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# Abstract Book

Compiled by  
David Bachman  
Miranda Starr  
Nina Karnovsky

# MOVEMENTS AND HABITAT-USE OF BREEDING SEABIRDS IN THE KA'IE'IE WAHO CHANNEL SEPARATING THE ISLANDS OF KAUA'I AND O'AHU

Josh Adams<sup>1</sup> (josh\_adams@usgs.gov) Jonathan J. Felis<sup>1</sup> Bill Henry<sup>1</sup> Eric A. VanderWerf<sup>2</sup> Michelle Hester<sup>3</sup> Lindsay C. Young<sup>2</sup> Andre F. Raine<sup>4</sup>

<sup>1</sup>USGS-WERC, 400 Natural Bridges Dr., Santa Cruz, CA 95060.

<sup>2</sup>Pacific Rim Conservation, Honolulu, Hawaii, 96822.

<sup>3</sup>Oikonos Ecosystem Knowledge, 41-1019 Nenu St., Waimanalo, HI 96795.

<sup>4</sup>Kaua'i Endangered Seabird Recovery Project, 3900 Hanapepe Rd, Hanapepe, Kaua'i 96716

<sup>5</sup>USFWS - Kilauea Point NWR, P.O. Box 1128 Kilauea, Hawai'i 96754.

In 2015, the Bureau of Ocean Energy Management (BOEM) received two unsolicited lease requests to develop offshore wind energy facilities in the Ka'ie'ie Waho Channel separating the islands of Kaua'i and O'ahu. Each project proposes an offshore wind facility with a capacity of 408 megawatts (MW) of renewable energy generated by 51 floating 8 MW wind turbines. This region is frequented by a diverse seabird community that includes three Federal and Hawaiian State listed species and several important seabird colonies are located adjacent to the channel. To gather new information about the at-sea behaviors and marine habitat use, we deployed GPS loggers and satellite transmitters on six seabird species at multiple colonies on Kaua'i and O'ahu during 2013-15. We evaluate movements and area-use patterns among this assemblage of seabirds within and beyond BOEM lease blocks, proposed wind energy developments, and the near-island (< 100 km) areas surrounding Kaua'i and O'ahu. (Talk)

## WHAT ADELIE PENGUINS CAN TELL YOU ABOUT CHLOROPHYLL

David Ainley<sup>1</sup> (dainley@penguinscience.com) Grant Ballard<sup>2</sup> Randy Jones<sup>3</sup> Steve Pierce<sup>4</sup>  
Kendra Daly<sup>5</sup> Stacy Kim<sup>6</sup>

<sup>1</sup>H.T. Harvey & Associates, Los Gatos, CA.

<sup>2</sup>Point Blue Conservation Science, Petaluma CA.

<sup>3</sup>Virginia Institute of Marine Science, Gloucester Point VA.

<sup>4</sup>Oregon State University, Corvallis OR.

<sup>5</sup>University of South Florida, Tampa Bay FL.

<sup>6</sup>Moss Landing Marine Lab, Moss Landing CA.

We investigated the foraging habitat and preyscape experienced by Adélie Penguins (ADPE) breeding at colonies on Ross Island, using tags that allowed investigation of foraging trip extent and depth, coincident with an ocean glider and ROV equipped with acoustics, CTD and fluorescence measurement capabilities. At the same time we logged ADPE diet. Three different study designs were used at two different colonies, 2005-2014. In the first, we found that ADPE sought areas of elevated chlorophyll, which with other habitat characteristics, indicated the presence of sub-mesoscale eddies that likely facilitated prey retention. These eddies were associated with bathymetric features (troughs). In the second, we found that ADPE together with baleen whales altered the preyscape, reducing prey availability, but in a way uncoupled from actual phytoplankton prevalence. In the third investigation, ADPE foraged to depths that avoided the low visibility prevalent in intense blooms, again apparently uncoupled from any direct positive connection to phytoplankton prevalence. While chlorophyll intensity is commonly used to explain seabird occurrence patterns in biologging efforts, our results indicate that at the scale or level of foraging in real space/time, with actual knowledge of the preyscape, we find that the bird-bloom interaction has unexpected elements. (Talk)

## DOES PAST SUCCESS PREDICT FUTURE SUCCESS IN NESTING SEABIRDS?

Jeffrey Allen<sup>1</sup> (jeffrey.allen@pomona.edu) Kyle Jensen<sup>1</sup> Nicole McDuffie<sup>1</sup> Leo Estrada<sup>1</sup> Diane Hichwa<sup>2</sup> Nina J. Karnovsky<sup>1</sup>

<sup>1</sup>Pomona College, 175 W. 6th St., Claremont, CA 91711.

<sup>2</sup>Madrone Audubon, PO Box 1911, Santa Rosa, CA 95402.

Gualala Point Island (GPI) is a small offshore island off the coast of The Sea Ranch, in Sonoma County, California. In 2014 and 2015 students from Pomona College studied the nesting success of Brandt's cormorants (*Phalacrocorax penicillatus*) and Western gulls (*Larus occidentalis*) nesting on the island. The purpose of this investigation was to better understand the factors that influence nest success and failure, particularly whether past success predicted future success. I predicted that prior success would predict future success, and that areas that supported successful nests in 2014 would support successful nests in the 2015. Observations of Brandt's cormorants and Western gulls breeding on GPI were made six days per week through a spotting scope. I recorded nest location and the number of eggs laid, and hatched and the number of chicks fledged. For Western gulls breeding performance in 2014 did predict performance in 2015. In general 2015 was less successful than 2014, possibly because of diminished food supply due to el Niño. (Poster)

# MIGRATORY CONNECTIVITY BETWEEN THE NORTHERN GULF OF CALIFORNIA AND THE SALTON SEA: SATELLITE TELEMETRY IN BROWN PELICANS

Daniel W. Anderson<sup>1</sup> (dwanderson@ucdavis.edu) Franklin P. Gress<sup>2</sup> Kristofer M. Robison<sup>3</sup>  
Renee E. Robison<sup>3</sup> Carlos R. Godinez-Reyes<sup>4</sup> Christian Schoneman<sup>5</sup>

<sup>1</sup>Dept. Wildlife, Fish, & Conserv. Biology, University of California, Davis, CA 95616.

<sup>2</sup>Calif. Inst. Environ. Stud., 3408 Whaler Ave., Davis, CA 95616.

<sup>3</sup>Colibri Ecol. Consulting LLC, 11238 N. Via Trevisio Way, Fresno, CA, 93730.

<sup>4</sup>CONANP/SEMARNAT APFF Islas del Golfo de California, Dom. Conocido, Bahia de los Angeles, Baja Calif., MX 22980.

<sup>5</sup>Sony Bono Salton Sea NWR, 906 W Sinclair Rd., Calipatria, CA, 92233.

Brown Pelicans marked with satellite transmitters at the Salton Sea (33°N)(SS)(3 adults) and in the Gulf of California (GOC)(7 fledglings + 4 adults) confirmed our hypothesis of a strong migratory connectivity between the two regions, established in the last 4-5 decades (the SS itself had not formed until post-1905). Due to the deteriorating ecological state of the SS, permanency of this new migratory pattern is tenuous. Fledglings at Isla San Luis (SLU, the nearest major breeding colony, about 380 km distant), including adults, dispersed to and returned from the SS region, traversed the Baja California Peninsula in migration, and moved extensively in the GOC and south/north along the outer Pacific Coast. Of the fledging pelicans marked at SLU in 2008, 3/7 actually made this journey into the Colorado River Delta Region (CRDR) (= 43%). Our data suggested more movement into and out of the CRDR (including the SS) than previously hypothesized from band-recovery data alone. In one phase of a GOC monitoring study in 2004, the frequency of West Nile virus (WNV) exposure indicators in pre-fledged GOC BRPE decreased to the south (N = 136): Isla San Luis (30.0°N) = 23%; Puerto Refugio (29.5°) = 10%; Isla Piojo (29.0°) = 8%; San Lorenzo Archipelago (28.7°) = 2%. The SS (with well-known WNV exposure in birds) was suspected to be the source of this exposure via previous migration of adults; in 2005, however, this pattern was not detected (N = 100). (Talk)

## HERRING GULLS: POPULATION SCALE PATTERNS OF MOVEMENT AND HABITAT USE

Christine M. Anderson<sup>1</sup> (to.christine.anderson@gmail.com) Mark L. Mallory<sup>1</sup> H. Grant Gilchrist<sup>2</sup>  
Robert Ronconi<sup>2</sup> Chip Wesloh<sup>2</sup> Dan Clark<sup>3</sup>

<sup>1</sup>Biology Department, Acadia University, 33 Westwood Drive, Wolfville, Nova Scotia, B4P 2R6.

<sup>2</sup>National Wildlife Research Centre, Environment Canada, Carleton University, Ottawa, ON, Canada.

<sup>3</sup>Massachusetts Department of Conservation and Recreation, 251 Causeway Street, Suite 600, Boston, MA 02114.

Annual movement patterns of Herring Gull (*Larus argentatus*) populations in eastern North America are fairly well understood on a broad scale, but information is lacking on the finer details of those movements: what migration routes they are taking, what habitats they are using, and the timing of their movements. Very little is known about the populations of Herring Gulls from the northern edge of their breeding range in the low Arctic. Recent studies suggest that the northern populations have higher survival rates than the southern populations, but it is unclear why. Using satellite transmitter data from populations in the Arctic (n=14), Atlantic Canada (n=14), and the Great Lakes (n=9), we show that each of these populations is using a distinct migration strategy. At the species level, we see a leap-frog migration pattern, as the Arctic population passes Atlantic wintering sites en route to the Mississippi Delta. By combining satellite transmitter tracks with open-source land-use data, we show that the Arctic population is using a much greater proportion of marine habitat during the winter. This could be a contributing factor in the differences in survival rates between northern and southern breeding populations. (Talk)

STABLE HYDROGEN, CARBON, NITROGEN AND RADIOCARBON ISOTOPES TRACE  
TERRESTRIAL-DERIVED ORGANIC MATTER IN GLACIER RUNOFF TO BRACHYRAMPHUS  
MURRELETS IN COASTAL ALASKA

Mayumi L. Arimitsu<sup>1</sup> (marimitsu@usgs.gov) Keith A. Hobson<sup>2</sup> John F. Piatt<sup>1</sup> Eran Hood<sup>4</sup>  
D'Arcy Webber<sup>3</sup> Jason Fellman<sup>4</sup>

<sup>1</sup>USGS Alaska Science Center, 250 Egan Dr, Juneau, AK 99801.

<sup>2</sup>University of Saskatchewan, 112 Science Pl, Saskatoon, Saskatchewan Canada S7N 5E2.

<sup>3</sup>Quantifish, New Zealand.

<sup>4</sup>University of Alaska, 11120 Glacier Highway, Juneau AK 99801.

Nearly half of freshwater discharge into the Gulf of Alaska originates from glacier runoff but little is known about how the influx of terrestrial-derived organic matter carried in freshwater affects the trophodynamics of coastal marine food webs. In this system, Kittlitz's Murrelets (KIMU, *Brachyramphus brevirostris*) are more strongly associated with glacial-marine habitats than Marbled Murrelets (MAMU, *B. marmoratus*), and so we hypothesized that the contribution of organic matter in freshwater sources will be greater in KIMU than in MAMU. We sampled stable ( $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ ,  $\delta^2\text{H}$ ) and radiogenic ( $^{14}\text{C}$ ) isotopes in Murrelets near tidewater glaciers during peak melt in summer. We developed a Bayesian stable isotope mixing model that integrated discernable isotope gradients from offshore, coastal and freshwater sources. Posterior mean point estimates (95% credible intervals) of freshwater source contributions to KIMU and MAMU were 45 (31-61) % and 21 (8-34) %, respectively. Differences are likely due to differences in life history and residence time in glacial-marine habitats. Radiocarbon data from a subset of samples indicate ancient glacial carbon does not subsidize coastal marine food webs as biota were composed of 92 - 99% modern carbon, which was similar to biota at an oceanic site without glacial freshwater influence. Given the predicted impact of global warming on glacier thinning and retreat in the Gulf of Alaska, this work facilitates a greater understanding of how projected changes in freshwater discharge from glaciers may impact these species in the future. (Talk)

# DISTRIBUTION, STATUS, AND CONSERVATION OF SNOW'S GUILLEMOT, AN ENDEMIC OF THE KURIL ISLANDS

Yuri B. Artukhin<sup>1</sup> Alan E. Burger<sup>2</sup> (aburger@uvic.ca) Gus B. van Vliet<sup>3</sup>

<sup>1</sup>Kamchatka Branch of Pacific Geographical Institute FEB RAS, Rybakov pr. 19a, Petropavlovsk-Kamchatsky, Russia.

<sup>2</sup>Department of Biology, University of Victoria, Victoria, British Columbia V8W 3N5, Canada.

<sup>3</sup>P.O. Box 210442, Auke Bay, Alaska 99821, USA.

Snow's Guillemot, described in 1897, is currently regarded as a subspecies of the Pigeon Guillemot (*Cephus columba snowi*), characterized by little or no white in the upperwing coverts. Endemic to the Kuril Islands and a few nearby locations on Kamchatka Peninsula, little is known about this taxon. Its range overlaps that of the Spectacled Guillemot (*C. carbo*) in the south and the Pigeon Guillemot (*C. c. columba*) in the north. Hybridization of the two forms of *C. columba* might occur, but have not been reliably documented. Genetic analysis to determine the taxonomic status of Snow's Guillemot is needed. Based on field notes and photographs, Snow's Guillemot occurs as two morphs one with no white and the other with very narrow white strips in the upperwing coverts. Surveys in 2000 to 2003 indicate that the population is only 4,000-5,000 individuals. Potential threats to this guillemot include oil spills, nearshore gillnets, introduced foxes, mink and rats at breeding colonies and destruction of nests by pinnipeds. With at least 16 islands supporting 100 or more birds, the breeding population is widely dispersed which could minimize the impacts of these threats; on the other hand, the entire range extends only 800 km. (Talk)



## MONITORING AND RESTORATION OF BURROW NESTING SEABIRDS ON THE BAJA CALIFORNIA PACIFIC ISLANDS, MEXICO

Yuliana Bedolla-Guzmán<sup>1</sup> (yuliana.bedolla@islas.org.mx) Mayra García-Mendoza<sup>1</sup> Alejandro Aguilar-Vargas<sup>1</sup> Betsabeel Córdova-Rojas<sup>1</sup> Óscar Hernández-Sánchez<sup>1</sup> Annie E. Little<sup>2</sup> Jennifer Boyce<sup>3</sup> Eduardo Iñigo-Elías<sup>4</sup> Stephen W. Kress<sup>5</sup>

<sup>1</sup>Grupo de Ecología y Conservación de Islas, A.C., Moctezuma 836, Zona Centro, Ensenada, Baja California, México 22800.

<sup>2</sup>U.S. Fish and Wildlife Service, 1901 Spinnaker Drive, Ventura, CA 93001.

<sup>3</sup>Montrose Settlements Restoration Program Manager/NOAA Restoration Center, 501 West Ocean Blvd., Suite 4470, Long Beach, CA 90802.

<sup>4</sup>Cornell Lab of Ornithology, 159 Sapsucker Woods Rd., Ithaca, NY 14850.

<sup>5</sup>National Audubon Society, 159 Sapsucker Woods Rd., Ithaca, NY 14850.

The ongoing seabird restoration project on Mexican islands in the Pacific Ocean, off the Baja California Peninsula shows encouraging results (after three seasons) for both surface and burrow nesting seabirds. We present the results for the third year (2015) of monitoring and restoration actions for burrow nesting species. We carried out the census and estimation of burrows for Cassin's Auklet (*Ptychoramphus aleuticus*), Scripps's Murrelet (*Synthliboramphus scrippsi*), Ashy Storm-Petrel (*Oceanodroma homochroa*), and Black-vented Shearwater (*Puffinus opisthomelas*). We also assessed the reproductive performance and the effectiveness of social attraction systems deployed for Cassin's Auklet. Cassin's Auklet nested on four islands, mostly on San Jerónimo, started to breed earlier than 2014's breeding season, and had low reproductive performance (0.3 to 0.5 fledglings/breeding pair). We registered 95 active burrows of Scripps's Murrelet on four islands, a noteworthy increment from last breeding season when we recorded only 19 burrows. Ashy Storm-Petrel was nesting exclusively on Todos Santos Islands, where we found 17 active burrows. BLSH nesting was recorded only on Natividad Island, with a high percentage of abandoned eggs. We recorded signs of seabird activity on more than 50% of artificial burrows installed. Cassin's Auklet nested in 10 artificial burrows on San Jerónimo, where we recorded eight eggs and five chicks. Although we recorded breeding failures in 2015 (a year characterized by unusual warm and poor waters along the California Current System), this regional seabird restoration project shows already good results and offers a cumulative positive balance over the past three years. (Talk)

SPATIAL AND DIETARY SEGREGATION AMONG THREE SYMPATRIC STORM-PETRELS OCEANODROMA SPP. BREEDING ON ISLANDS OFF BAJA CALIFORNIA, MEXICO

Yuliana Bedolla-Guzmán<sup>1</sup> (yuliana.bedolla@islas.org.mx) Juan F. Masello<sup>2</sup> Bertha A. Lavaniegos<sup>3</sup>  
Christian Voigt<sup>4</sup> Petra Quillfeldt<sup>2</sup>

<sup>1</sup>Grupo de Ecología y Conservación de Islas, A.C., Moctezuma 836, Zona Centro, 22800, Ensenada, Baja California, Mexico.

<sup>2</sup>Justus Liebig University Giessen, Heinrich-Buff-Ring 38, 35392 Giessen, Germany.

<sup>3</sup>Centro de Investigación Científica y de Educación Superior de Ensenada, km 107 Carretera Tijuana-Ensenada, 22860, Ensenada, Baja California, Mexico.

<sup>4</sup>Leibniz Institute for Zoo and Wildlife Research, Alfred-Kowalke-Str. 16, 10315 Berlin, Germany.

Ecologically-similar species are expected to partition their use of resources, thus may coexist in sympatry as a result of ecological segregation in space, time or diet. Storm-petrels, as other pelagic seabirds, are difficult to follow outside of their breeding colonies. Therefore, we have limited knowledge of movements and behavior of such species. Stable isotopes analysis and recent developments of stable isotopes quantitative metrics now enable to quantify resource partitioning for these species. We examined spatial and dietary segregation among the Black Storm-Petrel (*Oceanodroma melania*), Leach's Storm-Petrel (*O. leucorhoa*) and Least Storm-Petrel (*O. microsoma*) sympatrically breeding on San Benito Islands, off the Baja California Peninsula, Mexico, during breeding and non-breeding periods in 2012 and 2013. For the analysis, we used a combination of conventional dietary methods and isotopic signatures of carbon ( $\delta^{13}\text{C}$ ) and nitrogen ( $\delta^{15}\text{N}$ ) in blood and feathers. The conventional methods indicated that *O. melania* preyed mainly on krill while *O. leucorhoa* and *O. microsoma* preferred larval fish. Carbon and nitrogen values showed an apparent difference between breeding and moulting periods, and resource partitioning among species in diet and habitat use during the breeding period. Isotopic niche determinations showed differences among species and between years. The marine isoscape developed for the Mexican Pacific showed no latitudinal trend, and indicated storm-petrels may forage over 300 km off the breeding colony. Results show these three species are adapted to coexist sympatrically through niche specialization in prey selection and foraging areas. (Talk)

## MARINE HABITAT USE DURING BREEDING FOLLOWED BY LONG DISTANCE MOVEMENTS OF MARBLED MURRELETS IN CANADA.

Douglas F. Bertram<sup>1</sup> (douglas.bertram@dfo-mpo.gc.ca ) Christie A. MacDonald<sup>1</sup> Patrick D. O'Hara<sup>1</sup> Jenna L. Cragg<sup>1</sup> Kerry Woo<sup>1</sup> Malcolm McAdie<sup>1</sup>

<sup>1</sup>Environment Canada, c/o Institute for Ocean Sciences, 9860 West Saanich Road, P.O. Box 6000, Sidney, British Columbia, V8L 4B2, Canada.

In Canada the Species at Risk Act seeks to identify critical habitats for survival and reproduction. For the Marbled Murrelet (*Brachyramphus marmoratus*) much attention has been focussed on terrestrial nesting habitats, but more recently, emphasis has also been placed upon the identification of key marine habitats. In May 2015, we deployed 5 g solar powered satellite transmitters on nine Marbled Murrelets in Desolation Sound, BC. Throughout May two of the tags transmitted up to 25 locations per day, three tags transmitted one-two locations during the 10 hour “on cycle” every two days, three tags stopped transmitting, and one tag transmitted every five-seven days but the location quality was very poor. Marine habitat use was examined for individual Marbled Murrelets by using kernel density estimation to generate probability density functions of location, incorporating Argos location errors to identify areas of high, medium and low encounter probabilities. On 16 June 2015 one PTT still functioned and the bird left the study area and headed north. By 21 June the bird was on the northern mainland coast of BC and shortly thereafter arrived in SE Alaska to end up in the region of Juneau 1-16 July. Long distance northward movement from BC into Alaska was first documented in 2014 and we seek to further explore this connectivity between Canadian and American populations of Marbled Murrelets. (Talk)

# INTERSPECIFIC KLEPTOPARASITISM OF CASPIAN TERNS BY GULLS IN INTERIOR WASHINGTON, OREGON, AND CALIFORNIA

Kirsten S. Bixler<sup>1</sup> (Kirsten.Bixler@oregonstate.edu) Donald E. Lyons<sup>1</sup> Timothy J. Lawes<sup>1</sup>  
Peter J. Loschl<sup>1</sup> Daniel D. Roby<sup>2</sup>

<sup>1</sup>Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Oregon State University, Corvallis, OR 97331 USA.

<sup>2</sup>U.S. Geological Survey-Oregon Cooperative Fish & Wildlife Research Unit, 104 Nash Hall, Oregon State University, Corvallis, OR 97331 USA.

Interspecific kleptoparasitism, the theft by one species of prey items already captured by another, may have considerable impact on the host species. We compared rates of kleptoparasitism of Caspian Terns (*Hydroprogne caspia*) by sympatrically nesting California Gulls (*Larus californicus*) and Ring-billed Gulls (*L. delawarensis*) during 2008-2015 across 5 colonies in southeastern Oregon (OR) and northeastern California (CA), and 2 colonies in eastern Washington (WA). The kleptoparasitism rate was high at tern colonies in WA (mean = 12% of fish brought to the colony by terns were confirmed stolen by gulls) and relatively low at colonies in OR/CA (mean = 1%). The regional difference in kleptoparasitism rate is likely due in part to the size of gull colonies adjacent to tern colonies: larger at WA colonies ( 6,000-13,000 gull nests/island) than at OR/CA colonies ( 100-2,000 gull nests/island). Another factor influencing kleptoparasitism rates is likely tern colony size: larger at WA colonies (mean = 400 nests) compared to OR/CA (mean = 188 tern nests). There was a positive correlation between kleptoparasitism rate and annual peak tern colony size for both colonies in WA and 2 of 5 colonies in OR/CA. The age of tern colonies may also have influenced kleptoparasitism rates: Colonies in OR/CA formed more recently (4-8 years ago) than did colonies in WA (12-24 years ago). The rate of kleptoparasitism increased with colony age at 1 WA colony and at 2 OR/CA colonies. Ultimately, kleptoparasitism by gulls may be an important factor limiting growth of Caspian Tern colonies: At WA colonies, where kleptoparasitism was common, there was a strong negative relationship between kleptoparasitism rate and tern nesting success. (Poster)

## CHANGES IN CORMORANT POPULATIONS IN THE STRAIT OF GEORGIA, BRITISH COLUMBIA, 1955-2015

Harry R. Carter<sup>1</sup> (carterhr@shaw.ca) Trudy A. Chatwin<sup>2</sup> Mark C. Drever<sup>3</sup>

<sup>1</sup>Carter Biological Consulting, 1015 Hampshire Road, Victoria, BC V8S4S8 Canada.

<sup>2</sup>Ministry of Forests, Lands and Natural Resource Operations, 2080 Labieux Road, Nanaimo, BC V9R6R1 Canada.

<sup>3</sup>Canadian Wildlife Service, Environment Canada, 5421 Robertson Road, Delta, British Columbia, V4K 3N2, Canada.

Between 1987 and 2000, nesting populations of Pelagic Cormorant (*Phalacrocorax pelagicus*; PECO) and Double-crested Cormorant (*P. auritus*; DCCO) declined in the Strait of Georgia, BC. This northern section of the Salish Sea is a rapidly urbanizing area, and piscivorous birds are important indicators of ecosystem health. To update population status, we conducted a complete survey of 35 PECO and 23 DCCO colonies in July 2014 and opportunistic surveys of some colonies between 2001 through 2015. The PECO population decreased from  $\approx 2100$ - $2400$  nests in 1959-1987 to  $\approx 1100$  nests by about 2000, and then rose slightly to  $\approx 1600$  nests by 2015. The DCCO population increased from  $\approx 200$  nests in 1959 to  $\approx 2,000$  nests in 1987, before decreasing to  $\approx 600$  nests in 2000, and then remained at this level through 2015. Many smaller colonies no longer exist and the majority of PECO and DCCO currently nest in three locations: Mandarte Island, Mitlenatch Island, and bridges in Vancouver. The main factors affecting population changes from about 1990 to 2015 include reduced prey availability, increased Bald Eagle (*Haliaeetus leucocephalus*) predation and use of man-made structures for nesting at certain colonies. In 2013-2015, small numbers of Brandt's Cormorants (*P. penicillatus*) nested at Mandarte Island. This is the first reported nesting of Brandt's Cormorants nesting in the Strait of Georgia. (Talk)

## POPULATION SIZE AND DISTRIBUTION OF THE GUADALUPE MURRELET AT GUADALUPE ISLAND, 1892-2007

Harry R. Carter<sup>1</sup> (carterhr@shaw.ca) Darrell L. Whitworth<sup>1</sup> Eduardo Palacios<sup>2</sup> Franklin P. Gress<sup>1</sup>

<sup>1</sup>California Institute of Environmental Studies, 3408 Whaler Avenue, Davis, CA 95616 USA.

<sup>2</sup>CICESE, Miraflores 334 Col. Bellavista, La Paz, BCS 23050 México.

The Guadalupe Murrelet *Synthliboramphus hypoleucus* probably is the rarest alcid in the world (range 645-2,470 pairs) and breeds almost entirely at Guadalupe Island, with only small numbers at the San Benito Islands. Breeding at Guadalupe Island was first noted at the south end of the main island in 1892. Many nests were discovered on Afuera Islet in 1937, one at the south end in 1950, many at Negro Islet in 1955-1966, and one at Gargoyle Rock in 1963. In 1968, 4,000 birds (1,000-1,500 pairs) were estimated at Afuera and 800 birds (200 pairs) at Negro. In 2000-2004, breeding was confirmed at Afuera, Negro, and Gargoyle. In 2007, we conducted the first round-island spotlight survey and counted 1,553 birds in nocturnal at-sea congregations (corresponding to 600-2,400 pairs). About half were near Afuera and Negro but about one third were counted along the N and NW sides where breeding was not previously known. Fifty birds were captured at sea off the south end and blood samples taken for genetics studies. We also confirmed breeding at Afuera and Negro, discovered nests at Enmedio Islet and Steamboat Rock, and re-discovered breeding at the south end. Many murrelet carcasses were found at the south end in 2007, as also noted in 1892, 1977, and 2001-2003; most appeared killed by feral cats but a few by raptors. Eradication of feral cats, introduced in the 19th century, would increase adult survival and hatching success, allowing for greater numbers of nests at the south end. (Talk)

## THE JAPANESE SEABIRD CONSERVATION COMMITTEE: 1995-2015

Harry R. Carter<sup>1</sup> (carterhr@shaw.ca) Kuniko Otsuki<sup>2</sup> S. Kim Nelson<sup>3</sup> Motohiro Ito<sup>4</sup>

<sup>1</sup>Carter Biological Consulting, 1015 Hampshire Road, Victoria, BC V8S4S8 Canada.

<sup>2</sup>Marine Bird Restoration Group, 1-18 Ishida, Hokida, Fukushima-shi, Fukushima Prefecture 960-8163 Japan .

<sup>3</sup>Dept. of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR 97331 USA.

<sup>4</sup>National Institute of Polar Research, 10-3, Midori-cho, Tachikawa, Tokyo 190-8518 Japan.

In 1995, the Japanese Seabird Conservation Committee (JSCC) was formed within the Pacific Seabird Group (PSG) to encourage and support seabird conservation in Japan. The JSCC has helped identify conservation issues, recognize Japanese biologists, and facilitated international collaborations for work on Japanese Murrelet (*Synthliboramphus wumizusume*), Long-billed Murrelet (*Brachyramphus perdix*), 1997 Nakhodka oil spill, Short-tailed Albatross (*Phoebastria albatrus*), and rat (*Rattus* sp.) eradication on seabird islands. In 2001, PSG and the Japan Seabird Group (JSG) held a symposium on Japanese seabirds, and recognized H. Hasegawa (Special Achievement Award [SAA] 2001). The PSG-JSG meeting in Hakodate in 2009, assisted by Hokkaido University students and JSCC, greatly raised public awareness of seabirds in Japan, with recognition of H. Ogi (Lifetime Achievement Award [LAA] 2009) and Y. Watanuki (SAA 2009). In 2010, special public lectures in Japan by JSG and JSCC further developed interest in seabirds. PSG had a special 2014 paper session on Japanese and Korean seabirds, and with JSG hosted a special 2014 workshop on rat eradication at the 26th IOC in Tokyo. JSCC's work on rat eradication also was presented at the 2015 World Seabird Conference in South Africa. The JSCC will expand in 2016 to become the NE Asia Seabird Conservation Committee. JSCC Coordinators are: H. Carter (1995), K. Ono and J. Fries (1996-2006), M. Ito (2007-2012), and K. Otsuki and K. Nelson (2013-2015). We thank J. Piatt (LAA 2016) for his important efforts to form the JSCC and K. Ono and J. Fries for their leadership for 11 years. (Poster)

# THE “WARM BLOB” AND A COLD SEA: LARGE-SCALE TROPHIC PERTURBATIONS IN THE ALEUTIAN ISLANDS

Douglas Causey<sup>1</sup> (dcausey@uaa.alaska.edu) Veronica M. Padula<sup>2</sup>

<sup>1</sup>UAA Dept Biological Sciences, Anchorage, AK 99508.

<sup>2</sup>UAF School of Fisheries and Ocean Sciences, Fairbanks, AK 99775.

