of using satellite telemetry techniques in the near future to track the inland movements of both petrels and shearwaters to locate previously undescribed colony locations—an action required for effective management and conservation. Successful use of this technology to track deep diving Newell's Shearwaters will require modification of existing satellite tag design.

## DIET AND FORAGING ECOLOGY OF SEABIRDS IN THE EASTERN TROPICAL PACIFIC

PLENARY KEYNOTE SPEAKER

**David Ainley**, H.T. Harvey & Associates, San Jose CA 95118 USA,  
[dainley@penguinscience.com](mailto:dainley@penguinscience.com)

During a nine-year period, 1983 - 1991, we studied the diet and feeding ecology of the marine avifauna of the eastern tropical Pacific Ocean (ETP), defined here as pelagic waters from the coast of the Americas to 170° W and within 20° of the Equator. This is one of the first studies of the diet of an entire marine avifauna, including resident breeders and non-breeders as well as passage migrants, and is the first such study for the tropical ocean, which covers 40% of the Earth's surface.

Based on behavior observed during at-sea surveys, the ETP avifauna sorted into two groups: 15 species that generally fed solitarily and 15 species that generally fed in multispecies flocks. Otherwise, the avifauna used a combination of four feeding strategies: 1) association with surface-feeding piscine predators (primarily tuna); 2) nocturnal feeding on diel, vertically migrating mesopelagic prey; 3) scavenging dead cephalopods; and 4) feeding diurnally on non-cephalopod invertebrates (e.g., scyphozoans, mollusks, crustaceans, and insects) and fish eggs. Because of differential use of the four strategies, diets of the two seabird groups (investigated from stomach contents) differed; the solitary group obtained most of its prey while feeding nocturnally, primarily on mesopelagic fishes (myctophids, bregmacerotids, dipterygiids, and melamphids), and flocking species fed primarily on flyingfish (exocoetids and hemiramphids) and ommastrephid squid (*Sthenoteuthis oualaniensis*) caught when feeding diurnally in association with tuna. Many of the smaller species of solitary feeders, particularly hydrobatids, small *Pterodroma* and small larids, supplemented their diets appreciably by feeding diurnally on epipelagic non-cephalopod invertebrates and by scavenging dead cephalopods.

Compared to an analogous study of a polar marine avifauna, which found little prey partitioning, partitioning among the ETP avifauna was dramatic as a function of sex, body size, feeding behavior, and species; the diets of the ETP seabirds were far more diverse than those of their polar counterparts. In the polar system, partitioning was by habitat and behavior (foraging depth). The more extensive partitioning in the ETP likely reflected a much lower prey availability.

## AMERICAN BIRD CONSERVANCY'S SEABIRD PROGRAM: CONSERVING SEABIRDS THROUGHOUT THE AMERICAS

POSTER

**Jennifer Arnold**, Seabird program Director, American Bird Conservancy, 15526 North Nemo Court, Bowie, MD 20716 USA, [jarnold@abcbirds.org](mailto:jarnold@abcbirds.org)

Seabirds are critical to the marine environment both ecologically and aesthetically. However, the persistence of many seabird species is threatened by the past and present consequences of human activity. For example, of the 21 albatross species worldwide, 19 are listed as threatened with extinction under IUCN Red List criteria. The Hawaiian Islands and surrounding waters are important areas for many seabird species of conservation concern including the Hawaiian

Petrel (*Pterodroma sandwichensis*), Newell's Shearwater (*Puffinus newelli*), and three different albatross species. Major factors that affect seabird populations in Hawaii, and globally, include mortality of birds in long-line fisheries, the presence of invasive plant and animal species at breeding sites, contaminants, and the ingestion of marine debris. American Bird Conservancy (ABC) is a US-based conservation organization with the mission to conserve wild birds and their habitats in the Western Hemisphere. ABC's Seabird Program focuses on eliminating the greatest threats to seabird populations by working with government agencies, other non-government organizations, and researchers in the areas of on-the-ground conservation, education, and conservation advocacy. Specifically, ABC is working to eliminate by-catch in the Hawaiian long-line fisheries through the promotion of side setting and complementary techniques that reduce the availability of baited hooks to birds. ABC has pushed to include language on seabird by-catch in the Magnuson-Steven's Fishery's Act Reauthorization, including language allowing the Act to be used as a potential funding source. ABC also has a keen interest in Midway Atoll and has been actively involved in developing solutions to eliminate the exposure of Laysan Albatross chicks to lead paint, as well as supporting projects to eliminate golden crown-beard (*Verbesina encelioides*), an invasive plant that is severely impacting breeding success of ground nesting seabirds. Globally, ABC is supporting the development of the National Plan of Action to Reduce Seabird By-catch in Argentina, developing programs to support observer coverage in several South American countries, and working with foreign governments to support the development of strong regulations promoting seabird-friendly fishing.