The Arctic regions are experiencing rapid change in marine and terrestrial environments from many sources, primarily caused by climate change and anthropogenic impacts of increased development and pollution. Several endemic species, such as Red-faced Cormorants (*Phalacrocorax urile*) are currently undergoing dramatic population declines, likely related to climate-related change in food availability and trophic structure of the local marine environment. In this study, we are analyzing the constituent stable isotopes (eg. H, C, N, O, S) of blood and feather samples collected from 16 avian species collected in the far Western Aleutian Islands (eg., Near, Rat, and Delarof Islands) since 2000. Our preliminary results indicate that the community-wide spatial and temporal dynamics of marine bird ecosystems are far greater in the last decade (2009-2015) than has been evident over recent decades. We also find that the magnitude of change is lesser here in the low Arctic (e.g., western Aleutian Islands 53N) compared to High Arctic coastal marine ecosystems (e.g., 78N). In particular, we show that the ecological patterns observed within such widespread arctic species as puffins (*Fratercula* spp.), Northern Fulmars (*Fulmarus glacialis*), and Black-legged Kittiwake (*Rissa tridactyla*) indicate diets are strongly perturbed on small geographic and temporal scales of 101 km and decades. Moreover, we find that the variance in environmental and ecological parameters is increasing rapidly over time. We hypothesize that these fine-scale changes are related to mid-scale oceanographic and trophic-level changes (eg., the “Warm Blob”), in addition to larger-scale perturbations possibly related to a cascade of climate-related factors. (Talk)



## VIRAL SURVEILLANCE OF SEABIRDS OF THE CENTRAL AND WESTERN ALEUTIANS

Douglas Causey<sup>1</sup> (dcausey@uaa.alaska.edu) Megan Howard<sup>1</sup> Melanie Wright<sup>1</sup>

<sup>1</sup>UAA Dept Biological Sciences, Anchorage, AK 99508.

About 70% of the emerging pathogens infecting humans originate from animals. Most were due to RNA viruses due to their higher mutation rates compared with other types of microbes and their capability for unique genetic change, either by genetic recombination in positive-sense RNA viruses or genetic reassortment in RNA viruses with segmented genomes. Those with the greatest impact include coronaviruses and orthomyxoviruses (influenza) which, including other viral groups, birds serve as their natural reservoirs. Waterfowl are now routinely surveyed for the presence of certain types of influenza, but few seabirds, and fewer still for coronavirus, orthoreovirus, paramyxovirus, or other known zoonotic pathogens. Almost nothing is known about the prevalence, identity, titres, or host/reservoir distribution from breeding seabirds of the central and western Aleutians. We report here the results of viral survey of auklets, puffins, kittiwakes, and cormorants collected in 2013 - 2015 using genomic and gene-specific markers. Preliminary results indicate that influenza was not detectible in any of our samples, while as expected coronavirus and orthoreovirus were present. We discuss the implications of these baseline studies and how they may be interpreted compared to similar studies in other regions. (Talk)

ANOTHER SUCCESSFUL YEAR ON RESTORATION OF THE CHINESE CRESTED TERN (*THALASSEUS BERNSTEINI*) COLONY ON TEIDUN DAO, JIUSHAN ISLANDS, CHINA (2015): REPORT AND FUTURE PLANS

Simba Sing Yin Chan<sup>1</sup> (simba.chan@birdlife.org) Daniel D. Roby<sup>2</sup> Donald E. Lyons<sup>3</sup> Yasuko Suzuki<sup>3</sup> Yat Tung Yu<sup>4</sup> Shuihua Chen<sup>5</sup> Zhongyong Fan<sup>5</sup> Yiwei Lu<sup>5</sup> Xiao Zhou<sup>6</sup>

<sup>1</sup>BirdLife International Asia Division, 4F TM Suidobashi Bldg., 2-14-6 Misaki-cho, Chiyodaku, Tokyo, Japan 101-0061.

<sup>2</sup>U.S. Geological Survey-Oregon Cooperative Fish and Wildlife Research Unit, 104 Nash Hall, Corvallis, Oregon 97331 USA.

<sup>3</sup>Oregon State University, 104 Nash Hall, Corvallis, Oregon 97331, USA.

<sup>4</sup>The Hong Kong Bird Watching Society, 7C, V Ga Building, 532 Castle Peak Road, Lai Chi Kok, Kowloon, Hong Kong.

<sup>5</sup>Zhejiang Museum of Natural History, West Lake Cultural Square 6, Hangzhou City, Zhejiang Province, China.

<sup>6</sup>Zhejiang Normal University, Wucheng District, Jinhua City, Zhejiang Province, China.

Restoration of a breeding colony of Chinese Crested Terns in the Jiushan Islands, Zhejiang, China was initiated in 2013. A 2-ha island named Tiedun Dao was chosen as the restoration site. Since 2014, the Tiedun Dao colony has been monitored continuously during the breeding season, improving both nesting success and our understanding of the breeding biology of this critically endangered species. In both 2014 and 2015, record-breaking numbers of Chinese Crested Terns arrived on Tiedun Dao (more than 40 in 2014; more than 50 in 2015), along with several thousand Greater Crested Terns. Thirteen and 16 Chinese Crested Tern chicks fledged in 2014 and 2015, respectively. Both species of crested terns formed a very dense colony with 8-9 nests per square meter. Intense competition for nest sites and abandonment of nests in areas of the colony with lower nest densities were observed. In August 2015 the restoration team started color-banding crested terns on Tiedun Dao (both Greater Crested Terns and Chinese Crested Terns). The project will be extended to Indonesia where the terns are most likely to spend their winter. A survey trip to Seram Island in eastern Indonesia is planned for early 2016. (Talk)

## TERN BANDING PROJECT IN MATSU ISLAND TERN REFUGE, TAIWAN

Le-Ning Chang<sup>1</sup> (hdasjki@gmail.com) Chung-Hang Hung<sup>1</sup> Hsiao-Wei Yuan<sup>1</sup>

<sup>1</sup>School of Forestry and Resource Conservation, National Taiwan University.

Matsu island is the first site that Chinese crested terns (*Thalasseus Bernsteini*) were found and recorded their breeding success since 1937. Matsu, Wuzhishan and Jiushan archipelago are the three areas confirmed to have their breeding populations. Chinese Crested Terns co-habitat with the Greater Crested Terns (*T. bergii*) and also migrate and over-winter together. However, we only have very limited knowledge on their population dynamic and migration ecology in east Asian-Australasian flyway, which caused limited effects on planning conservation policy and management strategy. Tern banding project in Matsu Islands Tern Refuge (MITR) has been conducted by Wild Bird Society of Taipei and National Taiwan University since 2008. In 2008-2015, nearly 400 individuals of Greater Crested Tern, Bridle Tern, Roseate Tern and one Chinese Crested Tern(this year) have been banded and we get resighting data not only in Matsu but also in Jiushan. Further study will be focus on monitoring the site fidelity, breeding dispersal and migratory behavior for both terns via banding and satellite tracking. We expect to establish the base line data for both terns in terms of breeding, feeding and migration ecology, and population dynamics. We are in the hopes that we will understand the threats faced for the terns, and set up and execute the conservation action plan. (Poster)

## APPROACHES TOWARD RESTORATION OF THE CRITICALLY ENDANGERED CHINESE CRESTED TERN

Shuihua Chen<sup>1</sup> (chensh@zmnh.com) Daniel D. Roby<sup>2</sup> Simba Sing Yin Chan<sup>3</sup> Hsiao-Wei Yuan<sup>4</sup> Donald E. Lyons<sup>5</sup> Yasuko Suzuki<sup>5</sup> Zhongyong Fan<sup>1</sup> Yiwei Lu<sup>1</sup> Chung-Hang Hung<sup>4</sup>

<sup>1</sup>Zhejiang Museum of Natural History, Hangzhou, China.

<sup>2</sup>U.S. Geological Survey-Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis, Oregon USA.

<sup>3</sup>BirdLife International-Asia Division, Tokyo, Japan.

<sup>4</sup>School of Forestry and Resource Conservation, National Taiwan University, Taipei, Taiwan.

<sup>5</sup>Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon USA.

The Chinese Crested Tern (CCT, *Thalasseus bernsteini*) is probably the most threatened seabird species in the world. It was rediscovered in 2000 after a 63-year disappearance. Before 2013, there were only two unstable breeding colonies and three known breeding sites in the East China Sea; total population was estimated at no more than 50 individuals. Major threats include illegal egg harvest, typhoons, and their synergistic effect. This species has only been found nesting in large colonies of Greater Crested Terns (GCTs, *T. bergii*), with which it occasionally hybridizes. In 2013, a tern restoration project was initiated in the Jiushan Islands, a former breeding site of the CCT. Social attraction techniques were used to restore a large breeding colony of GCTs, in hopes that CCTs would subsequently recruit to the colony. The project was successful in the first year; 2,600 GCTs and 19 CCTs were attracted to the new site. Although success in attracting nesting GCTs and CCTs was even greater in 2014, it caused a new problem. The other two existing CCT colonies were negatively affected by attraction to the Jiushan Islands. Thus in 2015, social attraction was used at all three colony sites, and a CCT breeding colony formed at all three. The results showed that social attraction can provide an important tool for the conservation of this critically endangered species, and help create new breeding colonies, stabilize existing colonies, allow close monitoring and detection of potential threats, and improve estimation of total population size. Using this method, a well-protected and monitored conservation network for GCTs and CCTs in the East China Sea could be gradually established, with the hope of saving the CCT from extinction. (Talk)

# HEAVY METAL AND ORGANIC CONTAMINANT LOADS IN CALIFORNIA LEAST TERN (*STERNA ANTILLARUM BROWNI*) AND WESTERN GULL (*LARUS OCCIDENTALIS*) EGGS ACROSS THE SOUTHERN CALIFORNIA BIGHT

Corey A. Clatterbuck<sup>1</sup> (corey.clatterbuck@gmail.com) Rebecca L. Lewison<sup>1</sup> Nathan Dodder<sup>3</sup>  
Ken Schiff<sup>3</sup>

<sup>1</sup>Biology Department, San Diego State University, 5500 Campanile Drive, San Diego CA 92116.

<sup>2</sup>Graduate Group in Ecology, University of California-Davis, 1005 Wickson Hall, University of California, One Shields Avenue, Davis CA 92116.

<sup>3</sup>Southern California Coastal Water Research Project, 3535 Harbor Blvd, Suite 110, Costa Mesa, CA 92626.

Marine environments accumulate anthropogenic contaminants via runoff, the global water cycle, and atmospheric deposition. The most persistent contaminants can remain in these environments for decades and biomagnify in seabirds due to their position as high trophic level consumers. Unfortunate consequences of anthropogenic contamination have been observed in seabirds, including endocrine disruption, depressed breeding success, and altered behaviors. However, sampling and analyzing seabird tissues for contaminants can also inform the health of marine and coastal ecosystems. Here, we report concentrations of three organic toxicant classes and three heavy metals from egg tissues of two seabird species, which were part of a multi-species, regional seabird sampling effort in a biodiversity hotspot, the Southern California Bight. California least tern (*Sterna antillarum browni*, N = 51) and western gull (*Larus occidentalis*, N = 24) eggs were opportunistically collected from eleven sites in summer 2013. We analyzed eggs for a suite of polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and DDT-related compounds, as well as the heavy metals mercury, selenium, and arsenic. We compared contaminant concentrations within and between species in addition to other criteria, including egg morphometrics, latitude, distance to shore, and distance to urban areas. Our analyses constitute one of the most comprehensive regional studies of contaminants in seabird eggs, and demonstrate the need for more synoptic contaminant research to be able to compare contaminant exposure across species and important seabird areas within a region. (Poster)

## RESTORING CRITICAL BREEDING HABITAT OF THE GLOBALLY VULNERABLE PINK-FOOTED SHEARWATER (*AR DENNA CREATOPUS*)

Valentina Colodro<sup>1</sup> Peter Hodum<sup>1</sup> (peter@oikonos.org) Christian Lopez<sup>1</sup> Paola Gonzalez<sup>1</sup>  
Hannah Nevins<sup>2</sup>

<sup>1</sup>Oikonos Ecosystem Knowledge, P.O. Box 1918, Kailua, HI 96734.

<sup>2</sup>American Bird Conservancy, P.O. Box 249, 4249 Loudoun Ave., The Plains, VA 20198-2237.

The globally Vulnerable Pink-footed Shearwater (*Ardenna creatopus*) is a Chilean endemic known to breed on only three islands, Robinson Crusoe and Santa Clara islands in the Juan Fernández Archipelago and Mocha Island. Among the colony-based threats confronting the species, degradation of breeding habitat and predation by introduced mammals have had significant population-level impacts, especially in the Juan Fernández Islands. As part of a long-term conservation strategy for the species, we have been restoring breeding colony habitat by constructing fences to exclude mammals and outplanting native plants within colonies. Fences have been constructed on Robinson Crusoe Island to exclude cattle (*Bos taurus*) from one colony and feral cats (*Felis catus*), European rabbits (*Oryctolagus cuniculus*) and coati mundis (*Nasua nasua*) from a second colony. Rabbit exclusion fences have been installed within fenced areas to create plots in which outplanting of native plant assemblages occurs. On Santa Clara Island, techniques are being developed to facilitate reestablishment of native plants in breeding colonies vulnerable to high rates of soil erosion. All of the work is done by our team of trained local resident technicians and program coordinators. Limited local capacity, inconsistent support from government agencies, as well as the logistics of designing, constructing and maintaining infrastructure on remote islands have all been significant challenges. Community and agency support for such initiatives requires time, investment in laying a conceptual framework for the project, and genuine long-term engagement with stakeholders to build trust, credibility and collaborations. (Talk)

ENDANGERED HAWAIIAN PETREL AND THREATENED NEWELL'S SHEARWATER ENTER ARTIFICIAL BURROWS IN WEST-MAUI FENCED PREDATOR ENCLOSURES DURING THE SECOND YEAR OF CALL PLAYBACK

Mitchell Craig<sup>1</sup> (mcraig@sunedison.com) Spencer Engler<sup>1</sup> Sarah Scheel<sup>1</sup> Matthew Stelmach<sup>1</sup> Steve Sawyer<sup>2</sup> David Cowan<sup>1</sup> David Ainley<sup>3</sup> Greg Spencer<sup>3</sup>

<sup>1</sup>SunEdison, LLC, 3000 Honoapiilani Hwy, Wailuku Hawaii.

<sup>2</sup>Ecoworks NZ Ltd., 144 Makaraka Road, RD1, Gisborne 4071.

<sup>3</sup>H.T. Harvey and Associates, 983 University Avenue Building D, Los Gatos, CA 95032.

We implemented measures to increase survival of the endangered Hawaiian petrel (*Pterodroma sandwichensis*) and the threatened Newell's shearwater (*Puffinus newelli*) on West Maui, Hawaii in order to address provisions of two Habitat Conservation Plans. Predator-excluding fences around two roughly 4.25 acre sites were completed in September 2013. Mongoose and feral cats have been completely removed from both enclosures as of January 2014, and rats and mice have been reduced to less than 10 percent of the initial activity as measured with tracking tunnels. Fifty artificial nesting burrows and attached boxes have been installed in the ground in each of the two enclosures. Call playbacks and custom-fabricated decoys began to be used in February 2014 to attract prospecting birds to the sites with only petrel calls enclosure B and shearwater calls in enclosure A. Year-round trapping continues inside and outside of the enclosures. Fence lines are inspected bi-monthly for breaches or weaknesses from animal burrowing, erosion and wind. Calls were broadcast in continual loops from sunset to sunrise during two breeding seasons between February and November in both 2014 and 2015 using multiple speakers in each enclosure. Remote infrared game cameras spied on at least five artificial burrows in each enclosure focusing on burrows nearest to the speakers. One unknown petrel, possibly a Bulwer's (*Bulweria bulwerii*), was photographed in 2014 and at least one Hawaiian petrel, one Newell's shearwater, and one possible Bulwer's petrel were photographed multiple times in 2015, all nearest to the speakers but only in the enclosure B. (Talk)

## TAKING THE PLUNGE: COMPARING DIVING BEHAVIOR OF RED-FOOTED AND BROWN BOOBIES BREEDING ON LEHUA ISLET, HAWAI'I

Max Czapanskiy<sup>1</sup> (mzczapanskiy@usgs.gov) Jonathan J. Felis<sup>1</sup> Josh Adams<sup>1</sup> Bill Henry<sup>1</sup> Seth Judge<sup>1</sup>

<sup>1</sup>US Geological Survey Western Ecological Research Center, 400 Natural Bridges Dr., Santa Cruz, CA 95060.

Projected global growth of the offshore wind energy industry highlights the need for information on risks posed to seabirds and in the Pacific Ocean, there are no data regarding the impacts to seabirds. However, in Hawai'i several seabird species have been documented killed in association with terrestrial wind energy infrastructure. To better understand potential risks of wind energy infrastructure offshore of the main Hawaiian Islands (MHI), we tracked breeding seabirds from multiple colonies with GPS loggers and temperature-depth recorders (TDRs) from 2013-2015. Here, we present diving behavior data of sympatric breeding Red-footed (*Sula sula*) and Brown (*S. leucogaster*) boobies from Lehua Islet (32 km west of Kaua'i). We recovered paired GPS and TDR data from 36 Brown Boobies and 76 Red-footed Boobies. Deployments averaged 5.2 days and we identified  $\approx 9,000$  dives. Results show Brown Boobies dove more frequently and to greater depths than Red-footed Boobies. Although the Brown Boobies' dive frequency was more consistent across trips and individuals, their dive depths revealed greater variability. When combined with our GPS tracking data, these results will identify important foraging locations to better assist future marine spatial planning around MHI with the ultimate goal to decrease risks associated with offshore wind energy development. (Talk)



## RESTORATION OF THE SHORT-TAILED ALBATROSS COLONY IN OGASAWARA ISLANDS USING TRANSLOCATION AND HAND-REARING OF CHICKS: SHORT-TERM OUTCOMES OF POST-RELEASE MONITORING

Tomohiro Deguchi<sup>1</sup> (deguchi@yamashina.or.jp) Fumio Sato<sup>1</sup> Masaki Eda<sup>2</sup> Hiroe Izumi<sup>2</sup> Hajime Suzuki<sup>3</sup> Robert M. Suryan<sup>4</sup> Ellen W. Lance<sup>5</sup> Hasegawa Hiroshi<sup>6</sup> Kiyooki Ozaki<sup>11</sup> Yamashina Institute for Ornithology, Konoyama 115, Abiko, Chiba 270-1145, Japan.

<sup>2</sup>Hokkaido University Museum, Kita 10, Nishi 8, Kita-ku, Sapporo, Hokkaido 060-0810, Japan.

<sup>3</sup>Institute of Boninology, Miyanohamamichi, Chichijima, Ogasawara, Tokyo 100-2101, Japan.

<sup>4</sup>Hatfield Marine Science Center, Oregon State University, 2030S.E. Marine Science Drive, Newport, Oregon 97365, USA.

<sup>5</sup>U. S. Fish and Wildlife Service, Anchorage Fish and Wildlife Field Office, 605 W. 4th Ave., Room G61, Anchorage, Alaska 99501, USA.

<sup>6</sup>Toho University, 2-2-1 Miyama, Funabashi, Chiba, 274-8510, Japan.

Restoration or establishment of colonies using translocation and hand-rearing of chicks have been considered the effective tool for conservation management of birds. However, a well-designed post-release monitoring study for assessing translocation success has been rarely implemented. To evaluate short-term outcomes following the translocation of 70 post-guard phase Short-tailed Albatross (*Phoebastria albatrus*) chicks, we investigated the attendance and breeding attempts of hand-reared birds on their natal island, Torishima, and the translocation site, Mukojima, during 7 years since the first translocation. The results indicated our chick translocation attempts facilitated their recolonization and breeding on extinct nesting sites far away from the active colonies. Twenty-two hand-reared birds returned and of which a bird bred on Mukojima at 2-3 and 5 years of age, respectively. However, 73% of hand-reared birds visiting on Mukojima also visited on Torishima, and both individual numbers of birds visiting per day and breeding ( $n = 3$ ) on Torishima were more than Mukojima. Sex and body size did not affect on their return rate although 6 birds only returning to Mukojima had a trend of heavier body mass than 5 birds only returning to Torishima. Theses suggest conspecific social attraction and natal philopatry has a greater effect on colonization than philopatry to the translocation site. A pair of hand-reared female and naturally reared male, however, was successful in breeding on a different island 5 km away from Mukojima under little conspecific attraction. Further study is needed to fully understand breeding habitat selection of Short-tailed Albatross beyond conspecific attraction and philopatry. (Talk)

## MANDT'S GUILLEMOT (CEPPHUS GRYLLE MANDTII) - THE RAREST PACIFIC ALCID

G. J. Divoky<sup>1</sup> (divoky@cooperisland.org)

<sup>1</sup>Friends of Cooper Island, Barrow, AK and Seattle, WA.

The subspecies of *Cepphus* breeding in the Arctic adjacent to the Pacific was considered its own species until 1931 when it was lumped with *Cepphus grylle*, the Black Guillemot. Genetic analysis indicates the current Chukchi and Beaufort Sea population occupied an unglaciated refugium north of the Bering Land Bridge during the Last Glacial Maximum, leading to their dependence on Arctic Cod and zooplankton associated with Arctic sea ice. Mandt's Guillemot is present in the Pacific for only 5-6 months each year, entering the Bering Sea in early December when ice cover in the adjacent Arctic Ocean is nearly complete and the ice edge advances through the Bering Strait. Birds then occupy the winter sea ice over the Bering Sea shelf until April and early May before returning to colonies in the Arctic Basin. Minimal censusing of western Arctic colonies of Mandt's Guillemot has resulted in highly speculative and varying population estimates and precludes a reliable assessment of current population trends. Recent major reductions in summer sea ice extent and increases in sea surface temperature are affecting breeding success at a regularly monitored colony in northern Alaska with a population now half of what it was in the early 1990s. Reduced immigration rates at that colony for the last two decades may indicate decreased productivity at the large Siberian colonies where reductions in sea ice are also occurring. (Talk)

## USING SATELLITE IMAGERY TO COUNT NESTING SHORT-TAILED ALBATROSS

Jane Dolliver<sup>1</sup> (dollivej@oregonstate.edu) Robert M. Suryan<sup>2</sup> Christopher Noyles<sup>3</sup> Ellen W. Lance<sup>4</sup> Catherine Yeargan<sup>5</sup>

<sup>1</sup>Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR, 97331.

<sup>2</sup>Hatfield Marine Science Center, 2030 S.E. Marine Science Dr, Newport, OR 97365.

<sup>3</sup>Bureau of Land Management, Alaska State Office, 222 W 7th Ave, Anchorage, AK 99513.

<sup>4</sup>Bonneville Power Administration, 905 NE 11th Ave, Portland, OR 97232.

<sup>5</sup>U.S. Fish and Wildlife Service, Alaska Region, 4700 BLM Rd, Anchorage, AK 99507.

Approximately 20% of the Short-tailed Albatross (*Phoebastria albatrus*) population nests on the Senkaku Islands, however, because of territorial disputes between Japan and China, a nesting population count has not been conducted on this island since 2002. We are initiating a study to test the efficacy of satellite-based counts of nesting albatross using DigitalGlobe's WorldView-2 & 3 Satellite (0.5-0.3m monochromatic resolution) and ENVI image processing software. We will compare satellite-based counts with ground counts of 3 species of albatrosses (short-tailed, *Phoebastria albatrus*, black-footed, *P. nigripes*, and Laysan, *P. immutabilis*) at multiple colonies in Hawaii and Japan to test species identification accuracy and determine the correction factor(s) needed to ground truth satellite counts of unknown populations on the Senkaku Islands. Preliminary assessments are promising for separating nesting short-tailed albatross from other ground-nesting species. These methods could be broadly applied to many seabird populations in remote and/or inaccessible areas and at more frequent intervals, especially where human presence impacts ground-based estimates, or impacts other species. (Poster)

## DIET OF RED-FOOTED BOOBIES PROVISIONING CHICKS ON O'AHU

Sarah E. Donahue<sup>1</sup> (sarah.donahue93@gmail.com) K. David Hyrenbach<sup>1</sup> Josh Adams<sup>2</sup>

<sup>1</sup>Hawai'i Pacific University, Oceanic Institute, 41-202 Kalaniana'ole Hwy, Waimanalo, HI 96795.

<sup>2</sup>U.S. Geological Survey, 400 Natural Bridges Dr, Santa Cruz, CA 95060.

The diet of Red-footed Boobies, (*Sula sula*), was described from 106 regurgitation samples collected opportunistically at Ulupau Crater, O'ahu, Hawai'i, over two years: 2014 (June 1-7) and 2015 (June 17-July 27). This same colony was studied by Ashmole and Ashmole in 1963, providing an interesting comparison 50 years later. We sorted a total of 1001 prey items into 3 categories: fish, squid and other, including extremely digested tissue ("mush") and parasitic isopods. The average number of prey items per sample was 8.20 +/- 5.81 and 10.78 +/- 8.71 in 2014 and 2015, respectively. We first ranked the prey items on a categorical freshness scale: 1 (perfect condition), 2 (superficial digestion but good condition), and 3 (incomplete). Then, we took length and mass measurements for the complete prey items, which ranged widely in size, from 1.5 to 20.5 cm. Overall, the diet composition did not vary significantly between the two study years. Every sample (51 in 2014 and 52 in 2015) contained fish. Squid was present in 70.6% and 76.4% of the samples in 2014 and 2015, respectively. The Ashmoles collected 12 samples containing 107 complete prey items with an average of 9 items per sample. Squid was present in 75.0% of the 1963 samples. Ommastrephid squid were 4 - 8 cm in mantle length and fish were 4 - 20 cm. Ongoing identification analysis of the fish and squid from the contemporary samples will contribute to the diet and foraging ecology of Red-footed Boobies during two years of contrasting oceanographic conditions. (Poster)

## BREEDING SEABIRDS OF JOHNSTON ATOLL: IF YOU BUILD IT, AND LEAVE IT, THEY WILL COME

Kevin Donmoyer<sup>1</sup> (kevin\_donmoyer@fws.gov) Katrina Scheiner<sup>1</sup> Stefan Kropidlowski<sup>1</sup> Lee Ann Woodward<sup>1</sup> Beth Flint<sup>1</sup> Amanda Pollock<sup>1</sup>

<sup>1</sup>Pacific Islands Refuges and Monuments Office, 300 Ala Moana Blvd Rm. 5-231, Honolulu, HI 96850.

Johnston Atoll National Wildlife Refuge has what can be considered, a “colorful history.” Starting in 1934, the fourteen seabird species that relied on the atoll’s islets to breed were forced to do so in the shadow of an active U.S. military base, with all its myriad activities: dredging and filling to increase the land area, atmospheric nuclear tests, chemical weapons incineration, toxic chemical storage, 2,000 human residents, and an influx of non-native trees and shrubs. It’s no surprise then that at the time of base closure in 2004, Johnston Island, largest of the four islets in the atoll, was home to less than half of the 14 species of seabirds originally observed breeding on this island during the Tanager Expedition of 1923. In the time since closure, Johnston Island has been left mostly untouched. Thick vegetation obscures cracked streets and derelict bunkers, while birds are experiencing a resurgence in nesting. Ten species of seabirds are currently breeding on island and one previously unrecorded species, the White-tailed Tropicbird (*Phaeton lepturus*), is now frequently observed raising chicks. Some species, such as the Red-tailed Tropicbird (*Phaethon rubricauda*), are presently found on Johnston Island in far greater numbers than before or during human occupation. Bulwer’s Petrels (*Bulweria bulwerii*), Christmas Shearwaters (*Puffinus nativitatis*), and Great Frigatebirds (*Fregata minor*) have bred inconsistently on Johnston Island since 2004. The only original species not nesting on Johnston Island are the Laysan Albatross (*Phoebastria immutabilis*) and Masked Booby (*Sula dactylatra*), although Masked Boobies do breed on other islets in the atoll. (Poster)

## RESPONSE OF LEAST AND CRESTED AUKLETS TO NATURAL RESTORATION OF NESTING HABITAT FOLLOWING CATASTROPHIC DISTURBANCE

Gary S. Drew<sup>1</sup> (gdrew@usgs.gov) John F. Piatt<sup>1</sup> Jeffrey C. Williams<sup>2</sup>

<sup>1</sup>USGS Alaska Science Center, 4210 University Dr., Anchorage AK 99508.

<sup>2</sup>Alaska Maritime National Wildlife Refuge, 95 Sterling Hwy, Homer, AK 99603.

Prior to its eruption in August 2008, Kasatochi Island provided nesting opportunities to a variety of seabird species; most notably a large mixed colony of crested (*Aethia cristatella*) and least auklets (*Aethia pusilla*). The eruption buried all existing nesting habitat on the island. Despite extensive erosion, virtually all pre-eruption nesting habitats for auklets remain covered with ash. In the first two years following the eruption, auklet nesting attempts were restricted to low quality habitats near beaches. In 2011 large numbers of auklets were observed using a rock fall area in a watershed north of the primary pre-eruption colony site. Repeated photographs of this cove documented the accumulation of large rocks and talus. We were able to gain access to this new area through an erosion gully in June of 2012 and confirmed that this new colony site was being used for nesting by thousands of birds. Despite the substantial erosion, new rock fall sites represent the only nesting habitat currently available to crested and least auklets. Densities of auklets from surveys 2 km offshore, suggest there has been a shift in the relative abundance of auklets in favor of *A. pusilla*. Our results indicate that following a catastrophic disturbance such as the 2008 Kasatochi eruption, legacy sites play little or no role in the recovery of crevice nesting habitats. Instead, the availability nesting habitat depends on geomorphological processes, e.g., rockfalls or lava flows, and such processes can be relatively rapid and predictable. (Talk)

## AN UNUSUAL AVIAN CONTAMINANT: “MYSTERY GOO” IN SAN FRANCISCO BAY, JANUARY 2015

Rebecca S. Duerr<sup>1</sup> (rebecca.duerr@bird-rescue.org) Julie Skoglund<sup>1</sup>

<sup>1</sup>International Bird Rescue, 4369 Cordelia Rd, Fairfield, CA 94534.

On January 16, 2015, International Bird Rescue’s San Francisco Bay wildlife center (IBR) received word that at least 50 Surf Scoters (*Melanitta perspicillata*) were beached with contaminated plumage along the eastern shore of San Francisco Bay. By one week later, IBR had received 323 live-stranded contaminated birds from the waterfronts of Alameda to Hayward, CA. Several hundred additional birds were collected dead. Species affected included Surf Scoters, Bufflehead (*Bucephala albeola*), Horned Grebe (*Podiceps auritus*), Greater Scaup (*Aythya marila*), Western Sandpiper (*Calidris mauri*), Common Goldeneye (*Bucephala clangula*), Dunlin (*Calidris alpina*), and others. The contaminant was determined to not be a petroleum product, consequently California Department of Fish and Wildlife was unable to respond; hence, collection and care of birds was managed by the non-profit wildlife rehabilitation community. The contaminant resembled semi-cured epoxy in texture and was more difficult to remove than oil, but an effective washing procedure was developed. A large fraction of contaminated birds had serious medical problems, including emaciation, severe dehydration, and skin lesions at hocks, toes, carpus, and/or keel, plus several birds were attacked by predators while beached. Treatment and release of >50% of the live-captured birds was achieved through intensive medical management, hardworking staff and volunteers, and public financial support. Three federally banded scoters were treated and released, including two banded in 2008 in Padilla, WA, and one female banded by IBR in 2008 after transfer from Texas Sate Aquarium and treatment for a keel fracture. The source and identity of the contaminant was never definitively determined. (Talk)

# INVASIVE HOUSE MOUSE PREDATION ON ADULT NESTING ALBATROSSES AND SUBSEQUENT NEST ABANDONMENT AND MORTALITY ON SAND ISLAND, MIDWAY ATOLL NATIONAL WILDLIFE REFUGE

Meg Duhr-Schultz<sup>1</sup> (meg\_duhrschultz@fws.gov) Ann Humphrey<sup>1</sup> Beth Flint<sup>2</sup> David Dow<sup>1</sup>  
Allie Hunter<sup>2</sup> Thierry Work<sup>3</sup>

<sup>1</sup>US Fish and Wildlife Service, Midway Atoll National Wildlife Refuge, Honolulu, HI.