#### PEST EXCLUSION TECHNOLOGY FOR CONSERVATION MANAGEMENT: EXPERIENCES FROM NEW ZEALAND

FRIDAY

*Tim Day*, Research & Development Manager, Xcluder™ Pest Proof Fencing Company 1000c Hamurana Road, R.D. 2, Hamurana Rotorua, New Zealand, [tim@xcluder.co.nz](mailto:tim@xcluder.co.nz)

The development of effective pest exclusion fences and eradication techniques has enabled their increasing use for the management of high value conservation areas and species in New Zealand. Mainland exclusion projects range from those focused on protection of the breeding sites of single-species, to full ecological restoration projects involving multiple threatened and pest species in areas of up to 3400ha. The projects are run by a vast array of people, including private landowners and managers, community trusts, volunteers, professional researchers and Department of Conservation staff entrusted with the care of threatened species. The community has funded most exclusion projects and all appear to be achieving their restoration goals. Critical factors for the success of any pest exclusion project are: a clear vision for why pest exclusion is required and what it will achieve; justification for the cost of the project and long term commitment; appropriate and effective exclusion technology; eradication tools, expertise and commitment to remove every pest; and, wider community desire to see success. The application and use of exclusion technology for other islands (e.g. Hawaii, Mauritius, etc.) is now being considered, and these places also stand to gain extremely positive conservation outcomes.

## SEABIRD RESEARCH AND MANAGEMENT IN THE HAWAIIAN ISLANDS.

THURSDAY

*David Duffy*<sup>1</sup>, *Mark Rauzon*<sup>2</sup> and *Craig Harrison*<sup>3</sup>, <sup>1</sup>Pacific Cooperative Studies Unit, Department of Botany, University of Hawaii Manoa, Honolulu, HI 96822 USA, [dduffy@hawaii.edu](mailto:dduffy@hawaii.edu), <sup>2</sup>Marine Endeavors, Box 4423, Berkeley, CA 94704 USA, <sup>3</sup>Hunton & Williams, 1900 K Street NW Washington, DC 20006 USA

We examine the history of seabird science and management in the Hawaiian Islands since European contact. Science can be divided into three overlapping periods: an age of exploration, describing species and islands and determining their biota; an age of natural history, understanding the basic biology of individual species; and most recently an ecosystem phase in which research was focused on trying to understand the role of seabirds in their ecosystems. Similarly, management underwent three progressive, but overlapping stages, from exploitation, to protection, to restoration.

While the interaction between science and management is often seen as minimal or hostile, in Hawaii the relationship has been more successful, if not always acknowledged. Basic exploration has played a key role in the conservation of the mountain Petrels and Shearwaters and basic natural history set the stage for the management of the Northwestern Islands as ecosystems, rather than for single species. Scientific research prevented the extermination of Albatrosses on Midway, helped understand the extent and complexity of a recent oiling incident, and has modeled the decline of Newell's Shearwaters on Kauai. Given all this, the relationship between science and management still has great room for improvement.

## HISTORIC RANGE OF SEABIRDS IN HAWAII AND ECOSYSTEM EFFECTS

THURSDAY

*Heather Eijzenga*, Department of Botany, University of Hawaii at Manoa, 3190 Maile Way, Honolulu, HI 96822 USA, [eijzenga@hawaii.edu](mailto:eijzenga@hawaii.edu)

There is limited understanding of the effects of guano deposition on soil chemistry and plant communities. This is especially true in Hawaii where there have been no studies of the effects of seabird-derived nutrients despite the historic widespread occurrence of nesting seabirds. The influence of seabird colonies on the soils and flora in a coastal Wedge-tailed Shearwater (*Puffinus pacificus*) colony and an upland (3,048 m) Dark-rumped Petrel (*Pterodroma phaeopygia*) colony on Maui, Hawaii was investigated through chemical and isotope analysis. Compared to non-bird sites, seabird colony soils had higher concentrations of NO<sup>3-</sup>, NH<sup>4+</sup> total nitrogen (N) and available phosphorus (P) than non-bird soils; and, measurements of δ<sup>15</sup>N indicate that the higher concentrations of N were derived from guano. Plant analysis paralleled that of soils with elevated N, P, and isotope values, suggesting that guano deposition stimulates productivity not only at coastal sites, but also at high elevations. These data support the hypothesis that nutrients from breeding seabirds affected vegetation throughout the Hawaiian Islands.

## SEABIRD REHABILITATION AND RESPONSE FACILITIES IN HAWAII

FRIDAY

**Linda Elliott**, President, HAWAII WILDLIFE CENTER, PO Box 506, Hawi, HI 96719,  
[Hawaiiwildlifecenter@mac.com](mailto:Hawaiiwildlifecenter@mac.com)

An overview of oiled seabird rehabilitation basics, including lessons learned from Hawaii responses. Including an update on the progress of the HAWAII WILDLIFE CENTER response facility.

## AT-SEA MOVEMENTS AND MARINE HABITAT USE OF BLACK-FOOTED AND LAYSAN ALBATROSSES DURING THE NON-BREEDING SEASON

FRIDAY

**Karen N. Fischer**<sup>1,2</sup>, Robert M. Suryan<sup>2</sup>, Gregory R. Balogh<sup>3</sup>, and Daniel D. Roby<sup>1</sup>, <sup>1</sup>USGS-Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis, OR 97331 USA, [fischkar@onid.orst.edu](mailto:fischkar@onid.orst.edu); <sup>2</sup>USGS-Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Hatfield Marine Science Center, 2030 S.E. Marine Science Drive Newport, Oregon 97365, USA; <sup>3</sup>U.S. Fish & Wildlife Service, 605 West 4<sup>th</sup> Avenue, Room G-61, Anchorage, Alaska 99501, USA

Monitoring and conservation efforts for Hawaiian albatrosses have historically occurred during the breeding season. When away from colonies during the non-breeding season, however, little is known about their at-sea distribution and movement patterns, especially regarding residence time within geopolitical boundaries of Pacific Rim countries and interactions with regional fisheries. In August 2005 we captured albatrosses at-sea in the Aleutian Islands, Alaska. We deployed satellite transmitters on 10 Black-footed (*Phoebastria nigripes*) and 10 Laysan Albatrosses (*P. immutabilis*). Of the Black-footed Albatrosses tracked, all had been previously banded in the Hawaiian Islands, eight of which were adults ( $\geq 8$  yrs). No banded Laysan Albatrosses were captured. Black-footed Albatrosses ranged most widely, traveling along the continental shelf break of the Gulf of Alaska and British Columbia, and into the transition domain between Alaska and Hawaii. Laysan Albatrosses were not as far-ranging, remained further west compared to Black-footed Albatrosses and utilized deeper waters offshore of the continental shelf and slope. Half of both black-footed and Laysan Albatrosses stayed primarily within the Alaskan Exclusive Economic Zone, where deterrents (streamer-lines) are used to minimize seabird by-catch in most long-line fisheries. While in regions outside of Alaska, especially international waters, however, potential threats are less well known and regulated. Furthermore, we found a male sex bias in black-footed and Laysan Albatrosses captured; the male:female ratios were 17:8 for Black-footed and 12:2 for Laysan, indicating potential gender differences in the distribution or attraction to fishing vessels during the non-breeding season. Our tracking data demonstrated inter-species differences in movement patterns and habitat use. In combination with remote sensing and fisheries effort/by-catch data, satellite tracking is improving our understanding of ecological relationships and potential threats to these species during the non-breeding season.

## CONSERVATION STATUS AND POPULATION TRENDS OF SEABIRDS NESTING IN HAWAII

THURSDAY

*Elizabeth Flint*<sup>1</sup> *Maura Naughton*<sup>2</sup> and *Sally Marston*<sup>1</sup>, <sup>1</sup>Pacific Remote Islands National Wildlife Refuge Complex, PO 50167, Honolulu, HI USA, [Beth.Flint@fws.gov](mailto:Beth.Flint@fws.gov), [byrdgrl@mac.com](mailto:byrdgrl@mac.com); <sup>2</sup>Migratory Birds and Habitat Programs, USFWS, 911 NE 11th Ave. Portland, OR USA, [Maura.Naughton@fws.gov](mailto:Maura.Naughton@fws.gov)