<sup>2</sup>US Fish and Wildlife Service, Pacific Island Refuges and Monuments Office, Honolulu, HI.

<sup>3</sup>USGS National Wildlife Health Center, Honolulu Field Station, Honolulu, HI.

In December 2015, a small, localized cluster of Laysan albatrosses (*Phoebastria immutabilis*) with wounds on their necks was found on Sand Island, Midway Atoll National Wildlife Refuge. Absent an obvious mechanism of injury, a monitoring program was established. Our findings revealed that the severity of wounds, number of impacted birds, and area of impact had increased dramatically between December 23, 2015-January 5, 2016. Five birds were originally noticed and 25 were present by January 5th. Initially, small shallow wounds on the head and neck were present, but injury location later switched to the back and increased in size and depth. After consultation with wildlife health experts, it was suspected that rodents were responsible. USFWS staff and volunteers used trail cameras to determine the cause of the wounds on the nesting albatrosses, confirming that invasive house mice (*Mus musculus*) were repeatedly entering and staying in the feathers on the backs of nesting albatrosses for prolonged periods of time. Subsequent intensive monitoring of the area indicated a higher than average level of nest abandonment and higher adult mortality rate in the impacted area, with fresh carcasses displaying open wounds to their back. Initial necropsies of freshly dead, bitten birds revealed that the birds were in excellent body condition with no cause of death evident other than the large wounds on their backsides caused before death and the presence of bacteria at wound sites suggestive of sepsis. (Poster)



## DOUBLE-CRESTED CORMORANT DECLINES ON SAN FRANCISCO BAY BRIDGES

Meredith L. Elliott<sup>1</sup> (melliott@prbo.org) Mark J. Rauzon<sup>2</sup> Eric Lichtwardt<sup>3</sup>

<sup>1</sup>Point Blue Conservation Science, 3820 Cypress Drive, #11, Petaluma, CA 94954.

<sup>2</sup>Laney College, Geography Department, 900 Fallon Street, Oakland, CA 94607.

<sup>3</sup>LSA Associates, 157 Park Place, Point Richmond, CA 94801.

The double-crested cormorant (*Phalacrocorax auritus*) is a seabird known to occupy urban structures as nesting habitat. The old east span of the San Francisco-Oakland Bay Bridge (SFOBB) and the Richmond-San Rafael Bridge (RSRB) have hosted the two largest colonies of this species in the region. However, boat counts of these colonies in 2015 showed precipitous declines on both bridges; less than half of each colony remained from 2014. The old east span of the SFOBB is currently being dismantled, and despite social attraction techniques employed to attract cormorants to nesting platforms on the new SFOBB east span, the cormorants have not used these structures yet. The RSRB has maintenance projects that have blocked off where the cormorants have nested in the past. So it begs the question: where will the double-crested cormorants nest in the future? We are undergoing a region-wide study of double-crested cormorant colonies by censusing aerial photographs (2004-2014). These results will provide a regional status assessment for this species, as well as inform us on how this species moves and uses different areas in the Bay. Double-crested cormorants are known to move to other colonies within their west coast range, as evidenced by a banded double-crested cormorant on the SFOBB; this bird was hatched at East Sand Island in Oregon, a large double-crested cormorant colony which is soon to be reduced by the U.S. Army Corps of Engineers in an attempt to protect endangered salmonids in the Columbia River Estuary. (Talk)

# COMMON MURRES IN UNCOMMON NUMBERS: THE EFFECT OF THE RESURGENCE OF COMMON MURRES ON THE NESTING BEHAVIOR OF BRANDT'S CORMORANTS

Leo Estrada<sup>1</sup> (Leo.Estrada@pomona.edu) Diane Hichwa<sup>2</sup> Nina J. Karnovsky<sup>1</sup>

<sup>1</sup>Pomona College, 175 W. 6th St. Claremont CA 91711.

<sup>2</sup>Madrone Audubon, PO Box 1911, Santa Rosa, CA 95402.

The purpose of this project was to better understand the relationship between different species on Gualala Point Island (GPI), an important breeding site for marine seabirds in The Sea Ranch, California. The California Coastal National Monument Stewardship Taskforce has been using citizen science to collect data via aerial photographs of GPI taken approximately every two to three weeks during the summer breeding season for the last eight years. Within this last decade of observations, a resurgence in the presence of common murres has occurred; the population has gone from zero to over a thousand. We hypothesized that the abundance of common murres on GPI has a bidirectional effect on the abundance of Brandt's cormorants dependent on the density of common murres. We predicted that the increasing number of common murres would result in an initial increase in Brandt's cormorants nesting sites at low densities before declining at large densities during their breeding season. We tested our hypothesis by comparing the nest abundance of Brandt's cormorants for several years before and after the arrival of the common murres - utilizing the aerial photography of GPI to discern the count and location of nests. Our preliminary results indicate a general confirmation of our hypothesis with Brandt's nest counts ultimately declining from 2014 to 2015. (Poster)

## MONITORING AND RESTORATION OF SURFACE NESTING SEABIRDS ON THE BAJA CALIFORNIA PACIFIC ISLANDS, MEXICO

Alejandra Fabila-Blanco<sup>1</sup> (alejandra.fabilab@gmail.com) Yuliana Bedolla-Guzmán<sup>1</sup> María Félix-Lizárraga <sup>1</sup> Evaristo M. Rojas-Mayoral<sup>1</sup> Alfonso Aguirre-Muñoz<sup>1</sup> Esmeralda Bravo-Hernández<sup>1</sup> Alicia Aztorga-Ornelas<sup>1</sup> Luis Carrillo-Maldonado<sup>1</sup> Miguel Corrales-Sauceda<sup>1</sup> José Magos-Martínex<sup>1</sup> Jorge Sánchez-Solís<sup>1</sup> Annie E. Little<sup>2</sup> Jennifer Boyce<sup>3</sup> Eduardo Iñigo-Elías<sup>4</sup> Stephen W. Kress<sup>5</sup>

<sup>1</sup>Grupo de Ecología y Conservación de Islas, A. C., Moctezuma 836, Zona Centro, Ensenada, Baja California, México 22800.

<sup>2</sup>U.S.Fish and Wildlife Service , 1901 Spinnaker Drive, Ventura, CA 93001.

<sup>3</sup>Montrose Settlements Restoration Program Manager/NOAA Restoration Center, 501 West Ocean Blvd., Suite 4470, Long Beach, CA 90802.

<sup>4</sup>Conservation Science Program, Cornell Lab of Ornithology, 159 Sapsucker Woods Rd, Ithaca, NY 14850.

<sup>5</sup>Seabird Restoration Program, National Audubon Society, 159 Sapsucker Woods Rd., Ithaca, NY.

The Mexican islands in the Pacific Ocean, off the Baja California Peninsula, are priority-nesting sites for 21 seabird species, including six endemisms. As part of an ongoing seabird restoration project, we have carried out daily counts, nest censuses, and evaluated reproductive performance of Brown Pelican (*Pelecanus occidentalis*), Brandt's Cormorant (*Phalacrocorax penicillatus*), Double-Crested Cormorant (*Phalacrocorax auritus*), and Western Gull (*Larus occidentalis*) on seven island groups. We have also assessed the effectiveness of social attraction systems for Brandt's and Double-Crested Cormorants on two islands. For the 2015 breeding season, we recorded high maximum number of individuals ( $\approx 6500 - 25,000$ ) and nests (528 - 2984); reproductive performance was low for most species (0 to 0.5 fledglings/breeding pair). We observed nest abandonment on Brandt's and Double-Crested Cormorants and Brown Pelican, associated to the atmospheric and oceanic anomalous conditions and due to a high predation by Western Gull and Common Ravens on Brandt's Cormorant. Overall, encouraging positive results on social attraction systems are being recorded. For instance, we had eight nests of Double-Crested Cormorant in the middle of an artificial colony, with four producing fledglings. The high number of observed interactions are a direct indication that artificial colonies are successfully attracting both cormorant species. These results highlight the importance to continue with the long-term monitoring and conservation program to track fluctuations and trends in these seabird populations, while simultaneously enhancing and expanding the use of social attraction methods to restore breeding colonies. (Talk)

## IDENTIFYING KITTLITZ'S MURRELET NESTING HABITAT IN NORTH AMERICA AT THE LANDSCAPE SCALE

Jonathan J. Felis<sup>1</sup> (jfelis@usgs.gov) Michelle L. Kissling<sup>2</sup> Robb S. A. Kaler<sup>2</sup> Leah A. Kenney<sup>2</sup>  
Matthew J. Lawonn<sup>3</sup>

<sup>1</sup>US Geological Survey, 400 Natural Bridges Dr, Santa Cruz, CA 95060.

<sup>2</sup>US Fish and Wildlife Service, 3000 Vintage Blvd. Suite 201, Juneau, Alaska 99801.

<sup>3</sup>Kodiak National Wildlife Refuge, 1390 Buskin River Road, Kodiak, Alaska 99615.

The Kittlitz's Murrelet (*Brachyramphus brevirostris*) is a small, non-colonial seabird endemic to marine waters of Alaska and eastern Russia that may have experienced significant population decline in recent decades, in part because of low reproductive success and terrestrial threats. Although recent studies have shed new light on Kittlitz's Murrelet nesting habitat in a few discrete areas, the location and extent of suitable nesting habitat throughout most of its range remains unclear. Herein, we compiled all existing nest records and locations to identify landscape-scale parameters (distance to coast, elevation, slope, and land cover) that provide potential nesting habitat in four regions: northern Alaska, Aleutian Islands, Alaska Peninsula Mountains and Kodiak Island, and Pacific Coastal Mountains (including nearshore interior Canada). We produced a final map classifying 12% (70,411 km<sup>2</sup>) of the lands assessed as potential Kittlitz's Murrelet nesting habitat, with dense but distinct patches in northern Alaska and a more uninterrupted, narrow band extending across the Pacific Coastal Mountains, Alaska Peninsula Mountains, and Aleutian Islands. We found considerable regional variation in the extent of habitat-capable parameter values, indicating the Kittlitz's Murrelet may be able to use a variety of habitats for nesting depending on availability. Future nesting habitat studies should employ spatially random sampling designs to allow for more quantitatively robust modeling of nesting habitat and allow predictive extrapolation to areas where nests have not been located, but likely exist. (Poster)

## POST-RELEASE MONITORING OF BROWN PELICANS (*PELECANUS OCCIDENTALIS*) FOLLOWING OILING AND REHABILITATION AFTER THE REFUGIO OIL SPILL

Christine Fiorello<sup>1</sup> (cvfiorello@ucdavis.edu) Patrick G. R. Jodice<sup>2</sup> Kyra Mills-Parker<sup>1</sup> Juliet S. Lamb<sup>2</sup> Richard T. Golightly<sup>3</sup> Yvan Satge<sup>2</sup> Deborah Jacques<sup>4</sup> Laird Henkel<sup>1</sup> Robert McMorran<sup>5</sup> Mike Ziccardi<sup>1</sup>

<sup>1</sup>Oiled Wildlife Care Network, Wildlife Health Center, University of California, Davis, 1 Shields Ave, Davis, CA 95616.

<sup>2</sup>Clemson University/South Carolina Cooperative Fish & Wildlife Research Unit, G27 Lehotsky Hall, Clemson, SC 29634.

<sup>3</sup>Humboldt State University, Arcata, CA.

<sup>4</sup>Pacific Eco Logic, Astoria, OR.

<sup>5</sup>USFWS, 2493 Portola Rd Suite B, Ventura, CA 93003.

Oil spills represent a threat to marine wildlife, but the effects of capture and rehabilitation on oiled wildlife are poorly understood. In May 2015, Plains Pipeline 901 spilled >100,000 gallons of oil near Refugio State Beach, California. Many Brown Pelicans (*Pelecanus occidentalis*) were oiled; capture and rehabilitation efforts began within one day. Ultimately, 50 pelicans were captured. Forty-six survived and were released following rehabilitation using established protocols. Of these, 12 adults (6M, 6F) were fitted with solar-powered GPS satellite transmitters and released in June. In early July, we captured 8 adult (3M, 4F, 1U), unoiled pelicans near Ventura CA. These were similarly instrumented and released immediately. Four months after release, transmitters from 11 of 12 oiled and all 8 control pelicans were still transmitting. Initially, most birds remained in the release area, traveling between the mainland and the Channel Islands. Later, birds began to travel. Four oiled and 1 control bird traveled to the southern Oregon coast; 5 oiled and 1 control bird traveled to the San Francisco Bay area, 2 oiled and 1 control bird went to the CA central coast, and 1 oiled and 3 control birds traveled south to San Diego or Baja California. Two control birds remained in the Ventura area. One oiled bird disappeared abruptly in mid-September; despite multiple searches, no carcass was found. Although our sample size is limited, these data demonstrate that pelicans can survive oiling and rehabilitation, and that their movements are similar to those of controls for at least 4 months post-release. (Talk)

## FROM OBSERVERS TO NECROPSY: COLLABORATING TO DOCUMENT THE DEMOGRAPHY OF NORTH PACIFIC GROUND FISH FISHERY BYCATCH

Shannon Fitzgerald<sup>1</sup> (shannon.fitzgerald@noaa.gov) Jessie Beck<sup>2</sup> Hannah Nevins<sup>3</sup> Michelle Hester<sup>2</sup>

<sup>1</sup>Resource Ecology and Fisheries Management Division, Alaska Fisheries Science Center, NMFS/NOAA, 7600 Sand Point Way N.E., Seattle, WA 98115.

<sup>2</sup>Oikonos Ecosystem Knowledge & CDFW - Marine Wildlife Veterinary Care and Research Center, PO Box 2570, Santa Cruz, CA 95063.

<sup>3</sup>American Bird Conservancy, 180 Benito Ave., Santa Cruz CA 95062.

In Alaska, where incidental catch of seabirds has long been recognized as a conservation concern, organizations have worked collaboratively to implement seabird avoidance measures which reduced bycatch. Despite these successes, thousands of seabirds continue to be incidentally caught annually. The NMFS North Pacific Groundfish Observer Program monitors U.S. groundfish fisheries in federal waters off Alaska. The program collects data for quota-based fisheries management, records marine mammal and seabird interactions, and collects biological samples. To better understand seabird ecology and population-level impacts from bycatch, fishery managers encouraged research by providing seabird specimens to several institutions from 1995-2007. A comprehensive program was needed however, and in 2008 fishery managers paired with Oikonos Ecosystem Knowledge to create the Seabird Bycatch Necropsy Program. Since then, the program has examined 1880 seabirds from Alaska fisheries (including 3 Short-tailed Albatross (*Phoebastria albatrus*)), and has expanded to include over 500 seabird specimens from Hawaii longline fisheries. The program has documented adult biases of 4 procellariid species, indicating fisheries may have disproportionate effects on population growth by removing reproductively mature individuals. Sex biases were detected in albatross species in both Alaska and Hawaii, suggesting differences in behavior or distribution. Collaborations between NGOs, governmental agencies, and fishing industries in support of Seabird Bycatch Necropsy Programs can be instrumental in understanding bycatch impacts to seabirds and informing management for the continued reduction of seabird bycatch. (Talk)

NESTING DISTRIBUTION, SITE CHARACTERISTICS, AND ACOUSTIC MONITORING OF CRAVERI'S MURRELET *SYNTHLIBORAMPHUS CRAVERI* IN THE EASTERN MIDRIFF ISLANDS, GULF OF CALIFORNIA, MÉXICO

Abram B. Fleishman<sup>1</sup> (abfleishman@gmail.com) Emma Hurley<sup>2</sup> Naomi S. Blinick<sup>2</sup> Lorayne Meltzer<sup>2</sup>

<sup>1</sup>Prescott College Kino Bay Center for Cultural and Ecological Studies, 220 Grove Ave, Prescott, AZ 86301.

<sup>2</sup>Conservation Metrics, Inc., 100 Shaffer Rd, Santa Cruz, CA 95060.

Craveri's Murrelet (*Synthliboramphus craveri*) nesting grounds are constrained to northwestern México with the most important nesting islands thought to lie within the Midriff Island region of the Gulf of California. Despite the speculated density in the Midriff Region, nest records of the species are rare. Since the mid-1970s only a handful of nests have been documented. We conducted a nest search on all 7 of the Eastern Midriff Islands and tested the efficacy of automated acoustic surveys to detect the presence of Craveri's Murrelet. Murrelet nests were found on Islas Alcatraz (14 nests), San Pedro Mártir (1 nest), Dátil (1 nest), and Cholludo (1 nest); the latter two islands constitute previously unknown nesting sites. All nests were in rock crevices or under talus within 30 m of the high tide line. Each site was hidden from view and dark with a fine sand surface used as a nest cup. In addition, we deployed a Song Meter 2 acoustic sensor at two sites on Isla Alcatraz. One site was in a coastal area with an active nest and the other location was in the interior of the island where numerous crevices, caves, and rock piles would have provided nesting habitat. Craveri's Murrelet calls were only detected on the recordings near the occupied nest site. Calls were detected the first night after deployment on 23 January and continued until 9 March 2014. The sensor continued to record for three weeks without any additional detections. Call rates were greatest between 220 and 40 minutes before sunrise; however, calls were detected throughout the night from 70 minutes after sunset to 40 minutes before sunrise. From these preliminary data, acoustic monitoring appears to be an effective tool for detecting Craveri's Murrelet. (Poster)

## BAND-RUMPED STORM PETREL (*OCEANODROMA CASTRO*) COLONY PRESENCE AND FLIGHT PATTERNS AT POHAKULOA TRAINING AREA, HAWAII

Nicole K. Galase<sup>1</sup> (ngalase@rams.colostate.edu) Lena D. Schnell<sup>1</sup> Rogelio E. Doratt<sup>1</sup> Peter J. Peshut<sup>2</sup>

<sup>1</sup>Center for Environmental Management of Military Lands, CSU, 1490 Campus Delivery, Fort Collins, CO 80523.

<sup>2</sup>US Army Garrison, Pohakuloa Training Area, PO Box 5193, HI.

Since 2008, acoustic monitoring devices have detected Band-rumped Storm Petrels (*Oceanodroma castro*) at Pohakuloa Training Area (PTA) on Hawaii Island. Due to its imminent listing status, the Army is proactively working to determine the status of *O. castro* at PTA. In 2015 the PTA Natural Resource Office (NRO) conducted surveys at 8 locations in eastern PTA from May to October. Acoustic monitoring, night vision surveys, dog searches, and burrow searches were employed to assess if 1) an *O. castro* colony exists on the installation, and 2) there are any discernible flyway patterns over the installation. Results revealed the presence of an *O. castro* colony, with confirmed activity at a burrow. During 84 hours of night vision surveys, personnel made 449 visual *O. castro* observations. This elusive species nests in rough, inaccessible terrain and spends most of its life at sea. Breeding behavior and distribution are poorly understood. No active *O. castro* nesting burrows have previously been documented in the Hawaiian Islands. The presence of a colony with confirmed activity at a burrow at PTA is significant. To effectively manage *O. castro* at PTA it is imperative that further work is conducted. In 2016, the PTA NRO will conduct field investigations to determine the extent of the colony at the installation as well as behavioral characteristics of this species. (Poster)



## THE BUSY LIFE OF A CASSIN'S AUKLET: INTERANNUAL CHANGES IN DAILY TIME ALLOCATION

Gail Gallaher<sup>1</sup> (ghg02013@MyMail.pomona.edu) Peter M. Warzybok<sup>2</sup> Russell W. Bradley<sup>2</sup> Meredith L. Elliott<sup>2</sup> Jaime Jahncke<sup>2</sup> Andre Cavalcanti<sup>1</sup> Nina J. Karnovsky<sup>1</sup>

<sup>1</sup>Pomona College, 175 W. 6th St. Claremont CA 91711.

<sup>2</sup>Point Blue Conservation Science, 3820 Cypress Dr, Petaluma, CA 94954.

We characterized interannual differences in time allocation (time spent flying, diving and resting) by Cassin's Auklets (*Ptychoramphus aleuticus*) during foraging trips from the Farallones Islands. We hypothesized that these differences are related to differences in prey availability and reproductive success. We predicted that in years with low krill biomass, lower resting time and higher flying time would reflect the need to fly more between prey patches and dive more to obtain sufficient prey. During 2008-2015, we affixed Time Depth Recorders to the body feathers of adults raising chicks and recorded temperature and pressure every 5 seconds for 3-5 days and every 0.5 seconds during diving. We developed a Python program to determine time allocation to diving, flying, and resting during 337 trips away from the colony. Overall, results indicate sizeable interannual variation in diving and flying time and little variation in resting time. However, in 2010, when these Cassin's Auklets experienced very high krill availability and reproductive success, the birds rested more and flew around less. In contrast, in 2008, when both krill availability and reproductive success were low, birds flew around more. We found that diving time was lower in both 2008 and 2010. In 2008, they likely dove less because there was lower prey biomass, while in 2010 they spent less effort diving because prey was available in high densities. These findings indicate a complex relationship between Cassin's Auklet time allocation, particularly diving and flying time, prey availability, and reproductive success. (Poster)

## INVESTIGATION OF A LARGESCALE COMMON MURRE (*URIA AALGE*) MORTALITY EVENT IN CALIFORNIA IN 2015

Corinne M. Gobble<sup>1</sup> (cgobble@ucsc.edu) Kirsten Lindquist<sup>2</sup> Rebecca S. Duerr<sup>3</sup> Jackie Lindsey<sup>4</sup> Barbara Bodenstein<sup>5</sup> Raphael M. Kudela<sup>6</sup> Laird Henkel<sup>1</sup> Jan Roletto<sup>2</sup> Julia Lankton<sup>5</sup> Jim Harvey<sup>4</sup>

<sup>1</sup>Marine Wildlife Veterinary Care & Research Center, 1451 Shaffer Road, Santa Cruz, CA 95060 USA.

<sup>2</sup>Farallones Marine Sanctuary Association, 991 Marine Drive, San Francisco, CA 94129 USA.

<sup>3</sup>International Bird Rescue, 4369 Cordelia Rd, Fairfield, CA 94534 USA.

<sup>4</sup>Moss Landing Marine Laboratories, 8272 Moss Landing Road, Moss Landing, CA 95039 USA.

<sup>5</sup>U.S. Geological Survey, National Wildlife Health Center, 6006 Schroeder Road, Madison, Wisconsin, 53711 USA.

<sup>6</sup>University of California, Santa Cruz, 1156 High Street, Santa Cruz, CA 95064 USA.

Beginning in August 2015, a large number of Common Murres (*Uria aalge*) were reported dead on central and northern California beaches. Beach cast bird survey programs reported higher than average deposition from August through November. Beach Watch (Mendocino through San Mateo Counties) reported >500 dead Murres in August, >1,300 in September, and >850 in October. BeachCOMBERS (Santa Cruz through Ventura Counties) reported >400 dead Murres on California's central coast beaches in September, and >1,000 in October and November. Increased Murre mortality was not reported for southern California beaches. International Bird Rescue (IBR) in Fairfield, CA and other coastal wildlife rehabilitation centers collectively received more than 1,000 live stranded debilitated Murres from Sonoma County to San Luis Obispo County during August-October. Approximately 2/3 of birds admitted to IBR were after hatch year birds, typically emaciated, and molting flight feathers. To determine the probable cause of death, internal examinations were performed on a sample of birds at the Marine Wildlife Veterinary Care and Research Center (n=17) and the National Wildlife Health Center (n=15). Similar to IBR, the majority of examined birds were emaciated with starvation as the most likely cause of death. Birds were also tested for underlying infectious diseases at NWHC, and harmful algal bloom toxins at the University of California, Santa Cruz, results are on-going. While our work exclusively assesses the die-off in California, there was a large, concurrent die-off of Murres in Alaska and Washington. We continue to investigate potential contributing factors to the die-off. (Poster)

## INVESTIGATING NEW METHODOLOGY TO DETERMINE IF MICROCYSTIN TOXIN IMPACTS NEARSHORE FEEDING SEABIRDS IN MONTEREY BAY

Corinne M. Gobble<sup>1</sup> (cgobble@ucsc.edu) Raphael M. Kudela<sup>1</sup>

<sup>1</sup>University of California, Santa Cruz, 1156 High Street, Santa Cruz, CA 95064.

*Microcystis aeruginosa* blooms and associated toxin microcystin are a regular occurrence in freshwater and estuarine systems throughout California, and have recently been detected in nearshore marine environments along the central coast of California. Many marine and estuarine birds forage in the nearshore areas of Monterey Bay, CA, which provides an array of critical habitat. Nearshore feeders may be especially vulnerable to harmful algal blooms (HABs); notably those that produce biotoxins like microcystin, that are capable of concentrating in the invertebrates and fish that these animals rely on for food. We investigated the use of Whatman FTA blood sample collection cards for the detection of microcystin in marine birds admitted to the Monterey County SPCA Wildlife Center between 2011 and 2014. Blood cards were subsequently analyzed via competitive enzyme-linked immunosorbent assay (ELISA). Results of preliminary work indicated that a large volume of blood (0.5mL) was necessary to detect a realistic level of toxin (0.5ppb). This may not be obtainable from sick, dehydrated, or injured birds in rehabilitation. Because of these results, blood cards were combined and binned by species to determine what species were potentially being affected by microcystin toxicity. This information was used as a metric to determine at risk species and aid in development of a baseline of health for nearshore feeding seabirds in the Monterey Bay area. Current available data on the effects of HABs on marine birds is sparse, and better surveillance and detection techniques are needed. This work is intended to help address this deficiency. (Talk)

## PERSISTENT ORGANIC POLLUTANTS IN BOOBIES AND FRIGATEBIRDS FROM TWO REMOTE CENTRAL PACIFIC OCEAN COLONIES

Morgan E. Gilmour<sup>1</sup> (mgilmour@ucsc.edu) Abram B. Fleishman<sup>2</sup> Hillary S. Young<sup>3</sup> Scott A. Shaffer<sup>4</sup>

<sup>1</sup>University of California Santa Cruz, 100 Shaffer Rd, Santa Cruz, CA 95060.

<sup>2</sup>Conservation Metrics, Inc, 100 Shaffer Rd, Santa Cruz, CA 95060.

<sup>3</sup>University of California Santa Barbara, 2116 Noble Hall, University of California, Santa Barbara, CA 93106.

<sup>4</sup>San Jose State University, 1 Washington Square, San Jose, CA 95112.

Pelagic seabirds nest and forage far from mainland sites where intensive agriculture and industrial activities occur. However, due to the volatile nature of many Persistent Organic Pollutants (POPs), agricultural and industrial compounds like organochlorine pesticides, polychlorinated biphenyls (PCBs), and polybrominated diphenyl ethers (PDBEs), may be transported to remote locations, far from the site of synthesis or application. Because these compounds biomagnify in the food web, POPs can cause many adverse effects in high trophic level organisms like seabirds. We measured POPs in two populations of pelagic seabirds at 1) Laysan Island (Northwestern Hawaiian Islands); and 2) Palmyra Atoll (central Pacific), to assess their use as sentinel species for organochlorine contamination in the ocean. Samples from Great Frigatebirds (*Fregata minor*), Brown Boobies (*Sula leucogaster*), Red-footed Boobies (*Sula sula*), and Masked Boobies (*Sula dactylatra*) revealed that the highest amounts of POPs in these remote environments were PCBs, and organochlorine pesticides in the Chlorobenzene family, and DDT. These results are consistent with the distribution pathways of volatile compounds like Chlorobenzenes and DDT, which are light-weight, and travel large distances via the atmosphere. Foraging movements and utilization distribution analyses obtained via GPS tracking aid in characterizing the foraging ecology of seabirds from Palmyra Atoll, which may help us assess sources of POPs in these tropical seabirds' diet. (Talk)

## PREDICTED DOVEKIE DENSITIES IN THE LABRADOR SEA

Carina Gjerdrum<sup>1</sup> (carina.gjerdrum@canada.ca) Dave Fifield<sup>1</sup> April Hedd<sup>1</sup> Sarah N. P. Wong<sup>2</sup> Greg Robertson<sup>1</sup>

<sup>1</sup>Environment Canada, Canadian Wildlife Service, 45 Alderney Drive, Dartmouth, NS Canada.

<sup>2</sup>Acadia University, 15 University Ave., Wolfville, NS Canada.

The Dovekie (*Alle alle*) is considered the most abundant seabird in the North Atlantic and during the winter, a significant proportion of the global population inhabits waters off eastern Canada. Ship-based seabird surveys show the Labrador Shelf as particularly important, including areas that overlap with current oil and gas exploration activities. As a result, current estimates of seabird densities are required to assess both risk and damage in the case of oil spill. We developed seasonally explicit density predictions for Dovekie across the Shelf using Generalized Additive Models. Models were constructed with seabird survey data collected between 2006 and 2015, in addition to a number of remotely sensed environmental covariates. Using this approach, we explore the oceanographic determinants of Dovekie distribution during the non-breeding season and derive population estimates to be incorporated into oil spill damage assessments. (Talk)

## ALEUTIAN TERN INTERSEASONAL MOVEMENTS AND NON-BREEDING LOCATIONS

Michael I. Goldstein<sup>1</sup> (mgoldstein@fs.fed.us) Sanjay Pyare<sup>2</sup> David C. Duffy<sup>3</sup> Susan Oehlers<sup>4</sup>  
Nathaniel Catterson<sup>4</sup> Jeffrey H. Frederick<sup>2</sup>

<sup>1</sup>US Forest Service, Alaska Region, Juneau, AK.

<sup>2</sup>University of Alaska Southeast, Juneau, AK.

<sup>3</sup>University of Hawai'i Mānoa, Honolulu, HI.

<sup>4</sup>US Forest Service Tongass National Forest, Yakutat, AK.

In comparison to many migratory seabirds, essentially nothing is known about non-breeding migration and distribution of Aleutian terns, except anecdotal evidence that the species has been observed in Southeast Asia. We collated and present the known information on migration and non-breeding areas from published notes and non-published records. We add information on the migration pattern, timing, and non-breeding locations of Aleutian Terns deployed with geolocators from Yakutat, AK. We will show migration patterns and timing, including one-way distances of over 10,000 mi to and from a wide area between Southeast Asia and Austral-Asia with primary destinations of Indonesia, Philippines, and Papa New Guinea. (Talk)

## LIGHT ATTRACTION AND MORTALITY OF NOCTURNAL SEABIRDS FROM OFF-SHORE OIL PRODUCTION PLATFORMS, SOUTHERN CALIFORNIA

Thomas E. Hamer<sup>1</sup> (Hamer@HamerEnvironmental.com) David M. Pereksta<sup>2</sup> Erin A. Colclazier<sup>1</sup>  
Nathalie M. Denis<sup>1</sup> Matt R. Reed<sup>1</sup> Kelley A. Turner<sup>1</sup>

<sup>1</sup>Hamer Environmental, PO Box 2561, Mount Vernon, WA 98273 USA.

<sup>2</sup>Bureau of Ocean Energy Management, 760 Paseo Camarillo, Suite 102, Camarillo, California 93010 USA.

The attraction of seabirds to bright lights and associated light-induced mortality has been well-documented, but the extent of this light-induced threat was unknown, but had been recognized, for two special-status California seabird species, the Scripps's Murrelet (*Synthliboramphus scrippsi*; previously Xantus's Murrelet [*S. hypoleucus*]) and Ashy Storm-Petrel (*Oceanodroma homochroa*). Offshore oil operations are conducted from 27 brightly illuminated platforms along the southern coast of California and all within the ranges of Scripps's Murrelets and Ashy Storm-Petrels. In 2013, using ornithological radar and visual observations, we measured the rate of light attraction events and associated mortality of seabirds during the spring, summer, and fall seasons (n=56 nights) at two of these oil platforms. The average number of light attraction events recorded was 1.23 events per night with the majority of these targets (69.5%) recorded in the spring during an active nocturnal bird migration. Over the three seasons, light attraction events were recorded on 44.5% of the nights sampled. Visual observations of birds being attracted to lights and findings of grounded birds on the platforms indicated that the Cassin's Auklet, Leach's Storm-Petrel and Red-necked Phalarope were most at risk from collisions with offshore oil platforms. (Talk)

USING ORNITHOLOGICAL RADAR TO STUDY LIGHT ATTRACTION AND FALL-OUT OF NEWELL'S SHEARWATERS AND BAND-RUMPED STORM-PETRELS ON THE PACIFIC MISSILE RANGE FACILITY, KAUAI, HAWAII

Thomas E. Hamer<sup>1</sup> (Hamer@HamerEnvironmental.com) Cory Campora<sup>2</sup> Erin A. Colclazier<sup>1</sup>  
Nathalie M. Denis<sup>1</sup> Matt R. Reed<sup>1</sup> Kelley A. Turner<sup>1</sup>

<sup>1</sup>Hamer Environmental, PO Box 2561, Mount Vernon, WA 98273 USA.

<sup>2</sup>NAVFAC Hawaii, Environmental Planning, 400 Marshall Road, Joint Base Pearl Harbor-Hickam, HI 96860-3134 USA.

The conservation and management of endangered seabirds present significant challenges for the Department of Defense and other federal agencies in the Pacific Islands region. Traditional wildlife survey approaches are of especially limited utility for the Newell's Shearwater (*Puffinus auricularis newelli*) (Ao) and the Band-rumped Storm-Petrel (*Oceanodroma castro*) (Akeake), an ESA-listed seabird and candidate for ESA listing, respectively. Both species have extremely low detectability due to their nocturnal flight habits and often inaccessible and remote locations of nesting colonies. Both species can be attracted to light sources and become grounded or collide with man-made structures. The Pacific Missile Range Facility (PMRF) has documented Newell's Shearwater and Band-rumped Storm-Petrel fallout on the base during the fledgling period with 46 records of grounded birds recorded from 2007 to 2014. Using radar and night vision equipment, we monitored movements of birds over the PMRF during the fledgling season for 52 nights, beginning 28 September and ending on 23 November 2015. We summarize the passage rates, flight paths, flight heights, timing of activity, light attraction events, and flight behavior of nocturnal seabirds over the base. (Talk)



# SUCCESSFUL MITIGATION OF IMPACTS TO BONIN PETREL CHICKS (*PTERODROMA HYPOLEUCA*) DURING TWO MAINTENANCE WORK PROJECTS ON SAND ISLAND, MIDWAY ATOLL NATIONAL WILDLIFE REFUGE

Angela M. K. Hansen<sup>1</sup> (angelamklhansen@gmail.com) Meg Duhr-Schultz<sup>1</sup>

<sup>1</sup>U. S. Fish and Wildlife Service, USFWS Midway 1082 Makepono Street Honolulu, Hawaii, 96819.

Bonin petrels (*Pterodroma hypoleuca*) are a small, burrow-nesting procellariiform seabird resident to the North Pacific. They nest on remote islands and are sensitive to habitat loss, light pollution, and invasive species. Since 2000, the breeding population of Bonin petrels has increased dramatically on Sand Island within Midway Atoll National Wildlife Refuge following the successful eradication of black rats (*Rattus rattus*), modification of light sources, and other habitat improvements by the US Fish and Wildlife Service (USFWS). Burrow density is currently high across all unpaved areas of Sand Island. Two emergency maintenance projects involving ground disturbance in nesting areas were required during the chick-rearing season in April and May 2015. USFWS volunteers and staff surveyed the areas to identify burrows occupied by hatchlings and prepared and implemented plans for impact mitigation, captive care, and post-impact monitoring. Employing innovative methods to minimize burrow destruction while working with contractors to complete the projects as quickly as possible, chicks and burrow integrity were protected during repair work. Once work was completed disturbed burrows were monitored for parental visitation and fledging success. Efforts to mitigate impacts on Bonin petrels were highly successful; chick casualty rates at both sites were well below estimated levels, and new insights into the tolerance of Bonin petrels to differing levels of burrow disturbance, temporary relocation and holding were made. Lessons learned here may have applications for future minimization of construction impacts to burrowing seabirds. (Talk)

## USING GOPRO TECHNOLOGY TO SURVEY BONIN PETREL BURROWS IN THE MIDWAY ATOLL NATIONAL WILDLIFE REFUGE

Angela M. K. Hansen<sup>1</sup> (angelamklhansen@gmail.com) Meg Duhr-Schultz<sup>1</sup>

<sup>1</sup>U. S. Fish and Wildlife Service, USFWS Midway 1082 Makepono Street Honolulu, Hawaii, 96819.

Limits of time, personnel, equipment, and budget often lead to innovation. When emergency maintenance work within Midway Atoll National Wildlife Refuge was scheduled to impact small sections of the Bonin petrel (*Pterodroma hypoleuca*) colony during the nesting season in 2015 the US Fish and Wildlife Service biological volunteers and staff rallied to rapidly survey the impact areas to determine the number of burrows occupied by hatchlings. Initially, burrows were checked by hand using the “grubbing” technique, but some burrows were either too long to assess or contained a bend or partial blockage limiting access to the end of the burrow. A GoPro Hero camera, along with a flashlight and the GoPro mobile phone App were successfully used to survey all burrows, regardless of length or complexity, and document the presence or absence of hatchlings. Advantages of using this setup were numerous, including the ability to record high definition photos and video while monitoring burrow interiors in real-time. (Poster)

## FOOD WEB ECOLOGY AND POPULATION GENETIC STRUCTURE OF ALEUTIAN TERNS (*ONYCHOPRION ALEUTICA*) IN ALASKA

McKenna Hanson<sup>1</sup> (mhanson12@uaa.edu) Veronica M. Padula<sup>2</sup> Douglas Causey<sup>1</sup> Sanjay Pyare<sup>3</sup> Jeffrey H. Frederick<sup>3</sup>

<sup>1</sup>Dept Biol Sciences, University of Alaska Anchorage , 3211 Providence Dr, Anchorage, AK 99508.

<sup>2</sup>School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 1675 C St #100, Anchorage, AK 99501.

<sup>3</sup>Spatial Ecosystem Analysis Lab, University of Alaska Southeast, 11120 Glacier Hwy, Juneau, AK 99801.

The Aleutian tern (*Onychoprion aleutica*) is a highly migratory seabird known to breed along the coasts of Alaska and Russian Far East, and winter in Southeast Asia. Besides known breeding colonies established along Southeast Alaska and Eastern Siberia, almost nothing is known about their life outside of the breeding season due to large gaps of information about their diet, behavior, demographics and distribution. This species represents an area of concern because past trend analyses have indicated that colony counts in Alaska between 1960 and 2013 declined on average 8.1% per year, which over 3 generations equates to a 93% decline. Because these birds are quite understudied, they create a great opportunity for assessing not only the factors of their decline, but the severity of climate change affects on the health of migratory sea birds as well. A migration study initiated in 2009 resulted in having geolocators deployed on Aleutian terns from several colonies across Alaska over several years. Feather samples were taken from captured birds as well, for which stable isotope analyses are currently being performed. The stable isotope data will provide insight into variation in feeding behaviors for Aleutian terns. Combining geocator data and stable isotope analysis of feathers gathered in the field may help build a better understanding of their foraging behavior during their time in Alaska, with further analyses planned in the future to give better insight about access to resources during migration. (Talk)

## POTENTIAL EFFECTS OF ANESTHESIA TREATMENTS ON THE POST-CAPTURE MOVEMENTS AND BREEDING OF MARBLED MURRELETS

Percy N. Hébert<sup>1</sup> (phebert@tru.ca) Richard T. Golightly<sup>1</sup>

<sup>1</sup>Department of Wildlife, Humboldt State University, Arcata, CA 95521.

The purpose of this study was to examine the potential effects of isoflurane on the handling process and the post-capture behavior and breeding potential of Marbled Murrelets receiving radio-transmitters. Between 2001 and 2003 we attached radio-transmitters to 102 murrelets captured in the nearshore waters of northern California. Of these, 26 received anesthesia prior to radio attachment, while 76 murrelets were processed without receiving anesthesia prior to processing. Multivariate analysis of variance revealed time out of water, time to attach the radio transmitter and time to collect blood were similar between treatment groups. When the data were standardized and combined across years, the distances traveled 24h and 72h after release were similar for murrelets processed with and without anesthesia. The mean number of days between capture and nesting was similar ( $P > 0.2$ ) for murrelets processed with and without anesthesia, as was the mean date of nest initiation ( $P > 0.6$ ). The likelihood of nesting after capture differed between groups in each year, however, when the data are combined across years a similar proportion of murrelets processed with anesthesia (23.1%) and without anesthesia (36.8%) initiated nesting after capture ( $P > 0.1$ ). The results of this study suggest the use of anesthesia does not impact the time to process captured murrelets, nor the immediate post-capture movements. Overall, the use of anesthesia did not affect the probability of nesting after capture, however annual differences in nesting attempts suggest the use of anesthesia may impact nesting, but the causal relationship is unclear. (Poster)

## SEABIRD AND FORAGE FISH RESPONSE TO CONTRASTING COLD AND WARM YEARS IN PRINCE WILLIAM SOUND, ALASKA

Brielle M. Heflin<sup>1</sup> (bheflin@usgs.gov) Mayumi L. Arimitsu<sup>1</sup> John F. Piatt<sup>1</sup> Sarah K. Schoen<sup>1</sup>  
Erica N. Madison<sup>1</sup>

<sup>1</sup>U.S. Geological Survey, Alaska Science Center, 250 Egan Dr., Juneau, AK 99801.

Small-schooling fish like Pacific sand lance (*Ammodytes personatus*), capelin (*Mallotus villosus*), herring (*Clupea pallasii*) and krill are crucial prey for many seabirds populations, yet their patchy distribution and tendency towards “boom or bust” variability in abundance over time make them difficult to study. As part of Exxon Valdez Oil Spill Trustee Council’s Gulf Watch, Alaska Long-Term Monitoring Program in Prince William Sound, we are developing monitoring methods to assess changes in forage fish abundance, distribution, and community composition over time. These data along with information on forage fish predators and environmental conditions are useful in understanding ecosystem drivers of change in coastal areas of the Gulf of Alaska. In summers of 2012-2015 we used a combination of hydroacoustic surveys, aerial surveys, and net-sampling methods to monitor forage fish, while also conducting seabird and oceanography surveys throughout the Sound. To examine underlying spatial relationships of predators, prey and marine habitat, we mapped the distribution of seabirds, prey biomass, chlorophyll a and oceanographic variables. Preliminary findings show that capelin abundance in trawls was lower in warm years (2014-2015) compared to cold years (2012-2013). In 2015 we observed an apparent influx of Common Murres (*Uria aalge*) in the southern part of the Sound, perhaps due to changes in prey conditions offshore. Continuation of this integrated work along with other long-term ecosystem monitoring by the Gulf Watch Alaska Program will enhance our ability to detect natural and anthropogenic changes in the marine ecosystem. (Poster)

# INDIVIDUAL SPECIALISTS, POPULATION GENERALISTS, AND GENTOO PENGUIN FORAGING ECOLOGY ACROSS THE SCOTIA ARC

Rachael W. Herman<sup>1</sup> (rherma3@lsu.edu) Michael J. Polito<sup>1</sup>

<sup>1</sup>Louisiana State University, 1239 Energy, Coast Environment Building, Baton Rouge, LA 70803.

Populations of Gentoo Penguins (*Pygoscelis papua*), have stabilized and even increased within the Western Antarctic Peninsula (WAP) in the last four decades, while Chinstrap (*P. antarctica*) and Adélie penguins (*P. adeliae*) populations have declined extensively. Previous dietary studies suggest Gentoo Penguins have a generalist foraging niche, which may buffer them from recent climate-driven declines in key prey species, such as Antarctic krill (*Euphausia superba*). Ecological theory indicates that generalist populations fall under two categories: type A generalist populations exhibit large within individual variation and little variation between individuals, where type B generalist populations comprise individual specialists with little within individual variation and large variation between individuals. We conducted stable isotope analysis of  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  in Gentoo Penguin tail feathers from four geographically distinct breeding populations (WAP, South Shetland Islands, South Georgia, and Falkland Islands) to assess individual variation over time and determine the type of generalist strategies that each population utilizes. Monte Carlo resampling procedures of individual variance in  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  detected significant degrees of individual specialization in all four populations ( $p < 0.05$ ), concurrent with type B generalism. However, degrees of individual specialization varied by population, with the WAP population exhibiting the lowest and South Georgia exhibiting the highest. Geographic differences in prey abundance and diversity may drive variation in the degree of individual specialization between populations. Prevalence of type B generalism may help buffer Gentoo Penguin populations from various ecological pressures. (Talk)

## IMPROVING BURROWING SEABIRD HABITAT WITH SEA LION EXCLUSION, CLAY NEST MODULES, AND PLANT RESTORATION: RESULTS FROM AÑO NUEVO ISLAND, CALIFORNIA (2004 - 2015)

Michelle Hester<sup>1</sup> (michelle@oikonos.org) Ryan Carle<sup>1</sup> Jessie Beck<sup>1</sup> David Sands<sup>2</sup> Nathan R. Lynch<sup>3</sup> Matthew G. Passmore<sup>4</sup>

<sup>1</sup>Oikonos Ecosystem Knowledge, PO Box 2570, Santa Cruz, CA 95063.

<sup>2</sup>Go Native, P.O. Box 370103, Montara, CA 94037.

<sup>3</sup>California College of the Arts, 5212 Broadway, Oakland CA 94618.

<sup>4</sup>MoreLab, 1661 20th St. Suite 3, Oakland CA 94607.

<sup>5</sup>California Dept. of Parks and Recreation, Año Nuevo State Park, Pescadero, CA 94060.

A collaborative team of ecologists, artists, designers and native plant experts came together to develop new solutions and approaches for restoring denuded habitat on Año Nuevo Island, with the goal of mitigating Rhinoceros and Cassin's Auklets (*Cerorhinca monocerata* and *Ptychoramphus aleuticus*) mortality from oiling and collapsing burrows. The key steps for protecting burrows involved: 1) native plant restoration and soil stabilization, 2) sea lion (*Zalophus californianus*) exclusion, and 3) installation of erosion-safe clay nest modules. In 2010 we installed a Habitat Ridge (2.1m high x 120m long) to exclude sea lions from the marine terrace, planted 15,000 native plants, and replaced all the wood and plastic artificial nests with durable clay nest modules. As of 2015, breeding populations have increased in the restoration areas (RHAU 34% increase to 216 birds; CAAU 77% increase to 78 birds). These combined solutions have resulted in decreased annual erosion damage to burrows from 41 %  $\pm$  19 prior to restoration to 11 %  $\pm$  5 post restoration. Annual reproductive success in clay modules has been on par with the long-term average from previous wood/plastic nest boxes (0.50 chicks/pair, n = 18 years). By fall 2012, native plant cover reached 60 %  $\pm$  4 in restoration plots, but prolonged trampling by Brown Pelicans (*Pelicanus occidentalis*) and drought in 2013-2015 reduced native cover to 13%  $\pm$  1 by spring 2015. These findings highlight that the Habitat Ridge and clay modules will continue to provide erosion and trampling protection with almost no maintenance, while plant cover will require adaptive management to changing pelican populations and climate. (Talk)

## STATUS AND TRENDS OF TUFTED PUFFINS IN THE CALIFORNIA CURRENT

Peter Hodum<sup>1</sup> (peter@oikonos.org) Scott Pearson<sup>2</sup> Gerard J. McChesney<sup>3</sup> Peter M. Warzybok<sup>4</sup>

<sup>1</sup>Oikonos Ecosystem Knowledge, P.O. Box 1918, Kailua, HI 96734.

<sup>2</sup>Washington Department of Fish and Wildlife, 1111 Washington St. SE, 5th Floor Olympia, WA 98501-2283.

<sup>3</sup>U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex 1 Marshlands Road Fremont, CA 94555.

<sup>4</sup>Point Blue Conservation Science, 3820 Cypress Dr, Petaluma, CA 94954.

Tufted Puffin (*Fratercula cirrhata*) populations have declined significantly throughout the California Current System during the past century, with populations in California and Oregon estimated to have declined by more than 90% and in Washington by nearly 90%. In Washington, where the species was listed as Endangered in 2015, the population was estimated at approximately 25,000 birds in the early 1900s and at 2950 birds between 2007-2010. The number of active colonies in Washington waters declined from 43 in the early 1900s to 35 between 1978-1984 and, most recently, to 19 between 2007-2014. Prior to 1978, there were nine colonies in Washington with at least 1000 birds. By 2007-2014, the state had no colonies of that size remaining and only three estimated to contain 100-200 individuals. In California, puffins were fairly common in the early 20th century to the Channel Islands off southern California, with estimates up to 6,000 at the South Farallon Islands off central California. By the early 1980s, puffins were mostly gone from the Channel Islands and only hundreds remained statewide. Anecdotal and limited survey data suggests that most remaining colonies have disappeared since 1989; however, numbers at the South Farallon Islands are increasing, with an estimate of 326 breeding birds in 2015. Regional declines appear to have accelerated in the 1970s and early 1980s and continued to the present, although drivers remain poorly understood. Developing a better understanding of impacts and drivers of the decline is essential to help inform conservation planning for the species in this region. (Talk)



## GLOBAL PATTERNS OF SEABIRD BIODIVERSITY AND PRIORITIES FOR CONSERVATION

Kyle S. Van Houtan<sup>1</sup> (kyle.vanhoutan@gmail.com) Clinton N. Jenkins<sup>3</sup>

<sup>1</sup>NOAA Fisheries, NMFS/PIFSC/DO 1845 Wasp Blvd., Bldg 176, Honolulu, HI 96818.

<sup>2</sup>Duke University, Nicholas School of the Environment, Box 90328, Durham, NC 27708.

<sup>3</sup>Instituto de Pesquisas Ecológicas, Rod. Dom Pedro I, km 47, caixa postal 47, Nazaré Paulista - SP, 12960-000, Brazil.

The oceans cover two-thirds of the planet and host more biodiversity than terrestrial ecosystems, yet the oceans are significantly less protected. Recent advances in modeling threats to marine life and in species range distribution data provide an unprecedented opportunity to design global marine conservation priorities. In this analysis, we assess the global and regional conservation priorities for seabirds within the context of nine major marine phylogenetic groups. Since marine protected areas (MPAs) are the principal means for conservation actions, we pay particular attention to their distribution and its overlap with marine life. We find that 96% of the oceans are unmanaged, with 4% set aside as general MPAs, yet with < 1% currently in no-take marine reserves (MRs) - the most effective type of MPA for conservation. As a group, seabirds are the most threatened group of marine biodiversity yet are also among the least protected taxa. Almost 40% (82/220) of seabird species are listed as at least “vulnerable” by the IUCN, nearly twice the rate of marine mammals. However, out of nine taxonomic groups assessed, seabirds measure third worst in MPA coverage. For seabirds, the median case is that 99.5% of a species range lies outside a no-take MR. This metric is even more extreme for threatened, data deficient, and small ranged seabird species - categories specifically deserving conservation attention. We also discuss the biogeography of seabird diversity, and how global efforts based on all marine taxa may also fall short of protecting seabirds regionally and globally. (Talk)

## EFFECTS OF ARCTIC CLIMATE CHANGE ON LITTLE AUKS (ALLE ALLE)

Johanna E. H. Hovinen<sup>1</sup> (jhovinen@gmail.com) Jorge Welcker<sup>1</sup> Sebastien Descamps<sup>1</sup> Coline Marciau<sup>1</sup> Katarzyna Wojczulanis-Jakubas<sup>6</sup> Ananda Rabindranath<sup>3</sup> Dariusz Jakubas<sup>6</sup> Hallvard Strøm<sup>1</sup> Zachary W. Brown<sup>5</sup> Haakon Hop<sup>1</sup> Jørgen Berge<sup>2</sup> Dorota Kidawa<sup>6</sup> Kurt Jerstad<sup>1</sup> Nina J. Karnovsky<sup>4</sup> Harald Steen<sup>1</sup>

<sup>1</sup>Norwegian Polar Institute, Fram Centre, N-9296 Tromsø, Norway.

<sup>2</sup>Faculty of Biosciences, Fisheries and Economics, UiT-The Arctic University of Norway, N-9037 Tromsø, Norway.

<sup>3</sup>Scottish Ocean Institute, University of St Andrews, St Andrews, Fife, KY16 8LB, United Kingdom.

<sup>4</sup>Pomona College, Department of Biology, Claremont, California 91711, USA.

<sup>5</sup>Department of Environmental Earth System Science, Stanford University, Stanford, California 94305, USA.

<sup>6</sup>Department of Vertebrate Ecology and Zoology, University of Gdańsk, Gdańsk, Poland.

Ongoing climate change and corresponding changes in temperature and sea ice dynamics may dramatically alter nutrient cycling, species distribution and abundance, with consequences for structure and function of marine food chains in the Arctic. We examined the effects of both local and regional climatic and environmental variability on foraging, reproduction and survival of the little auk (*Alle alle*), the most abundant Arctic seabird species. We collected data at four breeding sites and adjacent sea areas along the West Spitsbergen coast that is influenced by the West Spitsbergen Current, the main carrier of warm Atlantic water into the Arctic. During the 9-year study (2005-2013), we found that little auk adults preferred to forage in cold water masses at the shelf-sea area, but that ocean temperature did not influence their foraging trip durations or chick provisioning rates. On the other hand, the number of good quality prey items delivered daily to a chick correlated negatively with summer sea-surface temperature (s-SST), and both chick fledging success and adult survival were higher when s-SST was lower. We predicted (using population matrix models) that if s-SSTs become warmer by  $\geq 2^\circ\text{C}$ , on average, little auks will face a 100% quasi extinction risk in the study area within the next century (i.e. they will reach a number below which extinction is very likely;  $\approx 1000$  adult females). Even slighter warming by  $\approx 0.03^\circ\text{C}$  is expected to trigger population decline in some of the breeding sites. Similar quasi extinction risks at different breeding sites underline the possible large-scale impact of the current Arctic climate change on the little auk populations. (Talk)

## SEX-SPECIFIC FORAGING BEHAVIOR IN CHICK-REARING NAZCA BOOBIES (*SULA GRANTI*)

Jennifer L. Howard<sup>1</sup> (howajl14@wfu.edu) Carlos B. Zavalaga<sup>2</sup> David J. Anderson<sup>1</sup>

<sup>1</sup>Department of Biology, Wake Forest University, Winston-Salem, NC 27109, USA.

<sup>2</sup>Facultad de Ciencias Ambientales, Universidad Científica del Sur, Perú, Carretera Antigua Panamericana Sur km 19, Lima 42, Peru.

Many male and female seabirds segregate in foraging behavior and at-sea distribution. The extent of sexual segregation can be region- and colony-dependent, as available resources and amount of competition vary. Spatial segregation is an important axis upon which males and females differ, as spatial data encompass not only distance from the colony but also marine habitat differences. We sought to determine if sexually size-dimorphic Nazca boobies (*Sula granti*), with documented differences in parental care roles, show foraging niche separation by sex. During the later chick-rearing period, male Nazca boobies spend more time attending the chick or defending the nest-site. Females are the primary provider, returning with larger prey loads and foraging more efficiently than males. We will test the hypothesis that there are intersexual differences in specific foraging parameters (i.e., trip distance and duration, forager's weight change, and core foraging areas) of Nazca boobies. GPS track data were collected March 2007 and April 2014 during the chick-rearing period at Isla Española, Galápagos, Ecuador. We analyzed foraging tracks from 51 males and 35 females of known-ages. Remotely-sensed sea surface temperature and chlorophyll a data were overlaid on core foraging areas. Foraging hot spots for Nazca boobies will be identified and results will be presented on the degree to which foraging behavior during chick-rearing is sex-specific in this sexually size-dimorphic marine predator. (Poster)

## RESTORATION OF CHINESE CRESTED TERN COLONY IN WUZHISHAN ARCHIPELAGO, CHINA

Chung-Hang Hung<sup>1</sup> (chrancor@gmail.com) Shuihua Chen<sup>2</sup> Hsiao-Wei Yuan<sup>1</sup> Zhongyong Fan<sup>2</sup>  
Yiwei Lu<sup>2</sup> Si-Yu Wang<sup>2</sup>

<sup>1</sup>National Taiwan University, No. 1, Sec. 4, Roosevelt Rd. Taipei, Taiwan, 10617.

<sup>2</sup>Zhejiang Museum of Natural History, Hangzhou, Zhejiang, 310014, China.

The Chinese Crested Tern (CCT, *Thalasseus bernsteini*) was previously thought to have been extinct. It was not until June 2000, that the breeding colony of CCT was rediscovered in Matsu Archipelago, Taiwan. Later on Jiushan Archipelago and Wuzhishan Archipelago in East China Sea, were confirmed to have breeding colonies in 2004 and 2008, respectively. Nowadays, these are the only three known breeding sites worldwide. Nevertheless, the breeding colony on Wuzhishan Islands disappeared in 2014. To restore and stabilize this breeding colony, the Wuzhishan Nature Reserve Administration and Zhejiang Museum of Natural History initiate a tern restoration project in 2015, in which 500 decoys and 3 audio playback devices were used to attract terns to the Yaqueshan in Wuzhishan Nature Reserve. The first pair of CCT arrived on May 20 and began to lay eggs amongst the Greater Crested Tern (GCT, *T. bergii*) colony of roughly 300 individuals. The GCT colony rapidly assembled to approximately 2,500 individuals by May 29. A severe typhoon directly impacted the island on July 10, which caused the deaths of more than 200 GCT chicks due to strong wind and heavy rain. Fortunately, the two CCT chicks survived through the typhoon, and another two nests successfully hatched on July 23. We analyzed the correlation with nest density, slope, vegetation coverage, CCT nest location, and number of decoys. The preliminary results showed that slope had a negative effect on the nest density ( $r=-0.427$ ,  $p<0.01$ ), and the five pairs of CCT all nested at the densest GCT nest area. Further studies will be focused on the interaction between GCT and CCT, nest site management, and population dynamics of CCT. (Talk)

## WHEN SEABIRDS AND HIGHWAYS COLLIDE: WEDGE-TAILED SHEARWATER FALLOUT ALONG SOUTHEASTERN O'AHU (2011 - 2015)

K. David Hyrenbach<sup>1</sup> (khyrenbach@hpu.edu) Devon Francke<sup>2</sup> Keith Swindle<sup>3</sup>

<sup>1</sup>Hawai'i Pacific University, Oceanic Institute, 41-202 Kalaniana'ole Hwy, Waimanalo, HI 96795, USA.

<sup>2</sup>Oikonos Ecosystem Knowledge, P.O. Box 1918, Kailua, HI 96734, USA.

<sup>3</sup>U.S. Fish and Wildlife Service, 3375 Koapaka St, Suite B-296, Honolulu, HI 96819, USA.

The Wedge-tailed Shearwater ('Ua'u kani, *Ardenna pacifica*) breeds on offshore islets along the windward coast of O'ahu. Fledging shearwaters are grounded due to light attraction followed by collisions with utility wires/poles and vehicles. To quantify the magnitude of this fallout, we repeatedly surveyed a 16-km stretch of the Kalaniana'ole highway during the fledging season (Nov.1 - Dec.21), and performed a mark-recapture study to assess survey biases due to carcass loss. We analyzed the influence of year and two covariates (date, percent of lunar disk illuminated), and found that shearwater fallout varied significantly from year to year, and in relation to the lunar cycle; yet, there was no significant date effect. The influence of the lunar cycle was further evidenced by the multi-modal distributions of fallout, with peaks during low moon periods. The mark-recapture study revealed that the carcass loss rate varied as a function of the number of days since marking, from 24.1% (first day) to 0.0% (eight day). We synthesized the mark-recapture data using an exponential decay model, with an additional variable to account for the non-linear influence of time. The best-fit regression confirmed that the number of days since marking had a significant non-linear influence on the probability of resighting a carcass. Namely, newer and older carcasses were lost at higher and lower rates, respectively. Altogether, this study documented temporal patterns of carcass deposition and loss along a seaside highway in southeast O'ahu, and demonstrated that fallout varies from year to year and increases during bright moon nights. (Talk)

# EFFECT OF PREY SIZE ON BILL-LOAD MASS AND BREEDING PERFORMANCE OF A MULTIPLE-PREY LOADING SEABIRD, THE RHINOCEROS AUKLET

Motohiro Ito<sup>1</sup> (ito.motohiro@nipr.ac.jp) Yutaka Watanuki<sup>2</sup>

<sup>1</sup>National Institute of Polar Research, 10-3 Midori-cho, Tachikawa, 10-3, Tokyo 190-0014 Japan.

<sup>2</sup>Graduate School of Fisheries Sciences, Hokkaido University, 3-1-1, Minato-cho, Hakodate, Hokkaido, 041-8611, Japan.

The structure of the marine food webs may vary considerably between years. Specifically, the type, abundance and body size of prey species may all be modified as a result of annual conditions, what may impact the breeding performance of seabirds. Previous studies detailed the importance of prey type and abundance to support seabird populations, however, relatively, little attention was paid to the effects of inter-annual prey size range. In this study, we examined the relationship between (1) annual trends in the size of fish prey in the diet fed to rhinoceros auklet *Cerorhinca monocerata* chicks, and (2) the breeding performance of adult rhinoceros auklets in Teuri island, Japan, from long-term monitoring data (1984-2015). We observed inter-annual variations in average size of Japanese anchovy *Engraulis japonicus* (80-160mm) in the auklets bill-loads and a non-linear relationship between anchovy size and total bill-load mass. When the size of anchovies (fork length: FL) in the bill-loads was around 120mm (medium size among the potential size range), the number of anchovies in a single bill-load could reach 3, and the total bill-load mass was potentially maximized. Also, during years when average size of anchovies in the bill-loads was closer to 120mm, the growth rate of auklet chicks was higher. This result suggests that inter-annual variations in prey size, in addition to prey type and abundance, may be an important factor potentially affecting the breeding performance of alcids, especially the species bring back diet for their chicks as bill-loads. (Talk)

## FLEXIBLE FORAGING BEHAVIOUR OF THE DOVEKIE (ALLE ALLE) REVEALED BY GPS-TRACKING

Dariusz Jakubas<sup>1</sup> (biodj@univ.gda.pl) Katarzyna Wojczulanis-Jakubas<sup>1</sup> Lech Stempniewicz<sup>1</sup>

<sup>1</sup>University of Gdańsk, Dept. of Vertebrate Ecology and Zoology, Wita Stwosza 59, 80-308 Gdańsk, Poland.