Seabird colonies in the Hawaiian Islands constitute one of the largest and most important assemblages of breeding seabirds in the world with more than fourteen million birds representing twenty-four species. All of the world's Hawaiian Petrels, Newell's Shearwaters, and Hawaiian population of the Band-rumped Storm-petrel nest here. Greater than 95% of the world's populations of Laysan and Black-footed Albatross nest in Hawaii and Bonin Petrel, Bulwer's Petrel, Tristram's Storm-petrel, Red-tailed tropicbird, and White Tern have colonies of global significance. The last complete inventory of breeding populations in the Northwestern Hawaiian Islands was done between 1979 and 1984. More recently wildlife managers have stepped up efforts to monitor coastal species on offshore islands in the main Hawaiian Islands and developed indirect methods of estimating population trend in upland breeding species of the main Hawaiian Islands. Available population trend information has come from more intensive monitoring at selected locations in the chain, but even in the best of circumstances trends have been difficult to measure. As part of North American Waterbird Conservation planning efforts, teams of ornithologists classified seabirds by levels of conservation concern using six ranking factors. In the entire plan area 14 of 24 species were ranked as either highly imperiled or of high conservation concern. When ranked regionally, Hawaiian seabird populations were healthier than conspecifics elsewhere; only 9 species were considered highly imperiled or of high conservation concern: Hawaiian Petrel, Newell's Shearwater, Band-rumped Storm-petrel, Laysan, Black-footed and Short-tailed Albatross, Christmas Shearwater, Tristram's Storm-petrel, and Blue Noddy. Greatest threats to seabirds in Hawaii are introduced mammals and other invasive species, fishery interactions, contaminants, oil pollution, collisions with lighted structures, and climate change with associated sea level rise. Over the past 25 years, active management for seabirds in the National Wildlife Refuges, State Seabird Sanctuaries, and other coastal lands has included the eradication of *Rattus rattus* at Midway Atoll and *Rattus exulans* at Kure Atoll; control and eradication of various rats at other offshore islets and at Kaena Point; the eradication and control of invasive plants; coordination with NOAA Fisheries, the West Pacific Fisheries Management Council, industry, and conservation organizations to reduce fishing impacts; and the clean-up of contaminants and removal of obstructions at former military sites. Hawaii is unique in having one of the largest marine protected areas in the world, first established in 1909 for the express purpose of protecting seabirds and now enlarged with the establishment of the new Northwestern Hawaiian Islands Marine National Monument to include nearly 140,000 square miles of land and ocean. Early protection and active management in Hawaii, particularly, in the Northwestern part of the state, has resulted in large, diverse, and relatively intact seabird populations.

## PROTECTING `UA`U FROM PREDATION

THURSDAY

**Hansen, Heidi**<sup>1</sup>, **Steven C. Hess**<sup>2</sup>, **Francis L. Benevides Jr.**<sup>3</sup>, and **Paul C. Banko**<sup>2</sup>, <sup>1</sup>Hawaii Cooperative Studies Unit (PACRC, UH Hilo), USGS Pacific Island Ecosystems Research Center, Kīlauea Field Station, P.O. Box 44, Hawaii National Park, HI, 96718, USA, [hhansen@usgs.gov](mailto:hhansen@usgs.gov); <sup>2</sup>USGS Pacific Island Ecosystems Research Center, Kīlauea Field Station, P.O. Box 44, Hawaii National Park, HI, 96718, USA; <sup>3</sup>FB Engineering, P.O. Box 5023, Hilo, HI 96720

We studied population genetics, diet, and bait preferences of feral cats, and developed and tested a trap-alerting device to formulate adaptive management strategies for protecting the endangered `Ua`u (Hawaiian Petrel; *Pterodroma sandwichensis*) on Mauna Loa. Estimates of genetic structure ( $F_{ST} = 0.028$ ) and number of migrants per generation ( $Nm$ ) suggested gene flow between populations on Mauna Loa and Mauna Kea. Assignment tests and relatedness estimates provided evidence for male-biased dispersal. The largest component of the feral cat diet on Mauna Loa was mice whereas orthopterans comprised the largest diet component on Kīlauea. Twenty eight percent of samples from HAVO contained birds. In one sample from Mauna Loa, we discovered a mandible set, feathers, and bones of an `Ua`u, providing definitive evidence that feral cats prey on this seabird. We tested 4 different types of food-based baits and attractants; canned cat food, sardines, catnip, and a bait sausage that we produced from pork and animal fats. We monitored visits to these baits with remotely-triggered cameras in 4 paired locations on Mauna Loa. We recorded > 8,000 events, but cats were photographed on only 5 (0.5%) occasions, all at sardine bait. We developed and tested a simple trap-alerting device on both Mauna Kea and Mauna Loa for 646 trap nights. We found these telemetry systems to be effective at a distance of 10.4 miles. The device failed in < 1% of trap-nights. The system allows staff to respond to the alerting trap, thereby reducing the amount of effort spent in checking traps.