A small zooplanktivorous alcid, the dovekie (*Alle alle*), as the most numerous seabird in the Arctic, is an essential component of pelagic food webs in this region. Due to high energetic demands, dovekies forage mainly on cold-water copepods, larger and energetically more profitable than their counterparts associated with warmer water. Thus, the dovekie is potentially highly susceptible to climate change. To characterize dovekie foraging, we used GPS loggers. We compared environmental conditions (bathymetry, sea surface temperature and chlorophyll a concentration) among foraging areas (stationary positions reflecting foraging positions) of GPS-tracked individuals from three large breeding colonies in Svalbard: Bear Island (B) at the southern edge of High Arctic; Hornsund (H) influenced by cold Arctic water masses; and Magdalenefjorden (M) influenced by warm Atlantic water masses but with productive marginal ice zone within fly range. In areas influenced by cold Arctic water, dovekies foraged in shelf zone and at the shelf break zone, close to the colony (H, Med=43 km). In areas with higher sea surface temperatures around the colony, dovekies foraged in close locations with high chlorophyll a concentration (B, Med=44 km) or in productive distant marginal sea ice zone (M, Med=126 km). Our results show that dovekies respond to spatial variability of oceanographic conditions by flexibility in foraging trip distance. To date, their breeding success is similar in the studied areas characterized by different environmental conditions. (Talk)

# DECIPHERING THE ODORPRINTS OF LEACH'S STORM-PETRELS (OCEANODROMA LEUCORHOA): IS THERE MORE TO PERSONAL ODOR AND INDIVIDUAL RECOGNITION THAN THE MAJOR HISTOCOMPATIBILITY COMPLEX?

Sarah L. Jennings<sup>1</sup> (slejennings@ucdavis.edu) Brian A. Hoover<sup>1</sup> Joshua C. Hincks<sup>2</sup> Susan E. Ebeler<sup>3</sup> Scott V. Edwards<sup>4</sup> Gabrielle A. Nevitt<sup>2</sup>

<sup>1</sup>University of California Davis, Graduate Group in Ecology, One Shields Avenue, Davis, CA 95616, USA.

<sup>2</sup>University of California Davis, Department of Neurobiology, Physiology and Behavior, One Shields Avenue, Davis, CA 95616, USA.

<sup>3</sup>University of California Davis, Department of Viticulture and Enology, One Shields Avenue, Davis, CA 95616, USA.

<sup>4</sup>Harvard University, Department of Organismic and Evolutionary Biology, 26 Oxford Street, Cambridge, MA 02138 USA.

The Major Histocompatibility Complex (MHC) is a suite of immune genes thought to influence personal odor in vertebrates. We are investigating the interplay between MHC, personal odor and individual recognition in Leach's storm-petrels (*Oceanodroma leucorhoa*) using a multi-disciplinary approach combining genetics, behavior and analytical chemistry. Here we test whether Leach's storm-petrels can discriminate individuals based on MHC Class IIB genotype. Leach's storm-petrels have a remarkable sense of smell and a strong, musky scent used for individual recognition. To study the molecular basis for chemical communication in this species, we genotyped 1500 birds from a population on Bon Portage Island, Nova Scotia, Canada for MHC Class IIB. Using an established behavioral bioassay, we show that chicks can discriminate the scent of parental feathers from MHC Class IIB / sex-matched adult feathers (86%, N=23, p=0.0015, binomial test). We then examined the aroma from feathers using state-of-the-art tools to elucidate the chemical drivers of the personal odor signature. We used headspace sorptive stir-bar extraction coupled with gas chromatography-mass spectrometry to identify and quantify the aroma profiles of feathers from the same adults used in behavioral tests. We find that feathers emit 130 distinct compounds, and that replicate samples from each individual share, on average a unique subset of 66 (range: 56-88) of these compounds. Multivariate analysis indicates that differences in the relative proportion of these odor compounds make up the unique odor signature of individuals. These results demonstrate that individual recognition does not rely on MHC Class IIB genotype in this avian model for chemical communication. (Talk)



## DOUBLE-BROODING IN CASSIN'S AUKLETS (*PTYCHORAMPHUS ALEUTICUS*): A BUFFER AGAINST ENVIRONMENTAL VARIABILITY

Michael E. Johns<sup>1</sup> (mejohns3@alaska.edu) Peter M. Warzybok<sup>2</sup> Russell W. Bradley<sup>2</sup> Jaime Jahncke<sup>2</sup> Mark S. Lindberg<sup>1</sup> Greg A. Breed<sup>1</sup>

<sup>1</sup>University of Alaska Fairbanks, P.O. BOX 756100, Fairbanks, AK 99775-6100.

<sup>2</sup>Point Blue Conservation Science, 3820 Cypress Drive #11, Petaluma, CA 94954.

Increased sea surface temperature (SST) anomalies can have negative impacts on seabird populations off the California coast. The Cassin's auklet (*Ptychoramphus aleuticus*), in particular, has exhibited a high sensitivity to these anomalies. Periods of above average SST during the summer breeding season are generally associated with low reproductive output from this species. An adaptive strategy to increase overall fitness and potentially buffer against years of poor productivity is to produce a late season second brood in years of optimal conditions. We evaluated the biotic and abiotic factors influencing the initiation and success of second broods in *P. aleuticus*, using a long-term dataset of known-age individuals that breed in artificial nest boxes on Southeast Farallon Island, California. Preliminary results indicate substantial age-specific and annual variation in the proportion of second brooding pairs, from 0 to 57% over a 33 year period. To address the source of this variation, a series of multiple logistic regressions incorporating biologically significant environmental and life-history parameters will be fitted and compared using AIC. Predictor variables will include SST, Southern Oscillation Index (SOI), parental age, experience, age of recruitment, and lay date. Knowledge of the underlying demographic mechanisms driving second broods in *P. aleuticus* will aid in predicting how this population will respond to an increasingly warmer, and more unstable environmental system. (Poster)

## HABITAT RESTORATION AND MONITORING OF AN URBAN SHEARWATER COLONY AT THE FREEMAN SEABIRD PRESERVE (2008 - 2015)

Wendy Johnson<sup>1</sup> (johnsonw002@hawaii.rr.com) K. David Hyrenbach<sup>2</sup>

<sup>1</sup>Hawai'i Audubon Society, 850 Richards Street, Suite 505, Honolulu, HI 96813, USA.

<sup>2</sup>Hawai'i Pacific University, Oceanic Institute, 41-202 Kalaniana'ole Hwy., Waimanalo, HI 96795, USA.

In September 2007, the Hawai'i Audubon Society was gifted a one-acre coastal property at Black Point, on the southern coast of O'ahu, by Buck and Doreen Freeman. This area has long been a nesting site for Wedge-tailed Shearwaters ('uau kani, *Ardenna pacifica*) and is the only habitat of its kind remaining on Oahu's south shore. Thus, restoring this property from a vacant residential lot into a native coastal habitat supporting a shearwater breeding colony is an ongoing priority of the Hawai'i Audubon Society. The Freeman Seabird Preserve has been constantly evolving since 2007, with ongoing habitat restoration efforts, educational activities, and Wedge-Tailed Shearwater research. Each year, volunteers remove invasive plants from the Preserve during the 3-month period (January through March) when there are no shearwaters in residence. Maintenance work entails opening up blocked burrows, removing litter from the area, and conducting predator control. Population monitoring involves weekly checks of marked nests (July - December) and two colony-wide censuses, scheduled during the peak incubation period (July 14th) and once the chicks have hatched (September 14th). In 2015, the incubation period census documented a record 268 nests, the highest count to date. The resulting significant 7-year trend (2009-2015) indicates that, on average,  $29 \pm 4$  (S.E.) nests are added to the colony each year. Despite ongoing impacts from cat predation and year-to-year changes in ocean productivity, this shearwater colony continues to grow and to provide unparalleled opportunities for public outreach and education about shearwaters, student training and scientific research. (Talk)

## ESTIMATING ABUNDANCE AND TRENDS OF PROCELLARIIFORM SEABIRDS USING BAYESIAN STATE-SPACE MODELS AND AT-SEA DATA

Trevor W. Joyce<sup>1</sup> (twjoyce@ucsd.edu) Jeffrey E. Moore<sup>2</sup> Robert L. Pitman<sup>2</sup> Lisa T. Ballance<sup>2</sup>

<sup>1</sup>Scripps Institution of Oceanography, University of California San Diego, 9500 Gilman Dr., La Jolla, CA 92093 USA.

<sup>2</sup>Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanographic and Atmospheric Administration, 8901 La Jolla Shores Dr., La Jolla, CA, 92037, USA.

Long-lived and slow-reproducing storm-petrels (Hydrobatidae) and petrels (Procellariidae) experience among the highest rates of endangerment within the class Aves. Moreover, cryptic breeding strategies and often inaccessible breeding habitats frequently hinder the use of colony-based data to estimate population growth rate ( $r$ ) and abundance ( $N$ ) parameters, which are critical in assessing extinction risk. Here we evaluate the use of a hierarchal Bayesian state-space model to simultaneously estimate posterior probability distributions of  $r$  and  $N$  using strip transect count data. Data were gathered aboard oceanic research surveys in the central and eastern Pacific over 17 field seasons spanning a 26-year period from 1988 to 2014. To examine the effects of patchiness and rarity on the estimation of  $r$  and  $N$  posterior distributions we selected as case studies the black-vented shearwater (*Puffinus opisthelo*), Townsend's shearwater (*Puffinus auricularis*), black storm petrel (*Oceanodroma melania*), and ashy storm petrel (*Oceanodroma homochroa*), representing common and threatened breeding resident species in flocking and dispersed families, respectively. Despite considerable inter-annual variability in point estimates of abundance due to both observation and process uncertainty, 82.3% of the posterior distribution of  $r$  in *P. auricularis* fell below 0 providing moderate evidence of a decline from a median initial abundance estimate of 37,500 individuals. In contrast, >99.9% of posterior distributions of  $r$  in both *P. opisthelo* and *O. melania* exceeded 0, yielding strong evidence of population increases in these species. Thus, the hierarchal Bayesian state-space models applied in this study yielded useful management information. (Talk)

## ADULT ATTENDANCE, CHICK DIET AND NEST SURVIVAL OF KITTLITZ'S MURRELETS IN THE WESTERN ALEUTIANS, ALASKA

Robb S. A. Kaler<sup>1</sup> (robert\_kaler@fws.gov) Leah A. Kenney<sup>2</sup> Sarah Saalfeld<sup>1</sup> Jeffrey C. Williams<sup>3</sup>  
John F. Piatt<sup>4</sup> Ellen W. Lance<sup>2</sup>

<sup>1</sup>USFWS Migratory Bird Management, 1011 E. Tudor Rd, Anchorage Alaska 99503.

<sup>2</sup>USFWS Anchorage Fish and Wildlife Field Office, 4700 BLM Rd, Anchorage Alaska 99507.

<sup>3</sup>USFWS Alaska Maritime NWR, 95 Sterling Hwy, Homer Alaska 99603.

<sup>4</sup>USGS Alaska Science Center, 4210 University Dr., Anchorage Alaska 99508.

The Kittlitz's murrelet (*Brachyramphus brevirostris*) is one of the rarest breeding seabirds in the North Pacific. During 2008-2011, we monitored 75 nests at Agattu Island, located in the western Aleutians, Alaska. Time-lapse cameras were placed at nests 2-3 days after the egg hatched to monitor adult attendance, chick diets, and nest survival. Overall, 84% of nests failed, with the leading cause of mortality likely attributed to starvation and exposure. Chicks fledged at approximately 50% of adult body mass (range: 104-139 grams, n=12), considerably lower than values reported from breeding studies at Kodiak Island and Icy Bay, Alaska. Over the 4-year breeding study we documented nearly 2,400 chick feedings and found chick diets were composed of sand lance (29%), Hexagrammids (kelp greenling, 25%), and Pacific cod/juvenile rock fish (24%). Reproductive success ranged from  $0.06 \pm 0.064$  (2008) to  $0.284 \pm 0.143$  (2011) with frequency of chick provisioning potentially more important to breeding success than diet composition. While 2011 had the greatest breeding success, heavier chicks at fledge, and adults made more frequent provisioning visits, 2011 had the third lowest proportion of sand lance observed in chick diets, a fish high in lipid and protein content. The continued study of murrelets breeding in the Aleutian Islands will provide further insight into the reproductive biology of this rare and elusive seabird and provide a unique opportunity to elucidate its life history in non-glaciated habitats, especially in light of warming ocean trends. (Talk)

# “MORE THAN A STRAGGLER” AN UPDATE OF THE PACIFIC POPULATION OF ALLE ALLE

Nina J. Karnovsky<sup>1</sup> (nina.karnovsky@pomona.edu) Ann M. A. Harding<sup>2</sup> John F. Piatt<sup>3</sup>

<sup>1</sup>Pomona College, 175 W. 6th St. Claremont CA 91711.

<sup>2</sup>Auk Ecological Consulting, PO Box 2052, Cordova AK 99508.

<sup>3</sup>USGS Alaska Science Center, 4210 University Drive, Anchorage AK 99508.

Dovekies (Alle alle) nest primarily in the Atlantic region of the Arctic with enormous nesting colonies on Greenland and Spitsbergen and large colonies in Franz Josef Land and other Arctic islands. They are the most abundant seabird species in the Atlantic. In the Pacific Ocean there is a small but persistent population of dovekies, i.e., “the Dovekie appears to be more than a straggler” (Bedard, 1966). Since the late 1960s, individual birds have been described attending colonies of crested auklets (*Aethia cristatella*) and least auklets (*A. pusilla*) on St. Lawrence Island. Dovekie specimens have been collected in Barrow, Little Diomed Island and sightings recorded from the Pribilof Islands and Cooper Island. In 2003, 11 birds were reported on St. Lawrence Island. The St. Lawrence Islanders are familiar with dovekies and they have a Yupik name; an indication that dovekies are a regular component of the island avifauna. Recent studies have observed dovekies in the Chukchi Sea in small numbers during cold years. Here we present what is currently known about the status, distribution and ecology of Pacific dovekies and, based what is known about their ecological requirements in the Atlantic, hypothesize about what declines in sea ice might mean for these rare Pacific seabirds. (Talk)

## AT-SEA EXPERIMENT TO DEVELOP THE MITIGATION MEASURES OF SEABIRDS FOR SMALL LONGLINE VESSELS IN THE WESTERN NORTH PACIFIC

Nobuhiro Katsumata<sup>1</sup> (katsumata@affrc.go.jp)

<sup>1</sup>National Research Institute of Far Seas Fisheries, Fisheries Research Agency, 5-7-1, Orido, Shimizu, Shizuoka 424-8633, Japan.

Incidental mortality of seabirds in longline fisheries is a major factor of negative impact on population of albatrosses and petrels. To reduce such mortality, Japanese small longline vessels (less than 24m) in the western North Pacific have used tori-line with variety of its designs. However, there are few quantitative data of the effectiveness of tori-line among different designs. It is necessary to collect more information from onboard research in the small longline vessels. To compare the effectiveness of 3 designs of tori-lines (light streamer tori-line, tori-line without streamer, bundled 3 polypropylene bands), which are used by small longline vessels operations, and control (no tori-line), attacking rates of seabirds on baited hooks and their bycatch rates were recorded through the operations. Through 18 operations (27,072 hooks), streaked shearwaters *Calonectris leucomelas*, Laysan Phoebe *Phoebastria immutabilis* and black-footed P. *nigripes* albatrosses were mainly observed and attacked on baited hooks during line setting. Those three species were bycaught. Attacking behavior were occurred near the vessel stern at the control segments, while attacking behavior spread over expanding area at all tori-line segments. In all tori-line segments, attacking rate and bycatch rate of those three species were less than those in control segments. In one of 18 operations, a light streamer tori-line showed entanglement of fishing gear at the underwater segments during line setting. These results indicated that tori-line with all those 3 designs substantially reduced bait attack and by-catch, and that light streamer tori-line could have some difficulties to deploy for the small vessel. (Talk)

## ASSESSING THE VULNERABILITY OF MARINE BIRDS TO WIND ENERGY INFRASTRUCTURE IN THE CALIFORNIA CURRENT

Emma Kelsey<sup>1</sup> Jonathan J. Felis<sup>1</sup> David M. Pereksta<sup>2</sup> Josh Adams<sup>1</sup> (josh\_adams@usgs.gov)

<sup>1</sup>USGS Western Ecological Research Center, 400 Natural Bridges Dr. Santa Cruz CA 95060.

<sup>2</sup>BOEM, Pacific OCS Region, 760 Paseo Camarillo, Suite 102, Camarillo California 93010.

Offshore wind power is considered a viable renewable energy source for the United States west coast. With the development of floating, deep-water wind energy infrastructure, wind energy production in >50m waters off the coast of California, Oregon, Washington and Hawaii is now a possibility. The implementation of deep-water wind energy installations will affect marine birds, which risk collision with and displacement by offshore wind energy infrastructure. We used published data related to natural history, demography, and behavior (flight heights, flight styles, and avoidance behavior) to quantify collision and displacement vulnerabilities for 62 seabird and 17 marine water bird species. Our analysis was based on similar assessments quantifying marine bird vulnerability to offshore wind facilities in the North Sea, UK, and western Atlantic and is the first such assessment for the eastern North Pacific region. Pelicans, cormorants, gulls, terns, and jaegers have the greatest risk of collision with offshore wind energy infrastructure due to low avoidance and a greater percentage of time flying at the height of turbine blades. Alcids, terns, grebes, and loons have the greatest risk of displacement by offshore wind energy infrastructure due to relatively high sensitivity to disturbance and low habitat flexibility. To further address the range of factors that could influence a species' risk within the CCS and to provide a working example, we combine our vulnerability assessment results with recent marine bird at-sea distribution and abundance data to evaluate the risk of offshore renewable energy site locations in the northern CCS. (Talk)

# MERCURY CONCENTRATIONS IN FRESHWATER FORAGE FISH FROM THE ALEUTIAN ARCHIPELAGO: SPATIAL PATTERNS AND THE INFLUENCE OF LAND USE AND MARINE BIRD BIOTRANSPORT

Leah A. Kenney<sup>1</sup> (leah\_kenney@fws.gov) Robb S. A. Kaler<sup>2</sup> Frank A. von Hippel<sup>3</sup> Collin Eagle-Smith<sup>4</sup> Joshua Ackerman<sup>5</sup>

<sup>1</sup>US Fish and Wildlife Service, Ecological Services, 4700 BLM RD, Anchorage, AK, 99507.

<sup>2</sup>US Fish and Wildlife Service, Migratory Bird Management, 1011 E. Tudor, Anchorage, AK, 99503.

<sup>3</sup>University of Alaska Anchorage, 3211 Providence Dr., Anchorage, AK 99508.

<sup>4</sup>USGS, Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way Corvallis OR, 97331.

<sup>5</sup>USGS, Western Ecological Research Center, 800 Business Park Drive, Suite D Dixon, CA 95620.

The Aleutian Archipelago (Aleutians) is an isolated arc of >300 volcanic islands stretching 1,600 km and separates the North Pacific Ocean and Bering Sea. The Aleutians are a critical region for avian conservation, supporting millions of seabirds, sea ducks, and waterfowl that rely on freshwater ecosystems for foraging and breeding habitat. While generally considered pristine, some islands in the Aleutians have been heavily impacted by military activities since World War II and potentially exposed to long-range contaminant transport via atmospheric deposition, prevailing ocean currents, and biotransport. We evaluated mercury concentrations of 1,121 resident-freshwater fish samples of two species, the threespine stickleback (*Gasterosteus aculeatus*) and Dolly Varden (*Salvelinus malma*). Samples were obtained across a longitudinal gradient from the western Aleutians to the Gulf of Alaska. Mercury concentrations for stickleback and Dolly Varden differed significantly among islands. There were no apparent longitudinal trends in mercury concentrations, nor were there differences in fish mercury concentrations between islands with and without military installations. Within islands, fish from lakes used by marine birds had higher mercury levels than those in lakes that did not support marine birds. At all islands, mean fish mercury levels were high enough to be of concern to the health of piscivorous marine birds. These results provide the first mercury levels in resident-freshwater fishes across the Aleutians, and provide important baseline information for which to further elucidate sources and pathways of mercury exposure between marine and freshwater environments. (Poster)



## INVASIVE PLANT VERBESINA ENCELIOIDES MANAGEMENT AT MIDWAY ATOLL NATIONAL WILDLIFE REFUGE: ADVANCING TOWARD ERADICATION

John Klavitter<sup>1,2</sup> (John.Klavitter@fws.gov) Greg Schubert<sup>1</sup> Pete Leary<sup>1,2</sup> C. Scott Hall<sup>3</sup> Susan Schulmeister<sup>1</sup> Meg Duhr-Schultz<sup>1</sup> Dan Clark<sup>1</sup> Bret Wolfe<sup>1</sup> Ann Humphrey<sup>1</sup> Eric Moore<sup>4</sup>

<sup>1</sup>US Fish and Wildlife Service, Midway Atoll National Wildlife Refuge, Papahānaumokuākea Marine National Monument, Honolulu, HI.

<sup>2</sup>US Fish and Wildlife Service, National Wildlife Refuge System, Headquarters, Falls Church, VA.

<sup>3</sup>National Fish and Wildlife Foundation, Washington, DC.

<sup>4</sup>Chugach - Defense Base Services, Inc., Honolulu, HI.

In 2011 a partnership was formed between the US Fish and Wildlife Service and the National Fish and Wildlife Foundation to eradicate an invasive plant, *Verbesina encelioides* (golden crownbeard) on Eastern Island (135 ha) and a portion of Sand Island (106 ha) within Midway Atoll National Wildlife Refuge and the Papahānaumokuākea Marine National Monument and to restore these areas with native and “albatross friendly” nonnative plants by 2018. At the onset of the project, *Verbesina* covered a majority of the available terrestrial albatross habitat leading to lower nesting abundance, productivity, and native plant diversity. A \$1 million competitive Service funding source was matched by private donations to the Foundation to conduct the work which would aid in: 1) Increasing native plant diversity, 2) Improving nesting and resting habitat for 19 species of seabirds and the endangered Laysan duck (*Anas laysanensis*), and 3) Increasing nesting density and abundance by approximately 30% for Laysan (*Phoebastria immutabilis*) and black-footed (*Phoebastria nigripes*) albatrosses. Control was largely accomplished by crews using backpack sprayers to apply 0.05% v/v Milestone (aminopyralid), a systemic, pre- and post-emergent, broadleaf herbicide. A native plant propagation and outplanting program was also implemented. *Verbesina* has decreased to near zero levels and native and albatross friendly nonnative plants are increasing. Recognizing other variables affect albatross nesting density and abundance, hatch year 2015 surpassed any previous documented year for nesting Laysan and black-footed albatrosses with 666,044 and 28,610 pairs recorded, respectively. (Talk)

## LONG-TERM KITTLITZ'S MURRELET NESTING ECOLOGY AND CHICK PROVISIONING ON KODIAK ISLAND, AK

Timothy W. Knudson<sup>1</sup> (knudson@siu.edu) Robin M. Corcoran<sup>2</sup> James R. Lovvorn<sup>1</sup> Matthew J. Lawonn<sup>3</sup> John F. Piatt<sup>4</sup> William H. Pyle<sup>2</sup>

<sup>1</sup>Department of Zoology and Center for Ecology, Southern Illinois University, 1125 Lincoln Drive, MC 6501, Carbondale, IL.

<sup>2</sup>U.S. Fish and Wildlife Service, Kodiak National Wildlife Refuge, 1390 Buskin River Rd., Kodiak, AK.

<sup>3</sup>U.S. Geological Survey, Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis, OR.

<sup>4</sup>U.S. Geological Survey, Alaska Science Center, Anchorage, AK.

For eight consecutive years we have studied the nesting ecology of the Kittlitz's murrelet (*Brachyramphus brevirostris*) on Kodiak Island, where there is accessible habitat in outcroppings of low-elevation ultramafic rock. We systematically searched scree slopes, placed digital cameras and temperature data loggers at nest sites, and visited nests at intervals to measure chick development. After several chicks tested positive for saxitoxin in 2011, we have collected all dead chicks for disease and contaminant analysis. We have monitored 4 to 23 active nests each year (134 nests total). Annual apparent nest success has ranged from 0 to 48% with mean of 22%. Most nest failures were due to predation. Murrelets in our study have exhibited the fastest growth rate of any semi-precocial Alcid. Nearly 90% of identified meals have been Pacific sand lance (*Ammodytes hexapterus*). We are investigating the hypothesis that the Kittlitz's population has declined in part due to lower chick growth rates when high-energy forage fish are scarce, thereby extending the period of exposure to predation before fledging. Such indirect effects of oceanographic conditions via predation rates on chicks might place predation by terrestrial predators in a broader perspective of changes in ocean climate. (Talk)

## USING SOCIAL ATTRACTION FOR TERN RESTORATION: A CALL FOR RESEARCH TO BENEFIT MANAGEMENT

Stephen W. Kress<sup>1</sup> (skress@audubon.org) Susan E. Schubel<sup>1</sup> Paula S. Shannon<sup>1</sup>

<sup>1</sup>National Audubon Society, Seabird Restoration Program, 159 Sapsucker Woods Road, Ithaca, NY 14850.

Social attraction has helped to create colonies of at least nine species of terns. Although the method is typically successful at initiating breeding, often with dramatic response, little is known about the relative importance of the basic elements, decoys and audio. Decoy details such as size and color to represent age and health, spacing and posture are usually ignored as are details of audio such as numbers of birds in recordings and context of recordings. Even less is known about seldom used tools such as model eggs, chicks, mirrors, and olfaction. The interplay between social attraction and vegetation restoration add further complexity to understanding how the method can be improved. We suggest that there is little basic information about social attraction because most practitioners are resource managers seeking measurable outcomes in a short time frame. We suggest that social attraction has become the method of choice for many seabird restoration programs because it offers a quick turnaround for investment and public relations benefits, while research may compromise management outcomes. We encourage managers to build experimental designs into restoration projects when possible and encourage researchers to conduct social attraction experiments designed to improve the methodology. Research outcomes derived from attraction experiments with common species can enhance the efficacy of management with rare species. (Talk)

## LATE SUMMER AND FALL MIGRATION OF SEABIRDS FROM THE BERING SEA TO THE CHUKCHI SEA

Kathy J. Kuletz<sup>1</sup> (kathy\_kuletz@fws.gov) Adrian Gall<sup>2</sup> Erik Osnas<sup>1</sup> Tawna Morgan<sup>2</sup> Elizabeth Labunski<sup>1</sup> Martin Renner<sup>3</sup>

<sup>1</sup>U.S. Fish and Wildlife Service, Anchorage, AK 99503.

<sup>2</sup>ABR, Environmental Research, Inc., Fairbanks, AK.

<sup>3</sup>TernAgain Consulting, Homer, AK.

In northern regions, many marine birds move south after breeding to replenish energy, yet we describe a broad-scale seasonal shift in distribution of millions of seabirds from the eastern Bering Sea in summer, north to the Arctic in late summer and early fall. Our findings are based on analyses of 190,000 km of vessel-based surveys in the eastern Bering, Chukchi, and western Beaufort seas, 2007-2014. The sea ice retreats north of the Bering Strait in June and seabird species richness and abundance increase in the Chukchi Sea from July to September, with a shift back south starting in late September and a rapid decrease in October. We also used the at-sea data and GAM models to visualize the seasonal patterns of selected species, which suggest differences in timing among foraging guilds. Seabirds that feed primarily on macrozooplankton (copepods and euphausiids) are numerically dominant, primarily auklets (*Aethia* spp) and short-tailed shearwaters (*Puffinus tenuirostris*), which do not nest on the coast of the Chukchi Sea. Migratory paths range from  $\approx 600$  km for auklets nesting in the Bering Sea to thousands of km for shearwaters that breed in the southern hemisphere. Possible advantages to moving into the Chukchi Sea include summer plankton blooms followed by abundant zooplankton, high energy density of those prey, and more hours of daylight and twilight. This brief, late-summer Arctic phenomenon is likely an important aspect of regional seabird ecology, but Arctic warming may affect the timing or duration of late season migrations, thus influencing seabird populations that nest farther south, as well as local populations. (Talk)

## NON-BREEDING DISTRIBUTION AND HABITAT USE OF BRACHYRAMPHUS MURRELETS IN ALASKA'S OCEANS

Kathy J. Kuletz<sup>1</sup> (kathy\_kuletz@fws.gov) Elizabeth Labunski<sup>1</sup> Martin Renner<sup>2</sup>

<sup>1</sup>U.S. Fish and Wildlife Service, 1011 E. Tudor Rd. Anchorage AK 99503.

<sup>2</sup>Tern Again Consulting, 308 E. Bayview Ave, Homer AK 99603.

During the breeding season marbled murrelets (*Brachyramphus marmoratus*) are found in coastal waters from California to Alaska, Kittlitz's murrelets (*B. brevirostris*) from south-east Alaska to northwest Alaska, and long-billed murrelets (*B. perdix*) in northeast Asia. Most populations leave coastal breeding areas from fall through spring. We examined non-breeding distribution and habitat use of these murrelets in Alaska waters using ship-board surveys from 2006-2015, with > 200,000 km of survey effort. During summer (May-July), murrelets were rarely observed offshore (> 10 km from shore or outside estuarine or fjord systems), but by August they occurred in the northern Gulf of Alaska (GOA) shelf and the southeast Bering Sea (SEBS). From mid-August through September marbled murrelets occurred in the SEBS inner shelf, particularly outer Bristol Bay, with low numbers in the inner and middle shelf as far as Bering Strait. During late summer/early fall, Kittlitz's murrelets occurred from the inner shelf north of Bristol Bay to the western Beaufort Sea, with highest densities between Point Hope and Point Barrow in the eastern Chukchi Sea. Long-billed murrelets were extremely rare, but were sighted in the Aleutians and lower Cook Inlet, including several summer records. In winter/early spring, marbled murrelets occurred primarily in the northern GOA, while Kittlitz's murrelets used polynyas of the northern Bering Sea ice pack. We describe marine habitats used and suggest that associated prey are important to non-breeding murrelets. Primary prey types available included juvenile Pollock and other forage fish in SEBS, euphausiids in the Chukchi, and ice-associated biota, especially hyperiid amphipods, in the Bering Sea polynyas. (Talk)

## HOW ATMOSPHERIC AND OCEANIC PROCESSES MAY INFLUENCE HYDROGRAPHY, ZOOPLANKTON AND THE DIET OF DOVEKIE ON THE WEST SPITSBERGEN SHELF?

Slawomir Kwasniewski<sup>1</sup> Marta Gluchowska<sup>1</sup> (mgluchowska@iopan.pl) Wojciech Walkusz<sup>1</sup>  
Nina J. Karnovsky<sup>2</sup> Dariusz Jakubas<sup>3</sup> Katarzyna Wojczulanis-Jakubas<sup>3</sup>

<sup>1</sup>Institute of Oceanology Polish Academy of Sciences, Powstancow Warszawy St. 55, 81-712 Sopot, Poland.

<sup>2</sup>Department of Biology, Pomona College, 175 W 6th Street, Claremont, CA 91711, USA.

<sup>3</sup>Department of Vertebrate Ecology and Zoology, University of Gdańsk, Wita Stwosza St. 59, 80-308 Gdańsk, Poland.

Climate change is currently having pronounced effects on Arctic marine ecosystems. The purpose of this study was to examine the influence of regional and large-scale atmospheric and ocean-climate phenomena on local oceanographic conditions adjacent to a large colony of dovekies (*Alle alle*) breeding on the scree covered slopes of Hornsund fjord (77°N, 15°E), on the Island of Spitsbergen. The SW Spitsbergen shelf close to the colony is a part of the Polar Front zone between Atlantic Waters of the West Spitsbergen Current and Arctic Waters of the Barents Sea. Zooplankton on the shelf consists of both Atlantic and Arctic species, the distribution and abundance of which varies in response to the interplay between processes in the atmosphere and ocean. From 2001-2008 we carried out at sea measurements of sea water physical characteristic and zooplankton density and distributions within the dovekie foraging area, and collected chick diets from provisioning adult dovekies at the colony. We found that the optimal food for dovekie chicks is the energy rich Arctic copepod *Calanus glacialis*. Our study suggests that the availability of *C. glacialis* within the dovekie feeding area is dependent on particular levels of winter sea ice and water temperatures, affected by phases of the North Atlantic Oscillation. We propose a model of relationships between these factors which influence ecosystem components with time-lags of 5 (zooplankton community) and 6-7 years (dovekie chick diet composition). We tested this model using data from 2009-2012. (Talk)

# FEATHER CORTICOSTERONE AS A POSSIBLE INDEX OF DEVELOPMENTAL CONDITIONS AND PROBABILITY OF POST-FLEDGING SURVIVAL IN BROWN PELICANS

Juliet S. Lamb<sup>1</sup> (jslamb@g.clemson.edu) Kathleen M. O'Reilly<sup>2</sup> Patrick G. R. Jodice<sup>3</sup>

<sup>1</sup>Dept. of Forestry and Environmental Conservation, Clemson University, Clemson, SC 29634.

<sup>2</sup>Dept. of Biology, University of Portland, 5000 N. Willamette Blvd., Portland, OR 97203.

<sup>3</sup>Clemson University, USGS South Carolina Cooperative Fish and Wildlife Research Unit, Clemson, SC 29634.

Measures of productivity and fitness in seabird colonies necessarily rely on the number of chicks fledged because it is difficult to follow juveniles after they leave the colony and it may be several years before they return to the colony to breed. From a conservation management perspective, improving estimates of juvenile survival during their first year of life informs a more realistic evaluation of population trends in the colony. We measured body condition and feather corticosterone levels in nestling brown pelicans (*Pelecanus occidentalis*) from several colonies across the northern Gulf of Mexico over a three-year period. We found the strongest negative correlation between body condition and corticosterone in younger chicks and at colonies with nutritional stress. Older chicks nearing fledging at food-limited colonies also had higher corticosterone levels than their peers at colonies with enough food. Additional colony- and nest-specific factors contributed to differences in corticosterone levels, enhancing the utility of feather corticosterone as an integrative measure of developmental conditions. The next step is to determine if fledglings with elevated feather corticosterone levels have lower return rates than fledglings with baseline feather corticosterone. (Poster)

## LEG-LOOP HARNESS AS A LONG DURATION ATTACHMENT METHOD FOR TELEMETRY TAGS ON A PLUNGE-DIVING SEABIRD

Timothy J. Lawes<sup>1</sup> (Timothy.Lawes@oregonstate.edu) Donald E. Lyons<sup>1</sup> Daniel D. Roby<sup>2</sup>  
James Tennyson<sup>1</sup> Allison G. Patterson<sup>1</sup>

<sup>1</sup>Department of Fisheries & Wildlife, Oregon State University, Corvallis, OR 97331-3803 USA.

<sup>2</sup>U.S. Geological Survey - Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries & Wildlife, Oregon State University, Corvallis, OR 97331-3803 USA.

We fitted adult Caspian Terns (*Hydroprogne caspia*) with 12-g, solar-powered PTT-100 tags at two nesting colonies in eastern Washington State as part of a multiyear study of breeding season dispersal, foraging ecology, and migration. We required an attachment method that would allow the solar tag to be properly exposed to maintain battery charge, not interfere with normal flight or breeding activities, withstand repeated plunge dives during foraging bouts, and remain attached for the life of each PTT tag. We chose to use a leg-loop harness consisting of 1/4-inch Teflon tape and a novel technique to secure tags. We used copper crimp connectors, typically used with electrical wiring, to secure the Teflon tape harness to the tag at the mounting loops; rather than the more common synch knotting. The Teflon tape was knotted below the copper connectors with a simple overhand knot coated with superglue as a secondary, but non-essential securing method. In 2014, 20 terns were captured pre-breeding and tagged in this manner, while in 2015, 46 terns were captured and tagged. Subsequent monitoring indicated that terns fitted with our leg-loop harnesses were capable of rearing and fledging young and completing long-distance movements. Six months post-attachment, 89% of tags deployed in each year were still actively transmitting locations. Of the tags deployed in 2014, 40% stopped transmitting at an average of 307 days (range = 54-525 days), whereas the remaining tags were still active after 18 months. We believe our approach is an excellent PTT-tag attachment method for a mid-sized, plunge-diving seabird given the rapidity of harness attachment, the longevity of tag deployments, and the normal behavior of birds post-attachment. (Poster)



## PHTHALATE ANALYSIS VIA PREENING OIL IN ALEUTIAN ISLAND SEABIRDS

Marin K. Lee<sup>1</sup> (mkleee@alaska.edu) Veronica M. Padula<sup>1</sup> Douglas Causey<sup>1</sup>

<sup>1</sup>University of Alaska Anchorage, 3211 Providence Dr, Anchorage, AK 99508.

Plastic usage, and subsequent pollution, is a worldwide issue that affects ecosystems from the Arctic to Antarctica. Plastic ingestion is now prevalent among seabirds, and these plastics continue to release chemical additives, such as phthalates, into seabirds' tissues. The wide-scale decline of seabirds has not gone unnoticed and populations have deteriorated more quickly in recent decades. Phthalates are known endocrine disruptors. Consequently, it may be plastic ingestion and subsequent phthalate exposure that is playing a role in large-scale seabird population decline, although more research is needed to understand the long-term effects. Our research aims to build a foundation of knowledge of phthalate exposure in seabirds from the Aleutian Islands, whose populations have been declining, yet the underlying cause of the declines remain unknown. We will be measuring concentrations of six phthalate congeners in preening oil from seabirds collected from numerous locations in the eastern Aleutian Islands during the summer 2015 field season. This work is in conjunction with phthalate analyses of muscle and reproductive tissues of Aleutian Islands seabirds. By comparing the phthalate levels detected in preening oils with that found in other seabird tissues, we can extrapolate the impact for any given species occupying any given trophic level. Additionally, analyzing the preening oil of seabirds offers a non-destructive means to garner information about a protected species' health. (Poster)

## MODELING SEABIRD DISTRIBUTIONS TO INFORM WASHINGTON'S MARINE SPATIAL PLAN

Jeffery Leirness<sup>1,2</sup> (jeffery.leirness@noaa.gov) Charles Menza<sup>1</sup> Timothy White<sup>1,2</sup> Arliss J. Winship<sup>1,2</sup> Brian P. Kinlan<sup>1,2</sup> John Pierce<sup>3</sup> Scott Pearson<sup>3</sup> Jeannette E. Zamon<sup>4</sup> Josh Adams<sup>5</sup> Karin Forney<sup>6</sup> Elizabeth Becker<sup>6</sup> David M. Pereksta<sup>7</sup> Liam Antrim<sup>8</sup> Lisa T. Ballance<sup>9,10</sup>

<sup>1</sup>NOAA National Ocean Service, National Centers for Coastal Ocean Science, 1305 East-West Highway, SSMC 4, Silver Spring, MD 20910.

<sup>2</sup>CSS-Dynamac, Inc., 10301 Democracy Ln, Suite 300, Fairfax, VA 22030.

<sup>3</sup>Washington Department of Fish & Wildlife, 600 Capitol Way N, Olympia, WA 98501-1091.

<sup>4</sup>NOAA National Marine Fisheries Service, Northwest Fisheries Science Center, 520 Heceta Place, Hammond, OR 97121-0155.

<sup>5</sup>USGS, Western Ecological Research Center, Santa Cruz Field Station, 400 Natural Bridges Dr, Santa Cruz, CA 95060.

<sup>6</sup>NOAA National Marine Fisheries Service, Southwest Fisheries Science Center, 110 Shaffer Rd, Santa Cruz, CA 95060.

<sup>7</sup>Bureau of Ocean Energy Management, Pacific Outer Continental Shelf Region, 770 Paseo Rd, Camarillo, CA 93010.

<sup>8</sup>Olympic Coast National Marine Sanctuary, 115 E. Railroad Ave, Suite 301, Port Angeles, WA 98362.

<sup>9</sup>NOAA National Marine Fisheries Service, Southwest Fisheries Science Center, 8901 La Jolla Shores Dr, La Jolla, CA 92037.

<sup>10</sup>Scripps Institution of Oceanography, 9500 Gilman Dr, La Jolla, CA 92093-0203.

Marine birds are diverse, highly mobile species with high potential for interactions with human activities in coastal ecosystems. Habitat modeling can help to avoid and minimize adverse interactions with marine birds by facilitating spatial planning of human activities. We developed long-term seasonal distribution maps of seven seabird species off the Pacific Coast of Washington by integrating visual sightings data from ship-based and aerial surveys conducted between 2000 and 2013. An ensemble machine-learning technique was used to model counts of each species as a function of multiple spatial and temporal environmental covariates, while accounting for heterogeneous survey effort and the aggregated nature of sightings. In particular, we examined the ability of long-term climatologies of dynamic environmental variables (e.g., sea surface temperature and chlorophyll-a concentration) and static predictors (e.g., bathymetry) to explain spatial patterns of seabird densities. Quantitative methods developed by the Washington Department of Fish and Wildlife will be used to evaluate and combine species-specific estimates of relative density with a goal of identifying ecologically important areas in the state's offshore environment. This procedure provides a starting point for evaluating risk to marine bird populations in the region from human activities. (Talk)

## PELAGIC CORMORANT POPULATION STATUS 2015

Ron LeValley (ron@levalleyphoto.com) Michelle Hester<sup>1</sup> Ryan Carle<sup>1</sup> David Calleri<sup>1</sup>

<sup>1</sup>Oikonos Ecosystem Knowledge, 180 Benito Ave, Santa Cruz CA 95062.

Pelagic Cormorants (*Phalacrocorax pelagicus*) breed in small and scattered locations along the coast of North America from Alaska to Southern California. Anecdotal evidence indicates a possibly declining population. A citizen science project has been monitoring selected colonies in Northern California for eight years and has documented dramatic annual and spatial variation in breeding success. In 2015 The El Nino and Pacific “Blob” combined with Global Warming caused a major decline in breeding success. Some colonies that had been monitored in previous years, were unoccupied this year, while most other colonies were at much lower numbers than in previous years and at least two colonies completely collapsed during the season. Discerning whether a decline in Pelagic Cormorant population is real will require a longer effort and a much broader geographic scope. The format of the citizen science monitoring that we have been using has been a viable way to increase this effort. (Talk)

## THE TRILATERAL ISLAND INITIATIVE: INTERNATIONAL COLLOBORATIVE EFFORTS FOR THE CONSERVATION AND RESTORATION OF SEABIRDS IN NORTH AMERICA

Annie E. Little<sup>1</sup> (annie\_little@fws.gov) Gregg Howald<sup>2</sup> Alfonso Aguirre-Muñoz<sup>3</sup> Laurie Wein<sup>4</sup>  
Humberto Berlanga-García<sup>5</sup> Eduardo Iñigo-Elias<sup>6</sup>

<sup>1</sup>U.S. Fish and Wildlife Service, 1901 Spinnaker Drive, Ventura, CA 93001.

<sup>2</sup>Island Conservation, 2161 Delaware Ave, Santa Cruz, CA 95060.

<sup>3</sup>Grupo de Ecología y Conservación de Islas, Avenida Moctezuma 836, Zona Centro, Ensenada, Baja California, México 22800.

<sup>4</sup>Parks Canada Agency, 30 Victoria St., 3rd floor, room 55, Destination Code PC-03-C, Gatineau, QC.

<sup>5</sup>Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Liga Periférico - Insurgentes Sur 4903, Col. Parques del Pedregal, Del. Tlalpan, México, D.F. 14010.

<sup>6</sup>Cornell Lab of Ornithology, 159 Sapsucker Woods Rd, Ithaca, NY 14850.

Marine birds have large geographic ranges that span political borders. Long-term conservation of marine birds requires protection at both their terrestrial breeding- mostly islands- and marine foraging habitats. Over the last decade, significant efforts have been made to protect and restore marine birds and islands within Canada, Mexico, and the U.S. As part of the Trilateral Committee for Wildlife and Ecosystem Conservation and Management, the three countries signed a Letter of Intent (LOI) in 2014 in Querétaro, Mexico. The goal of the LOI is to facilitate collaboration among the North American countries regarding the conservation and restoration of unique island ecosystems. Marine birds are an important unifying theme for the Trilateral Island Initiative. Several marine bird, island restoration, and research projects have benefited from trilateral and bilateral cooperation. These include an invasive rat eradication project in Haida Gwaii, British Columbia, a series of restoration programs in Mexico on the Baja California Pacific Islands, Revillagigedo Archipelago and Guadalupe Island, as well as long-term seabird research on the Aleutian Islands. Partners from all aspects of the marine bird community are vital to the success of this initiative. (Talk)

## POPULATION GENETICS AND ADAPTIVE EVOLUTION OF PROVIDENCE PETRELS (PTERODROMA SOLANDRI): GENETIC RISK ASSESSMENT OF A COLONY RE-ESTABLISHMENT

Anicee Jessica Lombal<sup>1</sup> (anicee.lombal@utas.edu.au) Theodore Joseph Wenner<sup>1</sup> Christopher Paul Burrridge<sup>1</sup>

<sup>1</sup>University of Tasmania, School of Biological Sciences, Private Bag 55, Hobart, TAS 7001 AUS.

The Providence petrel (*Pterodroma solandri*) is UCN listed as Vulnerable due to its restricted breeding range. The only significant breeding locality of this species of pelagic seabird ( $\approx 32,000$  breeding pairs) is Lord Howe Island, a small island off the eastern coast of Australia. Providence petrels used to breed on Norfolk Island ( $\approx 1,000,000$  breeding pairs) before becoming extinct after European settlement by the late 18th century. The species was considered extinct within the Norfolk Island group until 1986 when a small population ( $\approx 20$  breeding pairs) was discovered on Phillip Island, 7km south of Norfolk Island. Re-establishment of a Norfolk Island colony using Lord Howe Island individuals has been proposed. However, this translocation may erode any distinctiveness of the small adjacent Phillip Island colony, which shows a specific behavioural adaptation to diurnal predators. Our study used a 872-bp fragment of the mitochondrial cytochrome b gene and 14 nuclear intron loci sequenced for 52 individuals in addition to 10 microsatellites loci genotyped for 183 individuals to elucidate connectivity and genetic distinctiveness of these colonies. No genetic structure among colonies was detected (Global  $F_{ST} = 0.002$ ,  $P > 0.05$ , STRUCTURE  $K=1$ ) and evidence for population mixing was found with individual assignment and population coalescent analyses. Our results demonstrate that gene flow is high between the two remaining populations and suggest a recent behavioural adaptation to predators on Phillip Island. These results indicate limited genetic risks surrounding the re-establishment of a key species of pelagic seabird on Norfolk Island. (Talk)

# TEMPORAL VARIABILITY IN THREE-DIMENSIONAL HABITAT-USE OF COMMON MURRES (*URIA AALGE*) OFF THE OREGON COAST

Stephanie A. Loredos<sup>1</sup> (loredos@oregonstate.edu) Robert M. Suryan<sup>1</sup>

<sup>1</sup>Oregon State University, Nash Hall, 2820 SW Campus Way, Corvallis, OR 97331.

The Common Murre (*Uria aalge*) is the most abundant of the breeding populations of seabirds along the Oregon Coast, yet little is known about the extent of its offshore distribution during the non-reproductive season and diel patterns. Furthermore, the installation of wave energy converters off Oregon waters raises questions about potential interactions of this wing-propelled diving species with offshore alternative energy devices. Ship-based and aerial surveys of seabirds have provided some information, but these methods lack the ability to follow specific individuals. We address these questions by fitting individual murres with satellite transmitters and dive depth recorders throughout the year to better describe their distribution and foraging patterns. Both short-term fine-scale and long-term coarse-scale GPS tracking devices will be deployed to better capture habitat relationships in foraging techniques and maximize time-scale of habitat-use. Foraging behavior will be compared to time of day, wind patterns, tidal variations, bathymetry, chlorophyll concentrations, water temperature, and sea level pressure. The results of this study - along with transect vessel data - will improve predictive habitat-use models needed to inform marine spatial planners, and will allow development of spatial-vulnerability maps for offshore energy development in Oregon. This study is part of a larger multi-species analysis project, aimed at understanding year-round distributions of seabirds off Oregon. Project status: Conceptual (Poster)

# AT-SEA HABITAT SELECTION BY MARBLED MURRELETS DURING THE BREEDING SEASON: THE ROLE OF TERRESTRIAL AND MARINE FACTORS

Teresa J. Lorenz<sup>1</sup> (tlorenz@fs.fs.us) Martin G. Raphael<sup>1</sup> Thomas D. Bloxton<sup>2</sup>

<sup>1</sup>U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3625 93rd Avenue SW, Olympia, WA 98512, USA.

<sup>2</sup>U.S. Army Corps of Engineers, P.O. Box 3755, Seattle, WA 98124-3755.

The marbled murrelet (*Brachyramphus marmoratus*) is a declining seabird and the extent to which population declines are due to changes in terrestrial nesting habitat versus marine foraging habitat is unknown. Studies of resource selection are often used to identify and rank influential habitat components for declining populations. We conducted a 5-year study of murrelet resource selection in Washington. We used discrete choice models to examine habitat selection and ranked potentially influential habitat variables using two statistical methods. Among all models considered in our study, the global model had the most support ( $w_i = 0.99$ ,  $AICc = 8456$ ,  $k = 15$ ), suggesting that murrelet resource selection at-sea is affected by many factors, both terrestrial and marine. The most influential factors included nesting habitat availability, proximity to shore, terrestrial human footprint, and sea surface temperature. Locations with higher amounts of nesting habitat ( $\beta = 21.49$ ,  $P < 0.001$ ) that were closer to shore ( $\beta = -0.0007$ ,  $P < 0.001$ ) and in cool waters ( $\beta = -0.2026$ ,  $P < 0.001$ ) with low footprint ( $\beta = -0.0087$ ,  $P < 0.001$ ) had higher probabilities of use. We encourage future studies that measure availability of murrelet marine prey, as this may more accurately predict space use than remotely sensed factors, like sea surface temperature. Meanwhile, future conservation efforts should consider protecting both terrestrial and marine habitat for murrelets, as the current emphasis on terrestrial habitat may be insufficient for conserving populations. (Talk)

## CASPIAN TERN RESPONSES TO NON-LETHAL MANAGEMENT IN THE COLUMBIA PLATEAU REGION, USA

Peter J. Loschl<sup>1</sup> (pete.loschl@oregonstate.edu) Daniel D. Roby<sup>2</sup> Brad Cramer<sup>3</sup> Ken Collis<sup>3</sup>  
Donald E. Lyons<sup>1</sup>

<sup>1</sup>Oregon Cooperative Fish & Wildlife Research Unit, Department of Fisheries and Wildlife, Corvallis, OR 97331 USA.

<sup>2</sup>U.S. Geological Survey-Oregon Cooperative Fish & Wildlife Research Unit, Corvallis, OR 97331 USA.

<sup>3</sup>Real Time Research, Inc., 231 S.W. Scalehouse Loop, Suite 101, Bend, OR 97702 USA.

We assisted with implementation and monitored the efficacy of the Inland Avian Predation Management Plan, designed by federal management agencies (Corps of Engineers, Bureau of Reclamation, and Fish and Wildlife Service) to reduce Caspian Tern (*Hydroprogne caspia*) predation on salmonids (*Oncorhynchus* spp.) listed under the Endangered Species Act. We used combinations of passive dissuasion (ropes, flagging, and visual barriers) and active dissuasion (human hazing) techniques to limit tern access to active colony sites on Goose Island in Potholes Reservoir (2014-2015) and on Crescent Island in the mid-Columbia River (2015). Caspian Terns showed strong site fidelity at Goose Island, prospecting for and initiating nests in or near locations where dissuasion measures were used in both years, but where gulls (*Larus* spp.) continued to nest. At Crescent Island, however, tern nest dissuasion measures were completely effective in the first year of management, likely associated with use of closely-spaced fence rows of privacy fabric installed as visual barriers and the absence of a large gull colony on the island. While management goals for both islands were met in 2015, monitoring of other historical and potential Caspian Tern colony sites indicated that the breeding population in the Columbia Plateau region was stable, due to a 10-fold increase in the size of the Blalock Islands tern colony in the mid-Columbia River. Our results indicate that while the combination of passive and active dissuasion can reduce or eliminate Caspian Tern breeding at managed sites, if suitable alternative habitat is available, breeding dispersal can occur within the region, and potentially offset reduced predation rates on salmonids at managed sites. (Poster)



## SHEARWATERS AS ECOSYSTEM INDICATORS: CONNECTING PREDATORS IN THE CALIFORNIA CURRENT

Shannon E. Lyday<sup>1</sup> (shannon.lyday@gmail.com) Lisa T. Ballance<sup>2</sup> David B. Field<sup>1</sup> K. David Hyrenbach<sup>1</sup>

<sup>1</sup>Hawaii Pacific University, 41-202 Kalanianaʻole Hwy, Waimanalo, HI 96795.

<sup>2</sup>Southwest Fisheries Science Center, La Jolla, CA 92037.

The Puffinus shearwaters are an ideal focal taxa for monitoring ocean conditions in the California Current System (CCS) because these predators are abundant, conspicuous, and highly responsive to oceanographic variability. The goal of this study was to evaluate the utility of black-vented (*Puffinus opisthomelas*), Buller's (*P. bulleri*), flesh-footed (*P. carneipes*), pink-footed (*P. creatopus*), short-tailed (*P. tenuirostris*), and sooty (*P. griseus*) shearwaters as fishery-independent indicators by developing multivariate models of fish availability by integrating three disparate datasets: shearwater abundance, oceanographic metrics, and commercial fishery catch. We analyzed four years (1996, 2001, 2005, 2008) of monthly (August-November) National Oceanic and Atmospheric Administration (NOAA) seabird surveys, and United States Geological Survey (USGS) Pacific Coast Fisheries Database fisheries catch, from the coast of California seaward to 200 nm (370 km) offshore. Multiple linear regression models were created for the thirteen fish/squid species using five shearwater metrics: density, aggregation, and behavior (traveling, stationary, feeding), three basin-wide oceanographic indices, and latitude. Of the six shearwater species considered, black-vented shearwater metrics were most frequently related to the fisheries examined, and yielded the highest explanatory power. In particular, feeding black-vented shearwater abundance explained 75% of the dolphinfish (*Coryphaena hippurus*) caught with set longline. These results indicate that the Puffinus shearwaters are indicative of the spatial and temporal variability that affects other commercially-valuable predators in the CCS ecosystem. (Talk)

## MIGRATION AND WINTER MOVEMENTS OF PACIFIC FLYWAY CASPIAN TERNS

Donald E. Lyons<sup>1</sup> (don.lyons@oregonstate.edu) Timothy J. Lawes<sup>1</sup> Allison G. Patterson<sup>1</sup>  
Daniel D. Roby<sup>2</sup> Yasuko Suzuki<sup>1</sup> Peter J. Loschl<sup>1</sup>

<sup>1</sup>Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR 97331-3803 USA.

<sup>2</sup>U.S. Geological Survey - Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR 97331-3803 USA.

The Caspian Tern (*Hydroprogne caspia*) is a cosmopolitan species that displays a range of migratory behaviors across the world, from relatively sedentary to long-distance migrant. To characterize the movements of Caspian Terns in the Pacific Flyway of North America during migration and winter, we used 12-g solar-powered satellite PTTs to track 23 adults captured prior to the 2014 breeding season at a colony site in interior Washington State (47°N). Following an often lengthy post-breeding dispersal period, tagged Caspian Terns displayed a two-stage southward migration. Migration routes were variable during the initial stage, with individuals tracked along the Pacific Coast or at various distances (up to 600 km) inland, but routes eventually converged on the Salton Sea (33°N), a large hypersaline inland lake just north of the U.S.-Mexico border. Every tagged individual visited the Salton Sea on their southward migration and most spent several weeks there (median stopover was 36 days, range: 1 - 152 days). The second stage of southward migration followed the Mexican Gulf of California coastline of Sonora and Sinaloa states. None of the tagged Caspian Terns moved into Baja California. The most southerly winter location was in a coastal estuary near Acapulco, Mexico (17°N), approximately 3,800 km from the capture site. Winter ranges were highly variable in size and location, ranging from single estuaries (< 30 km<sup>2</sup>) to expansive movements between coastal estuaries and inland reservoirs and lakes (> 500,000 km<sup>2</sup>). Our results suggest that tern populations may be dispersed over relatively large areas during winter, but critically dependent on one or more key stopover locations en route between breeding and wintering areas. (Talk)

## POST-BREEDING MIGRATION ROUTES AND STOPOVER BEHAVIOR OF KITTLITZ'S MURRELETS

Erica N. Madison<sup>1</sup> John F. Piatt<sup>1</sup> (jpiatt@usgs.gov) David C. Douglas<sup>1</sup> Mayumi L. Arimitsu<sup>1</sup>  
Sarah K. Schoen<sup>1</sup>

<sup>1</sup>USGS Alaska Science Center, 4210 University Drive, Anchorage AK 99508.

Little is known about the basic biology of Kittlitz's murrelets (*Brachyramphus brevirostris*), making it difficult to assess their status or conservation needs. We attempted to fill data gaps about their post-breeding migration patterns and their foraging behavior during migration. We captured Kittlitz's murrelets and attached 5.5g solar-powered satellite transmitters to 35 birds from 2009-2014. Transmitters were attached dorsally using sutures, in four capture areas in the Gulf of Alaska and one in the central Aleutians. For 3-12 weeks post-attachment, we received latitude, longitude, and temperature data from the tagged murrelets. Across all study years, some Kittlitz's did not migrate, but those who did followed similar westward migration routes toward Cook Inlet and the Alaska Peninsula, and many continued on to the Bering, Chukchi, and Beaufort seas. Foraging stopovers were detected in several key areas, and temperature data indicated frequent diving during daylight hours, and reduced foraging at night. Speed of travel varied with distance travelled, reaching upwards of 85 km/h. Given the range of habitats used during the half-year that murrelets migrate away from nesting areas in the Gulf of Alaska, migration and movement routes need to also be considered when evaluating human and natural threats to populations. (Talk)

## HABITAT MODIFICATION AS A MEANS OF RESTORING AETHIA AUKLET COLONIES

Heather L. Major<sup>1</sup> (heather.major@unb.ca) Rachel T. Buxton<sup>2</sup> Carley R. Schacter<sup>3</sup> Melinda G. Conners<sup>4</sup> Ian L. Jones<sup>3</sup>

<sup>1</sup>Dept. Biol. Sci., University of New Brunswick, UNBSJ, PO Box 5050, Saint John NB E2L 4L5.

<sup>2</sup>Colorado State University, Dept. Fish, Wild., and Cons., Fort Collins CO 80523.

<sup>3</sup>Memorial University, Dept. Biol. St. John's NL A1B 3X9.

<sup>4</sup>University of California, Santa Cruz, Center for Ocean Health, 100 Shaffer Rd., Santa Cruz, CA 95060.

In December 2004 the M/V Selendang Ayu grounded at Unalaska Island, Alaska, oiling and killing thousands of Crested Auklets (*Aethia cristatella*). We undertook a large-scale BACI experiment to test whether habitat modification could be an effective means of restoring Crested Auklet numbers. One of the largest Crested Auklet breeding colonies is on old lava flows largely covered with vegetation at Gareloi Island. Because auklets prefer nesting in rocks without vegetation, we hypothesized that removing vegetation from lava boulders would allow new recruits to secure a previously unavailable nesting site, contributing new individuals to the population. In 2009 and 2010 we delineated a total of 34- 10x20m plots, in which we colour-marked 614 adult Crested Auklets. Within each plot, we counted the total number of nests, and calculated the ratio of banded to unbanded birds, and the ratio of banded to unbanded breeders landing. Subsequently, vegetation was removed from half of each plot and active monitoring continued during 2009-2011 and 2013. Overall, Crested Auklet active breeding sites, numbers of individuals socializing on the surface, and the number of breeders landing within plots did not increase after vegetation removal. As expected, the majority of marked birds (78%) did not show a change in sub-plot preference but those that did move to another plot half exhibited no preference for modified plot halves. Based on our experimental results, we found no evidence that habitat modification increased auklet breeding numbers, and thus may not be a viable option for auklet restoration. (Talk)

## BODY CONDITION AND BREEDING DECISIONS OF ARCTIC TERNS IN THE CANADIAN HIGH ARCTIC

Mark L. Mallory<sup>1</sup> (mark.mallory@acadiau.ca)

<sup>1</sup>Acadia University, Wolfville, NS, Canada, B4P2R6.

Arctic terns (*Sterna paradisaea*) are a ubiquitous migratory seabird of the high Arctic, currently thought to be in decline in most of the circumpolar world, but surprisingly little is known of its biology at high latitudes. I studied the body condition of male and female terns breeding beside a high Arctic polynya in Nunavut, Canada, from their arrival at the colony into the chick-rearing period. Female terns exhibited a linear increase in body fat through the breeding season, whereas the pattern was non-linear for males, suggesting that they lose body condition while providing courtship meals to females up to early incubation, before recovering body condition through incubation and chick-rearing. Protein levels did not exhibit a consistent trend for either sex during breeding. Both males and females had a linear decrease in gizzard size through breeding, with gizzard mass during chick-rearing 45% lower than on arrival at the breeding grounds. Over five years of monitoring, tern reproductive effort and success was generally successful when mean body mass of breeding birds was  $\approx 110$  g, but when body mass was  $< 105$  g, nesting effort was reduced (smaller clutch size, lower hatching success), suggesting that body condition is a key factor influencing reproductive decisions of Arctic terns at high latitudes. (Poster)

NATIVE PLANT COMMUNITY HABITAT RESTORATION ON THE CHANNEL ISLANDS TO ENHANCE NESTING HABITAT FOR SCRIPPS'S MURRELET (*SYNTHLIBORAMPHUS SCRIPPSI*) AND CASSIN'S AUKLETS (*PTYCHORAMPHUS ALEUTICUS*)

David M. Mazurkiewicz<sup>1</sup> (david\_mazurkiewicz@nps.gov) Josh Adams<sup>2</sup> Annie E. Little<sup>3</sup> Andrew A. Yamagiwa<sup>4</sup> James A. Howard<sup>4</sup> Marie-Eve Jacques<sup>4</sup>

<sup>1</sup>Channel Islands National Park, 1901 Spinnaker Dr. Ventura, CA 93001.

<sup>2</sup>US Geological Survey-Western Ecological Research Center, Santa Cruz Field Station, 400 Natural Bridges Dr. Santa Cruz, CA 95060.

<sup>3</sup>US Fish and Wildlife Service-MSRP, 1901 Spinnaker Dr. Ventura, CA 93001.

<sup>4</sup>California Institute of Environmental Studies, 3408 Whaler Avenue, Davis, CA 95616.

<sup>5</sup>Sutil Conservation Ecology, 30 Buena Vista Avenue, Fairfax, CA 94930.