## ORNITHOLOGICAL RADAR AND ENDANGERED SEABIRDS ON KAUAI: METHODOLOGY AND PLANNING FOR LONG-TERM POPULATION MONITORING

FRIDAY

**Nick Holmes**, Kauai Endangered Seabird Recovery Project, [nick.holmes@hawaii.edu](mailto:nick.holmes@hawaii.edu)

Hawaiian Petrels *Pterodroma sandwichensis* (`Ua`u) and Newell's Shearwaters *Puffinus auricularis newelli* (`A`o) are federally and state listed as endangered and threatened seabirds, respectively, with the greatest numbers of the later species known to breed on the island of Kauai. These seabirds represent unique challenges for conservation management on Kauai, with colonies located on steep vegetated slopes high inland, and breeding birds accessing colonies after nightfall. Ornithological radar is a method whereby bird movement can be monitored over larger areas (e.g. circle of 1.5 km radius) regardless of light availability. This technique has been previously used across coastal Kauai to locate flyways and 'hotspot' areas where these nocturnal birds move inland towards breeding colonies, and was also instrumental in identifying a decline in Newell's Shearwater numbers between 1993 and 1999-2001 (Day et al. 2003). As a part of the five-year recovery plan for Newell's Shearwaters, the development of a long-term monitoring program is required to adequately assess the population trends of this species. Determining the feasibility of using ornithological radar to achieve this aim is currently underway as part of the

Kauai Endangered Seabird Recovery Project (KESRP). Key questions to be asked include: what magnitude of change can be detected from year to year, and what sampling effort would be required to detect such a change. Here we present the methodology and preliminary results for using ornithological radar to monitor long-term trends of Newell's Shearwaters and Hawaiian Petrels on Kauai.

DAY, R.H., COOPER, B.A. & TELFER, T.C. 2003. Decline of Townsend's (Newell's) Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. *Auk* 120: 669–679.

#### MOVING AND REARING ALBATROSS CHICKS TO SUPPORT SHORT-TAILED ALBATROSS RECOVERY: LESSONS LEARNED.

FRIDAY

**Judy F. Jacobs**<sup>1</sup>, **Tomohiro Deguchi**<sup>2</sup>, **Tomoko Harada**<sup>2</sup>, **Brenda Zaun**<sup>3</sup> ; <sup>1</sup>Division of Federal Assistance, U.S. Fish and Wildlife Service, 1011 Eats Tudor Ave, Anchorage, AK 99503 USA; [judy\\_jacobs@fws.gov](mailto:judy_jacobs@fws.gov) <sup>2</sup>Yamashina Institute of Ornithology, Abiko, Chiba, Japan; <sup>3</sup>U.S. Fish and Wildlife Service, Kilauea Point National Wildlife Refuge, Kauai, HI USA.

In early March of this year, ten Laysan Albatross (*Phoebastria immutabilis*) post-guard stage chicks were captured at Midway Atoll National Wildlife Refuge (NWR), and moved to Kilauea Point NWR, Kauai, Hawaii where they were reared to fledging, which occurred in late June. Progress of the chicks and preliminary results of this project are discussed. This pilot translocation and rearing project is a precursor to conducting an operational translocation of federally endangered Short-tailed Albatross (*Phoebastria albatrus*) chicks. The Short-tailed Albatross Recovery Team has indicated that additional breeding colonies of the endangered Short-tailed Albatross must be established in order to achieve recovery of this species. By trans-locating Short-tailed Albatross chicks to a new safe colony site, we hope to 'jump-start' the process of new colony formation, thereby expediting the species' recovery.

#### RESTORING SEABIRD HABITAT ON LEHUA BY REMOVING RABBITS

THURSDAY

**Brad Keitt**<sup>1</sup>, **Thomas Ka'iakapu**<sup>2</sup>, **Chris Swenson**<sup>3</sup>, **Ken Wood**<sup>4</sup>, **Bill Wood**<sup>1</sup>, **Miguel Hermosillo**<sup>1</sup>, **Chad Hanson**<sup>1</sup> ; <sup>1</sup>Island Conservation, 100 Shaffer Road Univ. of California, Santa Cruz CA 95060 USA, [brad.keitt@islandconservation.org](mailto:brad.keitt@islandconservation.org); <sup>2</sup>DLNR - Division of Forestry and Wildlife, 3060 Eiwa Street, Room 306, Lihue, HI. 96766-1875 USA; <sup>3</sup>Pacific Islands Coastal Program Coordinator U.S. Fish and Wildlife Service 300 Ala Moana Blvd., Room 3-122 Honolulu, HI 96850 USA; <sup>4</sup> Research Biologist, National Tropical Botanical Garden, 3530 Papalina Road, Kalaheo, HI 96741 USA