Channel Islands National Park supports critical seabird nesting habitat in southern California. Over the last century, impacts by humans, non-native animals and plants have reduced suitable nesting habitat available to seabirds on these islands. In an effort to restore breeding habitat and improve reproductive success, extensive habitat restoration efforts have occurred over the last decade at Santa Barbara Island (SBI) and Scorpion Rock (Santa Cruz Island). On Scorpion Rock, the removal of the Crystalline Ice Plant (*Mesembryanthemum crystallinum*) and outplanting of >9,000 native plants has dramatically changed the landscape. Non-native cover has decreased from >90% to <10% in maintained areas, while native shrub cover has increased >55%, thereby providing accessible, protected habitat for burrow nesting Cassin's Auklets (*Ptychoramphus aleuticus*). On Santa Barbara Island (SBI), efforts have focused on restoring nesting habitat for the State threatened Scripps's Murrelet (*Synthliboramphus scrippsi*) and Cassin's Auklet. More than 30,000 native plants have been grown on SBI and outplanted in multiple restoration sites. Artificial nest boxes and social attraction have also been utilized to encourage recolonization of seabirds in historically occupied habitat. In 2015, five pairs of murrelets successfully nested in the restoration sites. In both projects, the establishment of permanent nurseries on-island and a large volunteer component has facilitated the work. Continued success of these seabird restoration projects rely on partner collaboration, sustained efforts over multiple years, and an adaptive management approach. (Talk)

## USE OF SOCIAL ATTRACTION TO RESTORE BREEDING COMMON MURRES AT DEVIL'S SLIDE ROCK, CALIFORNIA

Gerard J. McChesney<sup>1</sup> (gerry\_mcchesney@fws.gov) Michael W Parker<sup>1</sup> Harry R. Carter<sup>2</sup>  
Stephen W. Kress<sup>3</sup> Richard T. Golightly<sup>2</sup>

<sup>1</sup>U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, 1 Marshlands Rd., Fremont, CA 94555 USA.

<sup>2</sup>Humboldt State University, Dept. of Wildlife, 1 Harpst St., Arcata, CA 95521 USA.

<sup>3</sup>National Audubon Society, 159 Sapsucker Woods Rd., Ithaca, NY 14850 USA.

In 1996-2005, social attraction was used to re-establish a breeding colony of Common Murres (*Uria aalge*) at Devil's Slide Rock (DSR) in central California, with funding from an oil spill settlement. We deployed decoys (adults, chicks and eggs), sound systems broadcasting murre vocalizations, and mirrors which together simulated an active colony to attract murres to the rock and encourage breeding. Social attraction efforts at DSR began in January 1996, 10 years after this colony of about 3,000 murres in 1979-1982 was extirpated in 1986 from local mortality during the 1986 Apex Houston oil spill, after reduction from recent mortality in a local gill-net fishery. Murres began attending the rock one day after deployment and six pairs bred the first year. The original 10-year goal of 100 breeding pairs was reached after only five years. As the colony grew, social attraction was adaptively managed to encourage rapid development of dense core breeding groups. By 2005, the colony had grown to 190 breeding pairs and afterward decoys were no longer considered useful for encouraging colony growth. By 2013, colony size and distribution were similar to 1979-1982 levels. Breeding success has been relatively high in most years. Rapid initial re-colonization was likely assisted by remnant, surviving birds from the extirpated colony, nesting Brandt's Cormorants (*Phalacrocorax penicillatus*), and few predators. Recruitment of birds from other nearby colonies and, in later years, chicks hatched at DSR likely have both contributed to colony growth. (Talk)

## RESTORATION OF ASHY STORM-PETRELS AT ORIZABA ROCK, SANTA CRUZ ISLAND, CALIFORNIA, 2008-2015

William R. McIver<sup>1</sup> (bill\_mciver@fws.gov) David M. Mazurkiewicz<sup>2</sup> James A. Howard<sup>3</sup> Nathan R. Lynch<sup>4</sup> Matthew G. Passmore<sup>5</sup> Michelle Hester<sup>6</sup> Annie E. Little<sup>7</sup>

<sup>1</sup>U.S. Fish and Wildlife Service, 1655 Heindon Road, Arcata, California 95521.

<sup>2</sup>National Park Service, Channel Islands National Park, 1901 Spinnaker Drive, Ventura, California 93001.

<sup>3</sup>California Institute of Environmental Studies, 3408 Whaler Avenue, Davis, California 95616.

<sup>4</sup>California College of the Arts, 5212 Broadway, Oakland, California 94618.

<sup>5</sup>MoreLab, 1661 20th St. Suite 3, Oakland California 94607.

<sup>6</sup>Oikonos Ecosystems Knowledge, P.O. Box 2570, Santa Cruz, California 95063.

<sup>7</sup>U.S. Fish and Wildlife Service, 1901 Spinnaker Drive, Ventura, California 93001.

In 2008-15, the Montrose Settlements Restoration Program funded work to restore the colony of Ashy Storm-Petrels (*Oceanodroma homochroa*) at Orizaba Rock, off Santa Cruz Island, California. In 2008-10, 30 artificial nest sites composed of concrete roof tiles were deployed in caverns and vocalization broadcasting implemented. Common Ravens (*Corvus corax*) dismantled 12 artificial nest sites in 2010. In 2011-12, the roof tile nest sites were replaced with ceramic nest sites, which reduced raven impacts in 2011 but were not sturdy enough to prevent being moved or opened by ravens in 2012. In 2012-13, artificial sites were removed and vocalizations were stopped to further evaluate raven impacts. Building on these experiences, ceramic experts and designers joined the effort to create a nest site attractive to storm-petrels, but also inaccessible and unmovable by ravens. In 2014, heavier modules that included 3 nesting chambers per unit (10 modules with 30 nest sites) were designed and deployed. Eggs were laid in 4-7 artificial nest sites per year in 2008-12, eggs were not laid in artificial sites in 2014 and eggs were laid in 4 artificial sites in 2015. Numbers of active natural nests increased from 7-15 (2005-07) to 20-27 (2008-12) and 31-36 (2013-15). This work demonstrated the effectiveness of these restoration actions under certain conditions and the need to make artificial sites predator-proof. (Talk)



## GENETIC POPULATION PATTERNS OF NEWELL'S SHEARWATERS AND OTHER AVIAN SPECIES AT POHAKULOA TRAINING AREA FROM PRE TO POST CONTACT

Rachel E. McKenna<sup>1</sup> (remckenna@alaska.edu) Douglas Causey<sup>1</sup>

<sup>1</sup>University of Alaska Anchorage, 3211 Providence Dr, Anchorage, AK 99508.

Native Polynesian use of the Big Island of Hawaii provides unique sampling opportunities to provide insight into biological communities that are otherwise lost to time. Midden remains from the Pohakuloa Training Area contain remnants of birds both consumed and native to the area. Accurate analysis of shearwater species found in the middens provides information on the birds found and targeted in the uplands of the Big Island and identifies potentially rare and unusual birds transported or resident to the region. My preliminary results help understand the diversity of shearwater species found in the uplands of the Big Island. This research will be used as a foundation for planned studies using DNA and isotope analysis that can detect population-level ecological and genetic patterns before and after European Contact. The faunal assemblage is planned with the aid of comparative specimens loaned from the Bishop Museum, Smithsonian Natural History museum, Burke Museum, and others. It will test the middens not only for shearwaters known to inhabit and frequent the island, but for other rare Pacific species to detect unusual occurrences in the middens. (Talk)

## NON-BREEDING DISTRIBUTION OF BERMUDAN ORIGIN WHITE-TAILED TROPICBIRDS (PHATHEON LEPTURUS CATESBYI) IN THE NORTH ATLANTIC

Miguel A. Mejias<sup>1</sup> (mmejias@mun.ca) Yolanda F. Wiersma<sup>1</sup> Jeremy Madeiros<sup>2</sup>

<sup>1</sup>Memorial University, Department of Biology, PO Box 4200, St. John's, NL, Canada A1B 3X9.

<sup>2</sup>Department of Conservation Sciences, Ministry of the Environment, PO Box FL588, Flatts, FL BX, Bermuda.

The whereabouts of many migratory seabirds outside the breeding season is generally poorly known. Recent advances in technology have granted researchers the ability to track individuals long after colony departure. Using small (1g) light-based Migrate Tech geolocators, we identified the non-breeding distribution of 25 adult White-tailed Tropicbirds (*Phaethon lepturus catesbyi*) from Bermuda during July 2014 - June 2015. After breeding, 15 adults (60%) spent the autumn months moving eastward from their breeding grounds, while 10 (40%) remained within the Sargasso Sea, close to Bermuda. Tropicbirds spent early and late portions of the winter period at the Mid-Atlantic Ridge and Bermuda respectively. Almost all individuals undertook a southerly spring route, spending majority of April within the Caribbean before undertaking a northern route back to Bermuda to breed. To the best of our knowledge, these results highlight, for the first time, non-breeding distribution of a Tropicbird species in the Atlantic. The Bermudan population of White-tailed Tropicbirds represents the largest in the Atlantic, where this species is threatened across this region. Therefore, our study highlights areas where White-tailed Tropicbirds can be vulnerable outside the breeding season and where conservation efforts to minimize at-sea threats can be taken. (Poster)

## RESULTS OF INITIAL TRIALS TO DETERMINE IF LASER LIGHT CAN PREVENT SEABIRD BYCATCH IN NORTH PACIFIC FISHERIES

Edward F. Melvin<sup>1</sup> (edmelvin@uw.edu) William E. Asher<sup>2</sup> Esteban Fernandez-Juricic<sup>3</sup> Amy Lim<sup>4</sup>

<sup>1</sup>Washington Sea Grant, Box 355060, Seattle, WA 98195.

<sup>2</sup>Applied Physics Lab, University of Washington, Box 355640 Seattle, WA 98105-6698.

<sup>3</sup>Department of Biological Sciences, Purdue University, West Lafayette, IN 47907.

<sup>4</sup>Radiation Safety Office, University of Washington, Box354400, Seattle, WA 98105.

Here we report results of the first field trials of a laser-based seabird deterrent in North Pacific fisheries. We tested a commercially available product and a prototype device, each operating in the visible region at 532 nm (green). The optical power output measured in the laboratory was similar for both (1.26 and 1.1 W, respectively) placing them well within the class-4 laser classification. The calculated Nominal Optical Hazard Distance (NOHD) for each was also similar (175 m and 252 m, respectively). Field trials were carried out on a trawl catcher-processor off the Oregon-Washington coast in October 2015. Trawl was selected over longline because it represents a worst-case challenge for seabird deterrence: large aggregations of birds feeding on an abundant food source (continuous offal discharge from the factory) 24/7. Attending seabirds (all species) showed little detectable response to the laser beam during daylight hours. At night however, Northern fulmars (*Fulmarus glacialis*) showed a transient and localized response at lower vessel speeds (3.5 kts) while feeding in the offal plume. In contrast, gulls in flight at nighttime in pursuit of the vessel showed a strong aversion at higher vessels speeds (11 kts). These results suggest that laser beam detection by birds may be more challenging at high light levels. The implication is that lasers might be modified to increase its visual contrast during the day. From these field trials, lasers appear more likely to scare birds from an abundant food source at low light levels and success may be species and condition specific. (Talk)

## HOW DO GROWTH AND SIBLING COMPETITION AFFECT TELOMERE DYNAMICS IN THE FIRST MONTH OF LIFE OF LONG-LIVED SEABIRD?

Yuichi Mizutani<sup>1</sup> (yuichi-san@nagoya-u.jp) Yasuaki Niizuma<sup>2</sup> Ken Yoda<sup>1</sup>

<sup>1</sup>Nagoya university, Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan.

<sup>2</sup>Meijo university, 1-501, Shiogamaguchi, Tempaku-ku, Nagoya 468-8502, Japan.

Telomere attrition during early life can affect survival, health, and reproductive output. Although avian telomere dynamics during the nestling phase is likely to be affected by growth and stress factors. To untangle these effects occurring in coincidence we examined telomere dynamics of a chick of black-tailed gulls (*Larus crassirostris*) with and without a sibling. We measured telomere lengths using blood at hatching and fledging, and related them with hatching order, brood size of one or two, sex, age, body mass, and growth rate. Chicks in a nest of brood size of two had shorter telomere at hatching than singletons. Moreover, siblings experienced more considerable attrition of telomere from hatching to fledging than singletons. There was no trade-off between telomere loss and growth rates, but conversely, the lower growth rate was associated with telomere shortening. Growth rates and body mass at fledging were similar between singletons, younger siblings, and older siblings. Our results show that developmental telomere attrition was an inevitable consequence in two-chick nests during the pre- and post-hatching micro-environments due to social stress in a nest and also maternal (negative) effects. Our study shed light on the early life telomere dynamics that may work important physiological basis of life-history traits. (Poster)

LAYSAN ALBATROSS (*PHOEBASTRIA IMMUTABILIS*) ON GUADALUPE ISLAND, MEXICO: POPULATION STATUS, DISTRIBUTION, AND ADVANCES TOWARDS THE ERADICATION OF FERAL CAT

Julio C. Hernández-Montoya<sup>1,2</sup> (julio.montoya@islas.org.mx) Luciana M. Luna Mendoza<sup>1</sup>  
Alfonso Aguirre-Muñoz<sup>1</sup> María de los ángeles Milanés Salinas<sup>1</sup> Yuliana R. Bedolla-Guzmán<sup>1</sup>  
María Félix-Lizárraga<sup>1</sup> Frederico Méndez-Sánchez<sup>1</sup>

<sup>1</sup>Grupo de Ecología y Conservación de Islas, A.C. , Moctezuma 836, Zona Centro, Ensenada, Baja California, México 22800.

<sup>2</sup>Centro de Investigaciones Biológicas del Noroeste, Instituto Politécnico Nacional 195, Colonia Playa Palo de Santa Rita Sur, La Paz, Baja California Sur, México 23096.

Guadalupe Island and its islets, off the Baja California peninsula in Mexico is a key breeding site for seabirds. However, feral cats, introduced to the main island more than a 100 years ago are a serious threat to nesting seabirds, including Laysan Albatross (*Phoebastria immutabilis*), Guadalupe Murrelet (*Synthliboramphus hypoleucus*) and Leach's Storm-petrel (*Oceanodroma leucorhoa*). To protect these seabirds we have a permanent control program for feral cats around nesting colonies. The impact of these actions has been closely monitored for the Laysan Albatross (LAAL). The distribution on the island and islets, and the population status of the three colonies are monitored until the chicks fledge. During 2015, at the main island's colony 192 nests were recorded, in Morro Prieto Islet 233 and at El Zapato Islet 510. A total of 935 nests were recorded compared with 815 recorded in 2014. The reproductive success of LAAL on Guadalupe has been assessed each breeding season. In 2015 success to chick stage was 87.59%. Success to juveniles survivors after five months of life was 79.89%. Currently, the LAAL total breeding population is 1870 individuals; 89% are marked with rings and 100% of the juveniles have been marked for the past 12 years. To protect the LAAL colony of feral cat predation, an excluder fence was built in Punta Sur in 2014, establishing a 62 hectares feral cat-free peninsula. The fence might encourage to murrelets and other seabirds to nest on the cat-free area. The next strategic objective is to eradicate the feral cat population. While the monitoring and feral cat control continues, the eradication executive plan is being improved, and funds for the purpose are being raised. (Talk)

## ASSESSING PREDATORS OF JAPANESE SEABIRDS ON BIROJIMA ISLAND USING MOTION SENSING CAMERAS

Yutaka Nakamura<sup>1</sup> (nyutaka02@yahoo.co.jp) Nina J. Karnovsky<sup>2</sup> Yoshitaka Minowa<sup>3</sup> Kuniko Otsuki<sup>3</sup>

<sup>1</sup>University of Miyazaki, Faculty of Agriculture, Gakuen-Kibanadai-Nishi 1-1, Miyazaki, Miyazaki 889-2192, Japan.

<sup>2</sup>Pomona College, Dept. of Biology, Claremont, CA 91711 USA .

<sup>3</sup>Marine Bird Restoration Group, 1-18 Ishida, Hokida, Fukushima-shi, Fukushima Prefecture, Japan.

Birojima (32° 28' N, 131° 44' E) is a group of small islands located about 2.1 km off east Kyushu, and about 7 km east of Kadogawa Town, Miyazaki Prefecture, Japan. Both Japanese murrelets (*Synthliboramphus wumizusume*) and streaked shearwaters (*Calonectris leucomelas*) nest on Birojima. The purpose of this study was to assess the types of predators that could be preying on seabirds nesting on the island. We set out two motion sensing digital cameras in different areas of Birojima from late April until early October in 2015. We placed one camera in a tree on the south side of the island where Japanese murrelets nest which operated for 180 days. We placed another camera in a boulder field where Japanese murrelets nest on the northern side of the island which operated for 145 days. These two cameras took identifiable photos of jungle crows (*Corvus macrorhynchos*) on 125 days, carrion crows (*Corvus corone*) on 4 days, Japanese wood pigeons (*Columba janthina*) on 101 days, and streaked shearwaters on 140 days. A third camera operated for only one day. The northern camera documented a jungle crow depredating a wood pigeon egg. These results indicate that jungle crows could be important potential predators of Japanese murrelets and streaked shearwaters. We hope to repeat this study with more cameras in 2016 in our continuing effort to understand the conservation threats to Japanese seabirds. (Poster)

## STATUS AND ECOLOGY OF THE MARBLED MURRELET

S. Kim Nelson<sup>1</sup> (kim.nelson@oregonstate.edu) Alan E. Burger<sup>2</sup> Kathy J. Kuletz<sup>3</sup> John F. Piatt<sup>4</sup>

<sup>1</sup>Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR 97331 USA.

<sup>2</sup>Department of Biology, University of Victoria, Victoria, BC V8W 3N5 Canada.

<sup>3</sup>U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 E. Tudor Road, Anchorage, AK 99503 USA.

<sup>4</sup>U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, AK 99508 USA.

Marbled Murrelets (*Brachyramphus marmoratus*) are small, non-migratory diving seabirds that occur along the Pacific coast of North America. They forage for schooling fish or invertebrates in sheltered marine waters, generally within 5 km of shore. These secretive alcids breed primarily in older-aged coastal forests from Alaska to central California and fly long distances inland (up to 80 km) where nests are notoriously difficult to locate because of their cryptic nesting behavior. Murrelet populations have declined over much of their range due primarily to current and historic loss and fragmentation of their forest breeding habitat. Despite being listed as threatened in California, Oregon, and Washington in 1992 and implementation of the Northwest Forest Plan in 1994, populations have continued to decline or stay at low levels in these states. Murrelets are listed as threatened in British Columbia where habitat has been greatly reduced and populations in some regions are declining. In Alaska their recent status is uncertain, but declines may have leveled off in the early 2000s during a period of cooler ocean climate. While issues at sea, such as changes in prey populations and gill net mortality, are likely impacting murrelet populations, population size in southern areas is more closely related to amount of nearby quality nesting habitat than ocean conditions. Maintaining and increasing existing high-quality nesting habitat, and decreasing habitat fragmentation and predation are needed in order to promote recovery of murrelet populations. The effects of climate change, both at sea and in nesting habitat, remain unclear and are potentially serious. (Talk)

## ASSESSING KITTLITZ'S AND MARBLED MURRELET ABUNDANCE IN YAKUTAT BAY, ALASKA AND THE FEASIBILITY OF USING YAKUTAT BAY AS A LONG-TERM MONITORING SITE

Kelly Nesvacil<sup>1</sup> (kelly.nesvacil@alaska.gov) Jonathan S. Barton<sup>1</sup> Grey W. Pendleton<sup>1</sup> Miles O. Spathelf<sup>1</sup>

<sup>1</sup>Alaska Department of Fish and Game, PO Box 115526, Juneau, AK, 99811.

We estimated the abundance of Kittlitz's murrelets (*Brachyramphus brevirostris*) and marbled murrelets (*B. marmoratus*) in Yakutat Bay, and its associated bays and fiords, in June and July 2015. This was a pilot project to aid in determining the feasibility of a long-term monitoring program for *Brachyramphus* murrelets in Yakutat Bay. In 2000 and 2009, *Brachyramphus* murrelet surveys were conducted in Yakutat Bay, which is situated between two other long-term Kittlitz's murrelet monitoring sites. Adding Yakutat Bay as a long-term monitoring site in southeast Alaska could provide additional abundance and trend estimates in another high density murrelet area, as well as additional information on habitats utilized by Kittlitz's and marbled murrelets. We used distance sampling during two surveys in 2015 to determine the at-sea murrelet abundance. We conducted the first survey in mid-June, when the 2000 and 2009 surveys were conducted, with the second survey from 1-15 July, more in line with current survey protocols. Results of the surveys will be presented, including a within-year comparison of the 2015 surveys. Additionally, we evaluate the feasibility of long-term murrelet monitoring in Yakutat Bay and discuss the possibility of surveying twice each summer to retain the option of using 2000 and 2009 abundances estimates in trend analyses. (Talk)



## DISTRIBUTION AND ABUNDANCE OF KITTLITZ'S MURRELETS ON LAKE NERKA AND LAKE ALKENAGIK, ALASKA

Kelly Nesvacil<sup>1</sup> (kelly.nesvacil@alaska.gov) Jonathan S. Barton<sup>1</sup> Grey W. Pendleton<sup>1</sup> Rachel M. Ruden<sup>2</sup>

<sup>1</sup>Alaska Department of Fish and Game, PO Box 115526, Juneau, AK, 99811.

<sup>2</sup>University of Pennsylvania School of Veterinary Medicine, 3800 Spruce Street, Philadelphia, PA 19104.

This project determined the distribution and estimated the abundance of Kittlitz's murrelet (*Brachyramphus brevirostris*) on Lake Aleknagik and Lake Nerka in July 2015. The use of freshwater lakes during the breeding season has been documented for the congener species, marbled murrelet (*B. marmoratus*). Kittlitz's murrelets have been documented using Lakes Aleknagik and Nerka during migration, but documentation of use during the breeding season is new. Togiak National Wildlife Refuge staff surveyed Kittlitz's murrelets on Lake Aleknagik during breeding seasons in 2013 and 2014; this was the first study to use standardized distance sampling on Lake Nerka during the breeding season. In July 2015, we also used distance sampling to survey Lake Aleknagik to document distribution and estimate abundance. We also conducted 3 surveys on Lake Nerka to document distribution, estimate abundance, and estimate detectability for Kittlitz's murrelet. Results of these surveys will be presented as will potential for future research and monitoring opportunities on these lakes. (Poster)

## INTERANNUAL VARIATION IN ABUNDANCE OF ANCIENT MURRELETS IN ISE BAY

Yasuaki Niizuma<sup>1</sup> (niizuma@meijo-u.ac.jp) Takashi Yamamoto<sup>2</sup>

<sup>1</sup>Meijo Univ., Tenpaku-ku, Nagoya, Japan.

<sup>2</sup>Graduate School of Environmental Studies, Nagoya University, Furo-cho, 40 Chikusa-ku, Nagoya, Aichi 464-8601, Japan.

Kuroshio is one of the major currents in the world's oceans. It flows northward along the Pacific coast of Japan. The position of Kuroshio flow varies annually, which may influence biomass and species composition of zooplankton and fish communities in Pacific coastal regions by changes in water characteristics (e.g. temperature and nutrient richness). Previous studies examined the effect of annual changes in the position of Kuroshio on commercial fisheries, but few studies for its effect on abundance of seabirds. Ise Bay is a shallow enclosed bay (average depth of 19.5 m) located between Mie and Aichi Prefectures in central Japan, and joined to the Pacific Ocean by ca. 9 km width channel. We counted and recorded the number and species of seabirds during the course of commercial ferry in Ise Bay once a month for 10 years. Sixteen seabird species have been recorded throughout a year, and Ancient Murrelet (*Synthliboramphus antiquus*) was recorded as the most abundant species in winter season (January-March). The number of murrelets varied between the years, and it appeared to fluctuate in concert with the abundance of Japanese sand lance (*Ammodytes personatus*) in Ise Bay as age-0 sand lance is one of their main diet. We suggest that the abundance of murrelets in Ise Bay may relate to Kuroshio flow patterns, probably generating different habitat suitability for them. (Talk)

## EVALUATION OF NEWLY EMERGING SEABIRD BYCATCH MITIGATION GEARS FOR TUNA LONGLINE IN THE NORTH PACIFIC

Daisuke Ochi<sup>1</sup> (otthii@affrc.go.jp) Nobuhiro Katsumata<sup>1</sup> Kei Okamoto<sup>1</sup> Hiroshi Minami<sup>1</sup>

<sup>1</sup>National Research Institute of Far Seas Fisheries, Fisheries Research Agency, 5-7-1, Orido, Shimizu, Shizuoka 424-8633, Japan.

Incidental mortality of seabirds by fisheries operation (i.e. bycatch) is the major negative impact on the conservation of endangered seabird population. To reduce seabird bycatch in fisheries, development and deployment of bycatch mitigation techniques is one of effective approaches. In the North Pacific, there are interactions between tuna longline vessels and two albatross species, Laysan *Phoebastria immutabilis* and black-footed *P. nigripes* albatrosses. Several bycatch mitigation measures for the albatross species are mandatorily used on tuna longline vessels since 2007 but further improvement for its effectiveness and scientific evaluation are required. We evaluated three seabird bycatch mitigation gears (tori-line and two line weightings (lumo lead and underwater light)) for Laysan and black-footed albatrosses by an experiment in longline vessels in the North Pacific in 2015. Total 15 experimental operations (13500 hooks) carried out with using the mitigation gears by turns every operation and attacking rate to baited hooks and bycatch rate was compared among the gears. Attack rate of two albatrosses was the highest in underwater light and the lowest in tori-line. Bycatch rate of Laysan and black-footed albatrosses was the highest in the lumo leads. Therefore, the result suggest that tori-line are reliable mitigation measures for tuna longline operations in the North Pacific. (Talk)

## CAN WE USE THE GLOBAL POSITIONING SYSTEM TO DETERMINE FLIGHT ALTITUDES OF SEABIRDS? A COMPARATIVE APPROACH

Rachael A. Orben<sup>1</sup> (raorben@gmail.com) Scott A. Shaffer<sup>2</sup> Josh Adams<sup>3</sup> Robert M. Suryan<sup>1</sup>

<sup>1</sup>Department of Fisheries and Wildlife, Hatfield Marine Science Center, Oregon State University, Newport, OR 97365, USA.

<sup>2</sup>Department of Biological Sciences, San Jose State University, One Washington Square, San Jose, CA 95192-0100 USA.

<sup>3</sup>US Geological Survey Western Ecological Research Center, 400 Natural Bridges Dr., Santa Cruz, CA 95060.

The Global Positioning System (GPS) is now widely used to track the two-dimensional movements of seabirds to understand foraging distributions and individual movements. However, to-date, little attention has been paid to the altitude data associated with the two dimensional locations. Seabirds use both the horizontal and vertical space while at-sea. Therefore a better understanding of when and where seabirds gain altitude is needed to describe fundamental aspects of foraging behavior as well as to inform marine spatial planning. A limiting factor in using altitude from GPS data is that manufacturer reported errors are roughly +/- 20 m. Here we discuss the calculation and use of Dilution of Precision values (DOPs) in selecting the most accurate altitude estimates. We use altitude data from rhinoceros auklets (*Cerorhinca monocerata*) and western gulls (*Larus occidentalis*) carrying iGotu GPS dataloggers, black-legged kittiwakes (*Rissa tridactyla*) and thick-billed murrelets (*Uria lomvia*) carrying Technosmart Gypsy-2 & 3 dataloggers and short-tailed albatrosses (*Phoebastria albatrus*) carrying Microwave Telemetry GPS/PTT transmitters to compare between species with different flight morphologies and behavior. Preliminary results indicate GPS derived altitudes can distinguish differences among species, over time, and flight height changes at the land-sea interface. (Talk)

## PICKING AT THE SURFACE: RED-LEGGED KITTIWAKE FORAGING BEHAVIOR IN A YEAR OF POOR LAYING SUCCESS

Rachael A. Orben<sup>1</sup> (raorben@gmail.com) Abram B. Fleishman<sup>2</sup> Rosana Paredes<sup>3</sup> Marc D. Romano<sup>4</sup> Scott A. Shaffer<sup>2</sup> Alexander S. Kitaysky<sup>5</sup>

<sup>1</sup>Department of Fisheries and Wildlife, Hatfield Marine Science Center, Oregon State University, Newport, OR 97365, USA.

<sup>2</sup>Department of Biological Sciences, San Jose State University, One Washington Square, San Jose, CA 95192-0100 USA.

<sup>3</sup>Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, Oregon 97331-3803 USA.

<sup>4</sup>Alaska Maritime National Wildlife Refuge, U.S. Fish and Wildlife Service, 95 Sterling Highway, Suite 1, Homer, AK 99603 USA.

<sup>5</sup>Department of Biology and Wildlife, Institute of Arctic Biology, University of Alaska Fairbanks, Irving 311, Fairbanks, AK 99775.

It is critical to understand how conditions throughout the annual cycle might mediate life history and demographic responses. Individuals spend their time prior to breeding improving/maintaining body condition, defending nests, and pair bonding. For the Bering Sea endemic, the red-legged kittiwake (*Rissa brevirostris*), the majority of nests fail during either pre-lay or incubation, rather than during chick rearing. Here we present the first individual foraging distributions for red-legged kittiwakes during pre-lay and incubation. In May and June of 2015, we used GPS dataloggers to track red-legged kittiwakes prior to laying (n=10, 100% recovery rate) and during incubation (n=36, 92% recovery rate) from their largest colony located on St. George Island in the southeastern Bering Sea. Birds largely foraged in the deep waters of the Bering Sea basin and travelled up to 562 km from the colony. Pre-lay foraging trips were predominately westward, whereas incubation trips were both to the west and south. Of the birds tracked prior to egg lay, 30% laid eggs, compared to the colony wide percentage of 48%. Of the breeding birds tracked during incubation, 21% hatched chicks and all these chicks fledged. Colony-wide, 9% of birds that laid eggs hatched chicks, while productivity was only 1%. Our results provide a baseline for foraging behavior during a year of poor laying and hatching success. The continuation of this study will help to inform the use of reproductive parameters of red-legged kittiwakes as ecosystem indicators of the Bering Sea basin. (Poster)

## CURRENT STATUS OF JAPANESE CRESTED MURRELET

Kuniko Otsuki<sup>1</sup> (boomam@sa2.so-net.ne.jp) Yutaka Nakamura<sup>2</sup>

<sup>1</sup>Marine Bird Restoration Group, 1-18 Ishida, Hokida, Fukushima-shi, Fukushima Prefecture, Japan.

<sup>2</sup>University of Miyazaki, Faculty of Agriculture, Gakuen-Kibanadai-Nishi 1-1, Miyazaki, Miyazaki 889-2192, Japan.