Non-native mammals introduced to islands are the leading cause of population declines and colony extirpations for seabirds. Predators such as cats and rats are often the most damaging. However, herbivores can dramatically impact seabirds through both direct and indirect processes. Introduced rabbits on islands impact seabirds in three main ways: 1) decrease nesting

habitat quality by consuming vegetation used for nesting and reducing soil stability by reducing vegetation cover; 2) direct competition for nesting sites with burrow nesting species and eviction of bird's eggs; and 3) sustaining increased predator populations (such as cats and rats) and thus predation rate on seabirds by providing an alternate prey source. Fortunately, techniques and expertise exist to remove rabbits from islands and over the past 100 years more than 40 eradications have occurred on islands ranging from 1 to 1,400 hectares (2.5 to 3,500 acres).

Lehua Island, 126 hectares (311 acres), is among the most important seabird colonies in the main Hawaiian Islands with 50,000 individuals and nine breeding species. Rabbits were first reported on Lehua in 1931 and they have negatively impacted seabirds and native plants, damaging both Hawaii's natural and cultural resources. An effort to remove rabbits from Lehua was initiated in 2005 using hunting, dogs and trapping. The work was conducted in two phases: phase 1 lasted 32 days with three hunters and two Jack Russell terriers and phase 2 lasted 25 days with two hunters and two dogs. The project was estimated to cost a total of \$130,000 USD and the project may be confirmed completed in November 2006. The expected outcomes of this work are an increase in seabird numbers and recovery of sensitive plant populations. Monitoring to measure the effects of rabbit removal and planned rat eradication will be carried out over the ensuing several years.

## RESTORING BURROW-NESTING SEABIRDS TO ISLANDS: TRANSLOCATION AS A MEANS TO RESTORE ECOSYSTEMS

FRIDAY

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Burrow-nesting petrels (Procellariiformes) once formed enormous populations on most islands and parts of mainland New Zealand, where they heavily modified terrestrial ecosystems through input of marine-sourced nutrients, their burrowing activity, and physical disturbance of ground cover, seedlings and leaf litter. Burrow-nesting seabirds were disproportionately affected by predatory mammals, but there have been few attempts to restore them to sites where they have become locally extinct. Reintroduction efforts have been hampered by the absence of practical methods to overcome the strong philopatry typical of petrels. We describe techniques developed to reintroduce three species of burrow-nesting petrels to Mana Island (Cook Strait, New Zealand), and describe the outcomes of the first two translocations. Our models of potential population recovery of remnant and reintroduced petrel populations reveal that the ecological impacts of introduced predatory mammals may persist for centuries after their eradication.

**HABITAT PROTECTION = COLONY EXPANSION  
THE 'UA'U AT HALEAKALĀ**

POSTER

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The 'Ua'u (Hawaiian Petrel, *Pterodroma sandwichensis*) colony at Haleakalā, Maui was first documented in 1964. Fifteen burrows were found on the inner western slope of Haleakalā Crater. The need for "immediate, effective and continuing non-native animal control" to protect 'Ua'u was recognized at that time. After more than 20 years of habitat protection, the 'Ua'u colony is only now showing signs of colony expansion. By removing feral goats, pigs, mongooses, cats, rats and dogs within the fenced areas of Haleakalā National Park, the 'Ua'u colony is expanding within the fenced areas, as well as areas adjacent to and outside of the fencing.

**'UA'U ON LANAIHALE: HISTORY AND CURRENT STATUS**

THURSDAY

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Hawaiian Petrels or 'ua'u (*Pterodroma sandwichensis*) have only been sporadically reported from the island of Lanai since the early 19<sup>th</sup> century. We review the literature and add previously unpublished visual and audible reports from Lanai. Working from these reports, DLNR/DOFAW/PCSU began survey work in March 2006 to determine the presence or absence of 'ua'u on Lanai. We present a preliminary report on data from this year's listening surveys, and visual observations with night vision and thermal imaging equipment. We also report on the threat management activities which were initiated subsequent to the realization of the presence of a substantial breeding colony of 'ua'u. We present maps of the colony areas showing their close correlation with montane habitat dominated by uluhe ferns (*Dicranopteris linearis*, *Diplopterygium pinnatum*) under native trees and shrubs. We acknowledge the ongoing cooperation and collaboration of many individuals and agencies. We present recommendations for future inclusion of the entire 'ua'u breeding colony inside of the Lanaihale Watershed Protection fence.

**THE EFFECTS OF INVASIVE ANTS ON GROWTH, CONDITION, AND FLEDGING SUCCESS OF WEDGE-TAILED SHEARWATER CHICKS.**

THURSDAY

**Sheldon Plentovich**, Department of Zoology, University of Hawaii-Manoa, 2538 McCarthy Mall, Edmondson 152, Honolulu, HI 96822 USA, [plentovi@hawaii.edu](mailto:plentovi@hawaii.edu)

Invasive ants have been implicated in disrupting ecosystems by altering arthropod populations, directly and indirectly impacting plant communities, and directly harming vertebrate species. The impacts of ants may be especially noticeable on islands with no social insects in the native fauna, such as the Hawaiian Islands. The tropical fire ant, (*Solenopsis geminata*) and the big-headed ant (*Pheidole megacephala*) are two of 44 ant species that have been introduced to Hawaii and are suspected of disrupting ecosystems. Here, the experimental control of ant numbers was used as a tool to investigate the influence of invasive ants on seabird condition, growth-rate and nesting success. The study was conducted on two pairs of small (<5 ha) offshore islets similar in topography, geology, vegetation composition, bird species and ant species. Ant densities were reduced on one of each pair of islets using the pesticide hydramethylnon (Amdro®). There was no difference in growth, condition or fledging success of shearwaters on the pair of islets dominated by *P. megacephala*. On islets dominated by *S. geminata*, about half as many injuries (37% vs. 70%) to seabird chicks were observed on the treated islet vs. the untreated islet. Eight percent of shearwater chicks sustained severe injuries from fire ants. These individuals weighed substantially less than uninjured chicks and did not fledge.

**ARE SEABIRDS INCREASING OR DECREASING ON YOUR REFUGE – DESIGNING MONITORING PROGRAMS BASED ON CASE STUDIES FROM THE NORTHWEST HAWAIIAN ISLANDS**

THURSDAY

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**CONSERVING HAWAII'S SEABIRDS THROUGH FEDERAL LAW ENFORCEMENT**

FRIDAY

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The effects of artificial lights and other land-based threats to Procellariid seabirds around the world have been well understood and documented for over a century. In Hawaii, the Newell's Shearwater, once thought to be extinct, was "rediscovered" in 1954 when one flew into a lighted window on Oahu. This phenomenon, locally referred to as "fallout", for the annual downing of substantial numbers of seabirds due to light attraction and/or the striking of unseen objects, such as utility structures, continues today. State and federal officials have been aware of this phenomenon since at least 1977. Since that date, however, over 31,000 seabirds have been

grounded on Kauai alone--including over 29,000 federally and state threatened Newell's Shearwaters--with untold numbers having never been found. Still more have succumbed on other islands due to lights, utility lines and towers, and due to predation in and alteration of breeding colonies by invasive predators and ungulates. Scientific inquiry conducted decades ago on Kauai, identified easy-to-implement remedies. And yet, despite some noteworthy and valiant efforts by a few officials and volunteers to rescue downed birds, the people of Hawaii and their county, state and federal governments have resoundingly failed to address the underlying problems. Additionally, two endemic seabird species remain imperiled with at least one of them appearing to have suffered precipitous declines. Long-overdue enforcement action has been recently initiated in an attempt to apply tools of federal law in order to reverse and remedy this resource-management travesty. This presentation will describe the statewide scope of the "fallout" problem, illustrate the enforcement approaches on Kauai to date, and identify ways to apply lessons learned on Kauai to the remainder of the state.

#### CONSERVATION OF NEW ZEALANDS'S ENDANGERED SEABIRD SPECIES: RECENT SUCCESSES AND FUTURE PRIORITIES

FRIDAY

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Eighty-five species of seabirds breed in New Zealand, including 35 endemic species, the most diverse seabird community in the world. Introduced mammals, habitat loss, coastal and riverbed development, climate change and fisheries interactions are the key threatening processes. Mainland nesting and Chatham Island species are the most at risk groups. Overall, 52 seabird species are considered at risk of extinction. Recent successes include development of bold new pest eradication techniques for a range of introduced predators and browsers, including aerial poisoning of rodents on islands up to 11,000 ha in size. Sustained, intensive pest control at key sites on large islands and the mainland has saved several petrel species and an endangered tern from imminent extinction. New improvements in seabird translocation techniques are allowing seabirds to be reintroduced at sites where they have been absent for more than a century. Improvements in predator-proof fence designs are also allowing seabirds to be returned to sites on the mainland. Challenges for the future include restoring habitats for endangered terns and gulls on the South Island braided rivers, developing temporary predator-proof fences to protect colonies of seabird species that change nest sites annually, and further refining translocation techniques, including developing methods to transfer surface-nesting seabirds. We need to develop both international and local solutions to the problem of seabird interactions with fisheries. We also need to prioritize monitoring of seabird species and undertake more targeted research on key population parameters such as survival and recruitment rates in representative seabird species, to better understand the impact of global climate change on seabird populations.

## WHITHER THE WHITE TERN... POPULATION GENETICS, SYSTEMATICS, AND DISTRIBUTION

POSTER

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Based on morphological and geographical differences, the American Ornithologists' Union divides *Gygis alba* into three subspecies: *G. a. candida* (Pacific White Tern) *G. a. microrhyncha* (Little White Tern) and *G. a. alba* (Atlantic White Tern). The White Tern subspecies *Gygis alba microrhyncha* and *Gygis alba candida* occur in different areas of the Pacific. The only U.S. breeding is within the Hawaiian Archipelago, from Kure Atoll to Oahu. White Terns were first observed breeding on Oahu in 1961, prior to which, they were only found in the Northwest Hawaiian Islands (NWHI). This study uses mitochondrial DNA (mtDNA) to assess genetic structure of historical populations of *Gygis alba* through its distribution range within the Pacific Ocean (defined as all populations but Oahu), examine how the recent colonization of Oahu affects the population structure of the taxon, and determine the source population(s) for individuals on Oahu. Primers were designed for a region of the cytochrome b (cytb) gene (502 bp) and NADH 2 (ND2) gene (516 bp). A total of 109 individuals from French Frigate Shoals (Tern Island), Midway Atoll, Oahu, Saipan, Tinian, Kwajalein Atoll, Pitcairn, and French Polynesia were sequenced. Data indicates a moderately high level of significant differentiation among all populations. Historical populations show significant population structure for all pairwise comparisons. However, Oahu only shows significant differentiation from the South Pacific and is not significantly different from North Pacific or Marquesas populations. Lastly, the Oahu population shares haplotypes with all historical populations examined to date. These preliminary analyses show much promise in elucidating the genetic structure and variation of the White Tern within the Pacific Ocean.

## CONSERVATION GENETICS AS A TOOL FOR MANAGING SEABIRD POPULATIONS

THURSDAY

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Habitat degradation and the introduction of invasive predators often alter populations of plants and animals into a collection of smaller populations and increases their risk of extinction. Attempts to mitigate these risks through management are often impeded by a lack of biological and population information, particularly in the case of seabirds which are difficult to study when they are not attending their breeding colonies. The use of genetics is an increasingly popular tool in managing populations of declining species. Molecular markers can supply conservation scientists and ecological managers with a great deal of information on seabird biology: effective (or minimum) breeding population size, the amount of migration between breeding colonies, the source of migrants for newly formed colonies and the colony of origin for birds killed as by-catch in fisheries. However, the methods used and how to correctly apply them are often lost in the chain of communication from researcher to manager. This talk will go over current types of

molecular data in a simplified format, and how they can be applied in a variety of situations and species using Laysan Albatross (*Phoebastria immutabilis*) as an example.

## THE ALBATROSS EGG SWAP: AN INOVATIVE APPROACH TO ALBATROSS MANAGEMENT

POSTER

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In late January and early February 2005, when Laysan Albatross (*Phoebastria immutabilis*) eggs were ready to hatch, three agencies put their heads together and came up with a positive solution to a challenging problem. Because albatrosses could pose air-strike hazards to aircraft, the Navy Pacific Missile Range Facility (PMRF) has utilized the U.S. Department of Agriculture's Wildlife Services Branch since the late 1980s to manage their albatross abatement program including relocation of birds and, if necessary, destruction of eggs. Conversely, on the other side of the island, Kilauea Point National Wildlife Refuge is managed, in part, to promote and encourage albatross nesting in order to increase Kauai's populations. So transferring PMRF eggs and day-old chicks to foster parents in the Refuge colonies seemed a logical solution. This endeavor was successful because it relieved PMRF of potential additional aircraft hazards, reduced the number of birds that would return to the base in the future, generated positive publicity and support, and supplemented the north shore albatross population, increasing the Refuge's hatching success by 15%. Twenty-seven non-viable eggs were replaced with ready-to-hatch eggs or chicks. The new foster parents readily accepted all.