The Japanese Crested Murrelet (*Synthliboramphus wumizusume*) breeds at remote islands in southern Japan and the Republic of Korea. In 1994-1995, 26 colonies were reported, with a total estimated population of about 2,500-3,000 breeding pairs, but no information on numbers was available for Korea. By 2015, 38 colonies (current and historical) have been reported, with a total estimated population of 2,600-4,700 pairs, still one of the rarest alcids in the world. Birojima Island and the Izu Islands remain the two major breeding areas but relatively large numbers are now known at Guguldo Island and nearby islands in Korea. Trends in colony size are poorly known at almost all colonies due to insufficient monitoring, although 2012 surveys at Birojima Island suggested little change in size since 1994. After heavy mortality at Koyashima Island by Norway Rats (*Rattus norvegicus*) in 1987, rats were eradicated and the colony had been slowly recovering. In 2009, a rat reinvasion apparently from nearby Okinoshima Island again impacted murrelets at Koyashima. Numbers at Kohjima Island have increased since 1994. Harvesting of murrelet eggs for human consumption prior to the 1960s has become recognized as a major past impact at several colonies. Chief current threats are rats at certain colonies and high predation by crows (*Corvus* sp.) on murrelet nests at Birojima Island (likely related to attraction of crows to the island by surf fishermen's leftover bait). Detailed monitoring is needed at sample colonies to measure trends in colony size, investigate predator impacts, and develop restoration actions. (Talk)

## THE IMPACTS OF PLASTIC ON WESTERN ALEUTIAN ISLANDS SEABIRDS: DETECTION OF PHTHALATES IN MUSCLE AND REPRODUCTIVE TISSUES

Veronica M. Padula<sup>1</sup> (vmpadula@alaska.edu) Birgit Hagedorn<sup>3</sup> Anna Sabri<sup>3</sup> Douglas Causey<sup>2</sup>

<sup>1</sup>University of Alaska Fairbanks School of Fisheries and Ocean Sciences, 905 N. Koyukuk Drive, 245 O'Neill Building, PO Box 757220 Fairbanks, Alaska 99775-7220.

<sup>2</sup>University of Alaska Anchorage, Department of Biological Sciences, 3211 Providence Drive Anchorage, AK 99508.

<sup>3</sup>University of Alaska Anchorage, Applied Science, Engineering, and Technology Laboratory (ASET) , 3211 Providence Drive Anchorage, AK 99508.

The plastic debris that enters the Pacific Ocean eventually reaches the seabird communities of the Bering Sea. Seabirds and the fish upon which seabirds feed may mistake plastic debris for food items and ingest them. They are consequently exposed to numerous plastic-associated chemical adjuncts, particularly endocrine-disrupting compounds like phthalates. We do not know the full extent of phthalate exposure in seabirds, nor do we know well their consequent effects on seabird health. The objective for this research is to build a foundation of knowledge of phthalate exposure in Bering Sea seabirds that leads to better understanding of their correlative effect on seabird reproduction and survival, population dynamics, and, more broadly, ecosystem health. To date, we have detected DMP (Dimethyl phthalate), DEP (Diethyl phthalate), BBP (Benzyl butyl phthalate), DBP (Dibutyl phthalate), and DEHP (Diethyl hexyl phthalate) in muscle tissues from individuals, representing ten seabird species that breed in the Bering Sea ecosystem, with and without inorganic matter in their stomachs. Crested auklets (*Aethia cristatella*) appear to have higher phthalate concentrations in comparison to the other species examined. Furthermore, there appears to be geographic variation in phthalate exposure among crested auklets from Segula, Amchitka, and Kanaga Islands. Additionally, we detected phthalates within reproductive tissues (enlarged ovarian follicles) from 11 female seabirds, indicating that these compounds are metabolically active and labile within the adult bird. This raises the question of whether or not exposure to endocrine-disrupting compounds such as phthalates impacts chick development and long-term health. (Talk)

## WESTERN GULL-BILLED TERN (*GELOCHELIDON NILOTICA VANROSSEMI*) COLONY DYNAMICS AND RESILIENCE IN SAN DIEGO BAY, CALIFORNIA

Robert T. Patton<sup>1</sup> (rpatton@san.rr.com) Katharine Goodenough<sup>2</sup>

<sup>1</sup>Avian Research Associates, 830 Orange Ave., Coronado, CA 92118.

<sup>2</sup>Oklahoma Biological Survey, University of Oklahoma, 111 E Constitution St., OK 73019.

The Western Gull-billed Tern (*Gelochelidon nilotica vanrossemi*) was first documented breeding in South San Diego Bay in 1987 and the colony increased to 30 nests by 1991. The site gained increased protection as a National Wildlife Refuge beginning in 1999. With increased monitoring of colony activity and initiation of a predator management program, the colony increased from 11-20 breeding pairs in 1999 to 65 pairs in 2013. However, by the end of the 2013 breeding season, the colony was depleted to 12 adults and one surviving fledgling. This mass mortality was attributed to acanthocephaliasis contracted through mole crabs (*Emerita analoga*), a primary prey item in the Gull-billed Terns' diet in San Diego. In the two seasons following the mortality, the colony has recovered to at least 23 breeding pairs. We report on colony dynamics, including age composition and mark-recapture results, seasonal nesting phenology, mortality, fledging success, diet and predation of chicks of the federally endangered California Least Tern (*Sternula antillarum browni*); on factors influencing reproductive success, including predation and competition for space from other colonially nesting species; and on the role of juvenile recruitment in the colony's recovery. (Talk)



## PERSISTENT ORGANIC POLLUTANT AND MERCURY CONCENTRATIONS IN EGGS OF GROUND-NESTING MARINE BIRDS IN THE CANADIAN HIGH ARCTIC

Liam E. Peck<sup>1</sup> (liamedpeck@gmail.com) H. Grant Gilchrist<sup>2</sup> Conor D. Mallory<sup>3</sup> Birgit M. Braune<sup>2</sup> Mark L. Mallory<sup>1</sup>

<sup>1</sup>Acadia University, 33 Westwood Ave, Wolfville NS, Canada, B4P2R6.

<sup>2</sup>Environment Canada, National Wildlife Research Centre at Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, Canada, K1A0H3.

<sup>3</sup>Department of Environment, Government of Nunavut, 1104A Inuksugait Plaza, Iqaluit, Nunavut, Canada, X0A0H0.

We collected eggs of eight marine bird species from several colony sites in the Canadian high Arctic located at approximately 76N and analyzed them for concentrations of legacy persistent organic pollutants (POPs) and mercury. We provide the first report on concentrations of POPs in eggs of three Arctic species (Thayer's gull *Larus thayeri*, Sabine's gull *Xema sabini*, Ross's Gull *Rhodostethia rosea*), and we found significant differences in each of the POP profiles among the five species with sufficient data for statistical comparisons (Thayer's gull, black guillemot *Cepphus grylle*, Sabine's gull, Arctic tern *Sterna paradisaea* and common eider *Somateria mollissima borealis*). The Ross's Gull had unexpectedly high POP concentrations relative to the other species examined, although this was based on a single egg, while glaucous gull *L. hyperboreus* eggs from our sampling location had very low POPs. Sabine's gulls had the lowest Hg of the eggs studied, consistent with their low trophic position, but concentrations of their legacy POPs were higher than expected. We also noted that total hexachlorocyclohexanes were higher than reported elsewhere in the circumpolar Arctic in three species. (Poster)

## FORAGING HABITAT USE AND NICHE PARTITIONING IN TWO SYMPATRIC CORMORANT SPECIES NESTING IN THE COLUMBIA RIVER ESTUARY, OREGON

Adam G. Peck-Richardson<sup>1</sup> (PeckRichardson@gmail.com) Donald E. Lyons<sup>1</sup> Daniel A. Cushing<sup>1</sup>  
James A. Lerczak<sup>2</sup> Daniel D. Roby<sup>3</sup>

<sup>1</sup>Oregon Cooperative Fish & Wildlife Research Unit, Department of Fisheries and Wildlife, 104 Nash Hall, Oregon State University, Corvallis, OR 97331-3803 USA.

<sup>2</sup>College of Earth, Ocean, and Atmospheric Sciences, 104 CEOAS Administration Building, Oregon State University, Corvallis, OR 97331-5503 USA.

<sup>3</sup>U.S. Geological Survey Oregon Cooperative Fish & Wildlife Research Unit, Department of Fisheries and Wildlife, 104 Nash Hall, Oregon State University, Corvallis, OR 97331-3803 USA.

Double-crested Cormorants (*Phalacrocorax auritus*) and Brandt's Cormorants (*P. penicillatus*) nest sympatrically in a large mixed-species colony on East Sand Island (ESI), in the Columbia River estuary. Ecological theory predicts that such morphologically similar species will partition prey resources through either dietary or spatial segregation, when faced with resource limitations. During the summer of 2014, we investigated local movements, foraging dive behavior, and habitat selection for both species using GPS tags with integrated temperature and depth data-loggers (GPS-TDlog, Earth & Ocean Tech. GmbH). Double-crested Cormorant foraging area and core foraging area (defined as the 95% and 50% kernel density estimates of dive locations, respectively) were larger and covered a broader range of marine and estuarine habitats than those of Brandt's Cormorants. Most of the foraging area and core foraging area of Brandt's Cormorants (59% and 89%, respectively) overlapped with those of Double-crested Cormorants. Conversely, only 26% and 27% of Double-crested Cormorant foraging area and core foraging area overlapped with those of Brandt's Cormorants. Within areas of overlap, Brandt's Cormorants tended to dive deeper (median = 6.48 m, max = 24.7 m) than Double-crested Cormorants (median = 2.67 m, max = 20.6 m) and dives often reached colder, more marine water. After accounting for local water depth, Brandt's Cormorants more often utilized a deeper, more benthic portion of the water column. Preliminary results suggest that these two cormorant species reduce interspecific competition by foraging across different geographic extents, selecting different habitat types, and utilizing different portions of the water column. (Talk)

# SEABIRDS AND HUMAN INFRASTRUCTURE LIGHTING CONFLICT - A REVIEW OF CURRENT KNOWLEDGE AND REQUEST TO DEVELOP AND IMPLEMENT MITIGATING TECHNOLOGIES

Jay Penniman<sup>1</sup> (jayfp@hawaii.edu) Hannah Nevins<sup>2</sup> Christine Sheppard<sup>2</sup>

<sup>1</sup>Maui Nui Seabird Recovery Project, Pacific Cooperative Studies Unit, University of Hawaii, P.O. Box 903, Makawao, HI 96768.

<sup>2</sup>American Bird Conservancy, 4249 Loudoun Ave., The Plains, VA 20198.

Light pollution is a global problem for nocturnally active seabirds. Fledglings are most susceptible on first departure from colonies, but adults transiting from sea to colonies during the nesting season, can also be distracted by street lights and lighted buildings, become disoriented and collide with utility and guy wires and structures. Once grounded, both adults and chicks can become victim to car strikes and predators. In Hawaii, the endangered Hawaiian Petrel (*Pterodroma sandwichensis*), threatened Newell's Shearwater (*Puffinus newelli*) and Band-rumped Storm-petrel (*Oceanodroma castro*), are all affected every year. In Hawaii, the issue of urban light pollution and wildlife is at a crucial point. Community members on Kaua'i are enraged by FWS 2010 decision to ban night high school football games to reduce bird groundings. Bird conservationists are concerned that not enough is being done, fast enough, to reduce impacts to these critically endangered species. For both biological and community reasons, it is essential to find and implement practical solutions to mitigate impacts of light pollution on seabirds. Fortunately, mitigating light pollution is possible by modifying light fixture direction, providing effective shielding, changing lightbulb type and controlling spectrum of irradiance. However, to date, there have been few definitive studies of what lighting characteristics will minimize seabird distraction. We present a review of relevant literature and technological developments with a goal of engaging the seabird community in developing and testing appropriate seabird friendly lighting solutions. (Talk)

## STATUS OF OFFSHORE RENEWABLE ENERGY DEVELOPMENT IN THE UNITED STATES AND NEEDS FOR COLLECTING AND ANALYZING AT-SEA AND COASTAL AVIAN DATA TO ASSESS POTENTIAL EFFECTS

David M. Pereksta<sup>1</sup> (david.pereksta@boem.gov)

<sup>1</sup>Bureau of Ocean Energy Management, 760 Paseo Camarillo, Suite 102, Camarillo, CA 93010.

At the time of the last PSG meeting on Oahu, there was one issued lease for an offshore wind energy project off the coast of the United States. Since then, additional leases have been issued on the Federal outer continental shelf, lease sales have been held in the Atlantic, and other projects are currently under development. In the Pacific, wind energy proposals include a demonstration project off Oregon, three commercial-scale projects off Hawaii, and a commercial-scale project off of Morro Bay, California. The increase in renewable energy development proposed off the coasts of the United States has led to a rush for data needs on potentially affected resources, particularly those related to avian species. The potential effects to avian species are complex and varied including collision, displacement, barrier effects, and attraction. With broad-scale assessments of suitable areas for wind, wave, and tidal energy production offshore, the challenge has been to collect and compile information quickly and at as large a scale as possible. Assessing what we know, what we can predict, and how can we assess risk has led to the development of a variety of studies including baseline data assessments, at-sea surveys, predictive modeling of seabird distribution and abundance, vulnerability and risk assessments, and technology testing for efficient ways to inventory birds on the OCS. These are being applied in both the Atlantic and Pacific, including the Main Hawaiian Islands, to provide for assessments of potential effects and data needs early in the planning process at regional and local scales with the goal of designing and implementing projects that will minimize effects to avian species to the greatest extent practicable. (Talk)

## A SUMMARY OF ALBATROSS BAND RECOVERY DATA IN THE HAWAII DEEP AND SHALLOW SET LONGLINE FISHERIES

John L. Peschon<sup>1</sup> (John.Peschon@noaa.gov)

<sup>1</sup>NOAA IRC, National Marine Fisheries Service, Pacific Islands Regional Office Observer Program, 1845 Wasp Blvd., Honolulu, HI 96818.

This project is a summary of Hawaii Longline Fisheries observer program seabird band recovery data that has been accrued during the January 01, 2002 through December 31, 2014 period. The National Marine Fisheries Service Pacific Island Regional Office Fisheries Observer Program has been deploying observers on board Hawaii-permitted longline fishing vessels, as part of a mandatory requirement, since February of 1994. Seabirds, most commonly the Black-footed and Laysan Albatross species, are known to occasionally interact with the observed longline fisheries. As a part of their regular responsibilities, observers deployed on longline fishing vessels record seabird sightings, document any observed fisheries interactions, assist with handling hooked or entangled seabirds, salvage dead seabirds, and report on compliance with all existing fisheries-related regulations (many of which are aimed at mitigating seabird interactions). Observers also opportunistically record seabird band recovery data. All banding-related data, is maintained in an 'in-house' database, and is also submitted to the United States Geological Survey, Patuxent Bird Banding Laboratory (BBL) where it is joined with existing banding data provided by the United States Fish and Wildlife Service, and others, into a centralized bird banding laboratory database. The results presented here represent a cooperative effort between the NMFS, USFWS, USGS, as well as other governmental and non-governmental agencies. (Poster)

## A SUMMARY OF SEABIRD INTERACTIONS IN THE HAWAII DEEP AND SHALLOW SET LONGLINE FISHERIES IN 2014

John L. Peschon<sup>1</sup> (John.Peschon@noaa.gov)

<sup>1</sup>NOAA IRC, National Marine Fisheries Service, Pacific Islands Regional Office Observer Program, 1845 Wasp Blvd., Honolulu, HI 96818.

The National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) observer program has been monitoring the catch of the Hawaii pelagic longline fisheries under mandate since 1994. During this time NMFS observers have documented seabird interactions (hookings or entanglements) with the following species: Black-footed Albatross (*Phoebastria nigripes*), Laysan Albatross (*Phoebastria immutabilis*), Sooty Shearwaters (*Puffinus griseus*), Unidentified Shearwater species (*Puffinus* spp.), Brown Boobies (*Sula leucogaster*), Red-footed Boobies (*Sula sula*), and Northern Fulmars (*Fulmarus glacialis*). The deep set fishery has been monitored under mandatory 20% observer coverage since 2000, and the shallow set fishery has been monitored at 100% coverage since 2004. Seabird-specific mitigation measures implemented after 2004 significantly reduced interaction rates from 2,433 in 2000 to 123 in 2014. Total seabird interactions decreased from 171 in 2013 to 123 in 2014. For the deep set fishery, the number of interactions decreased from 104 to 51, despite an increase in overall fishing effort. The shallow set fishery had decreased effort and a slight decrease in the number of interactions from 75 to 72. In the deep set fishery, most (88%) of the seabirds were caught dead. In the shallow set fishery, most (78%) seabirds were caught and released alive in 2014. (Talk)

## SEABIRD RESPONSE TO INTERANNUAL VARIATION IN OCEANOGRAPHIC PROPERTIES AND PREY IN THE NORTHERN BERING AND CHUKCHI SEAS

A. Catherine Pham<sup>1</sup> (apham4@my.hpu.edu) K. David Hyrenbach<sup>1</sup> Kathy J. Kuletz<sup>2</sup> Ed V. Farley<sup>3</sup> Lisa B. Eisner<sup>3</sup> Alexei I. Pinchuk<sup>4</sup>

<sup>1</sup>Hawai'i Pacific University, 41-202 Kalaniana'ole Hwy., Waimanalo, Hawai'i 96795.

<sup>2</sup>U.S. Fish & Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.

<sup>3</sup>NOAA Alaska Fisheries Science Center, Auke Bay Laboratories, AFSC/NMFS/NOAA/DOC, Ted Stevens Marine Research Institute, 17109 Pt. Lena Loop Road, Juneau, AK 99801.

<sup>4</sup>University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, 17101 Point Lena Loop Rd Fisheries Division, Juneau, AK 99801.

The ongoing loss of sea ice in the Pacific Arctic is predicted to lead to environmental changes in the region. Managers need a baseline understanding of the ecosystem to assess potential impacts of such changes. The Arctic Ecosystem Integrated Survey (Arctic Eis) project surveyed the northern Bering and Chukchi seas in late summer of 2012 - 2013. We conducted seabird surveys aboard the Arctic Eis cruises, totaling 6,500 km of effort, in conjunction with research on oceanographic properties, plankton, and fish. Interannual differences in winter sea ice cover and timing of the spring ice retreat likely affected ecosystem structure. In 2012, the study area was characterized by cooler and saltier water, higher nutrient and chlorophyll-a concentrations, higher zooplankton biomass, and lower forage fish biomass compared to 2013. Seabird communities seemed to shift as well: in 2012, auklets were more northerly and abundant, while shearwaters were more offshore and less abundant compared to 2013. We examined prey and oceanographic factors that influenced seabird community structure between years. We defined seabird communities and their associations with habitat factors and prey using a nonmetric multidimensional ordination. The ordination identified two habitats that were most strongly correlated with latitude, longitude, depth, salinity, and chlorophyll-a. A multi-response permutation procedure revealed significant differences in seabird community structure between years and geographic regions. These results suggest that Pacific Arctic pelagic seabird communities are structured by ecotones that may shift location interannually, with oceanographic properties being stronger predictors of seabird distribution than prey abundance. (Talk)

## RECENT STATUS OF KITTLITZ'S MURRELET IN ALASKA

John F. Piatt<sup>1</sup> (jpiatt@usgs.gov) Kathy J. Kuletz<sup>2</sup> Mayumi L. Arimitsu<sup>1</sup> Sarah K. Schoen<sup>1</sup>  
Robin M. Corcoran<sup>3</sup> Timothy W. Knudson<sup>4</sup>

<sup>1</sup>USGS Alaska Science Center, 4210 University Drive, Anchorage, AK 99508.

<sup>2</sup>U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage AK 99503.

<sup>3</sup>Kodiak National Wildlife Refuge, 1390 Buskin River Rd., Kodiak, AK 99615.

<sup>4</sup>Department of Zoology and Center for Ecology, Southern Illinois University, 1125 Lincoln Drive, MC 6501, Carbondale, IL.

Kittlitz's Murrelet, a small seabird in the auk family, evolved in Beringia during the early Pleistocene and thrives in icy-cold environments. Present-day breeding populations are associated with glaciated coastal areas of the Gulf of Alaska (GOA) and Bering Sea. Recent satellite tagging and isotopic diet studies suggest that after breeding, murrelets from the GOA migrate up to 3500 km into the Bering and Chukchi seas in search of fatty forage fish. Many murrelets then overwinter in polynyas or along the sea-ice edge of the Bering Sea. Compared to other alcids, murrelets have a limited capacity to buffer against environmental changes. How have they fared during recent marine climate cycles? As water temperatures entered a warm phase in the GOA and Bering Sea after the 1976 regime shift, murrelet populations declined markedly until the mid- 2000s. These declines coincided with large-scale changes in biogeography and abundance of forage species in the GOA and Bering Sea. As conditions returned to a cold phase in the SE Bering Sea and GOA after 2008, murrelet populations started increasing again for the first time in 30 years. Similarly, breeding success of murrelets on Kodiak Island steadily improved in the late 2000s and reached a peak in 2013. It appears that murrelet populations are sensitive to marine climate change, and fare better under cold than warm regimes. The impact of unusually warm ocean temperatures ("the blob") in 2014 and 2015 are still being evaluated. (Talk)



## NOVEL PREY IN SEABIRD DIETS: INDICATORS OF CLIMATE REGIME SHIFTS

Alexa R. Piggott<sup>1</sup> (alex.piggott1@oregonstate.edu) Donald E. Lyons<sup>1</sup> Matthew J. Lawonn<sup>2</sup>  
Kirsten S. Bixler<sup>1</sup> Mark J. Hipfner<sup>3</sup> Daniel D. Roby<sup>4</sup>

<sup>1</sup>Oregon State University, Oregon Cooperative Fish & Wildlife Research Unit, Department of Fisheries and Wildlife, 104 Nash Hall, Corvallis, OR 97331.

<sup>2</sup>Oregon Department of Fish and Wildlife, 4907 Third Street, Tillamook, OR 97141-2944 USA.

<sup>3</sup>Environment Canada, Pacific Wildlife Research Centre, RR#1 5421 Robertson Road, Delta, BC, Canada, V4K 3N2.

<sup>4</sup>U.S. Geological Survey, Oregon Cooperative Fish & Wildlife Research Unit, Department of Fisheries and Wildlife, 104 Nash Hall, Oregon State University, Corvallis, OR 97331.

Seabirds are increasingly recognized as indicators of the state of marine ecosystems. Diets of generalist piscivorous seabirds can provide information on forage fish community composition and ocean climate conditions. In late 2013, the California Current System (CCS) underwent a major phase change towards warmer waters, lower productivity, and an incipient El Niño. Historically, such large scale ocean changes affected fish abundance, species composition, and food web dynamics, and resulted in numerous reports of novel species outside their typical ranges. The pelagic forage fish community in the northern CCS, though diverse, is largely dominated by a few species. Changes in distribution and abundance of these dominant taxa often lags behind larger scale climate anomalies, but increased occurrence of novel species may act as early indicators of climate change. With a focus on novel species, we investigated the diet of 2 generalist predators associated with inshore/estuarine habitats within the northern CCS ( $> 45^{\circ}\text{N}$ ), Caspian Terns (*Hydroprogne caspia*) and Double-crested Cormorants (*Phalacrocorax auritus*), during the 2012-2015 breeding seasons. We also reviewed published literature and scientific forums for reports on novel fish throughout the CCS. Caspian Terns consumed a greater diversity of prey types after the phase shift. In 2015, Pacific pompano (*Peprilus simillimus*), a common central CCS species, formed a notable part of tern diets. Fish species common to the northern CCS, but rarely observed in inshore waters, were also present in tern and cormorant diets during warmer conditions, including sablefish (*Anoplopoma fimbria*), Pacific jack mackerel (*Trachurus symmetricus*), and Pacific eulachon (*Thaleichthys pacificus*). (Poster)

## APPLICATION OF A SYSTEMATIC EVIDENCE REVIEW PROCESS FOR MARBLED MURRELETS

Jonathan H. Plissner<sup>1</sup> (Jonathan.Plissner@tetratech.com) Brian A. Cooper<sup>1</sup> Peter M. Sanzenbacher<sup>1</sup>  
Robert H. Day<sup>2</sup>

<sup>1</sup>ABR, Inc., P.O. Box 249, Forest Grove, OR 97116.

<sup>2</sup>ABR, Inc., P.O. Box 80410, Fairbanks, AK 99708.

The Oregon Department of Forestry sponsored a review of studies that address questions pertaining to several elements of the Marbled Murrelet Inland Survey Protocol and other aspects of marbled murrelet (*Brachyramphus marmoratus*) ecology that can help inform forest management practices. The review was conducted following a protocol based on guidelines for a Systematic Evidence Review (SER), which provides a structured, transparent, and objective approach to identifying and synthesizing results of pertinent studies. The nature of marbled murrelet studies posed challenges to the application of typical SER procedures and illustrated important considerations for use in ecological studies; however, the results also identified important data gaps in understanding the significance of murrelet behaviors at inland sites and the associations between habitat area and structure and use by nesting murrelets, gaps that may be addressed through re-analysis of existing data and/or novel focused studies. (Talk)

## MERCURY AS A PROXY FOR GENETICS ANALYSIS IN ALBATROSS (PHOEBASTRIA SPP.) EGGS FROM MIDWAY ATOLL

Stacy S. Vander Pol<sup>1</sup> (stacy.vanderpol@nist.gov) Colleen E. Bryan<sup>1</sup> Rebecca Greenberg<sup>2</sup>  
Yung Wa Sin<sup>2</sup> Scott V. Edwards<sup>2</sup>

<sup>1</sup>National Institute of Standards and Technology, Chemical Sciences Division, Hollings Marine Laboratory, 331 Fort Johnson Rd., Charleston, SC 29412.

<sup>2</sup>Department of Organismic and Evolutionary Biology and Museum of Comparative Zoology, Harvard University, 26 Oxford Street, MCZ Labs Room 306, Cambridge, MA 02138.

Laysan albatross (*Phoebastria immutabilis*; LAAL) and black-footed albatross (*P. nigripes*; BFAL) are sympatric breeders at Midway Atoll. Abandoned eggs were collected between 2011 and 2013 for the Marine Environmental Specimen Bank (ESB) located in Charleston, SC by USFWS staff and volunteers. The eggs are indistinguishable and while the collectors generally had an idea of which species laid the eggs, several were listed as unidentified species. Total mercury analysis was conducted on an aliquot of the homogenized egg contents and showed much higher levels in BFAL ([0.639-2.965]  $\mu\text{g/g}$ ) eggs compared to LAAL ([0.127-511]  $\mu\text{g/g}$ ), but there were some exceptions, raising questions as to whether or not the species were properly identified in the field. Genetic analysis was performed on half the eggshell with membrane attached to determine species of each egg banked. A total of 50 eggs had the species determined and confirmed what was suspected based on the mercury analysis. An additional seven eggs could not be determined due to no DNA was recovered from the eggshell samples. Future processing protocols were revised to ensure better quality samples for future DNA analysis. (Talk)

## RESOURCE PARTITIONING AMONG FOUR SYMPATRICALLY-NESTING AUKS IN A CHANGING SUB-ARCTIC ECOSYSTEM

Isabeau Pratte<sup>1</sup> (isabeau.pratte@hotmail.com) Mark L. Mallory<sup>1</sup>

<sup>1</sup>Acadia University, 15 University Drive, Wolfville, Nova Scotia.

Atlantic puffin (*Fratercula arctica*), razorbill (*Alca torda*), common murre (*Uria aalge*) and thick-billed-murre (*Uria lomvia*) all piscivorous pursuit divers share breeding space on the Labrador coast, Canada. In this region, the capelin (*Mallotus villosus*) is a major food resource for the seabirds but had suffered several shifts and declines during the past decades. Previous studies had shown that the breeding parameters of the birds were not affected by these prey availability changes. However, predator species could likely be forced to change their foraging behaviour when low abundance of their optimal prey occurs. Such behavioral changes could push on other species optimal prey item niche, what might enhance competition among sympatric seabirds. Thus, we looked at two dimensions of the foraging niche (i.e., horizontal foraging distribution and diet) to compare the degree of interaction between the four species mentioned. Some species did overlap in their focal foraging distribution (4-62%) but were segregated in their diet. Overall, differences in either the horizontal foraging distribution or the prey items selected were observed. Despite changes in capelin stocks, this apparent segregation could explain the co-existence of the four closely related species in this changing environment. We provide novel and important insights into sympatric seabirds interactions and characterize the foraging distribution of these four species together during a breeding season at an important monitoring seabird colony for the Canadian Arctic. (Talk)

## STATUS AND INFORMATION NEEDS OF THE ALEUTIAN TERN

Sanjay Pyare<sup>1</sup> (spyare@uas.alaska.edu)

<sup>1</sup>University of Alaska Southeast, 11120 Glacier Highway, Juneau, AK 99801.

The purposes of this presentation are to review information about the distribution, ecology, and abundance of the Aleutian Tern (*Onychoprion aleuticus*; ALTE), frame future research priorities, and help coordinate efforts at a prospective ALTE working-group meeting at the Feb 2016 PSG conference. The  $\approx 5,500$  birds nesting in Alaska (of 31,000 globally) appear to have declined from historical levels at a rate of 8.1% annually since 1960; punctuated by the decline or local extinction of 73% of large ( $>200$  individuals) colonies. The certainty of ALTE status is clouded by low-quality abundance data, limited survey effort along the  $\approx 6500$ -mi Alaska coastline, and enigmatic aspects of ALTE biology. Shifts in breeding locations, the lack of re-sighting of several hundred banded individuals at a breeding site, and over a decade of observations suggest ALTE do not have strong breeding-site fidelity and that colony structure may be loose even when colony numbers are relatively stable inter-annually. From tracking data, Alaska-based ALTE exhibit a previously undocumented 32,000-36,000 km migration route to wintering range to Southeast Asia and as far as offshore Papua New Guinea. While there are many unknowns about ALTE demographics, the most immediate information needs are: within and between-year variability in colony occupancy and size over a 3-5 yr period, systematic estimation of survey bias in “unsurveyed” portions of Alaska’s coastline, and longitudinal studies of nest productivity. In addition, we suggest evaluation of these potential stressors: prevalence of egg harvesting, contaminants like marine-based plastics, shifts in marine prey-base, and possible conflicts causing overwinter mortality. (Talk)

## MAKING THE RIGHT CHOICES - SEARCHING FOR HAWAIIAN PETREL CHICKS FOR A TRANSLOCATION PROJECT ON KAUA'I

Andre F. Raine<sup>1</sup> (araine6@hawaii.edu) Mike McFarlin<sup>1</sup> Megan Vynne<sup>1</sup> Brooke McFarland<sup>2</sup>  
Lindsay C. Young<sup>3</sup> Eric A. VanderWerf<sup>3</sup>

<sup>1</sup>Kauai Endangered Seabird Recovery Project, PO Box 81, Hanapepe 96716, Kauai.

<sup>2</sup>Division of Forestry & Wildlife, 4272B Rice Street, Lihue, HI, 96766.

<sup>3</sup>Pacific Rim Conservation, PO Box 61827, Honolulu, HI, 96839.

<sup>4</sup>Seabird Habitat Conservation Plan, 4272B Rice Street, Lihue, HI, 96766.

<sup>5</sup>American Bird Conservancy, P. O. Box 249, The Plains, VA 20198.

In November 2015, the first translocation of Hawaiian Petrels (*Pterodroma sandwichensis*) was undertaken on Kaua'i. The day of the translocation was the end result of four years of intensive effort to locate appropriate source colonies of these endangered seabirds. The species breeds in remote and inaccessible locations on the island of Kaua'i, typically in areas of dense native forest, making locating colonies challenging. Eleven different montane sites were initially considered for translocation purposes for both Hawaiian Petrel and Newell's Shearwater (*Puffinus newelli*), and surveys were undertaken over three years to assess breeding density and translocation feasibility. All sites were ranked using multiple criteria and three selected as the best source colonies for the initial translocation. In 2015, all known burrows at these sites were monitored throughout the breeding season. A sub-set of these were designated as potential burrows for donor birds, being shallow enough that the chicks were accessible without having to modify the burrows. Burrows were monitored using remote camera and checked monthly by fieldworkers. On the day of translocation, two teams were deployed by helicopter to the colonies. The cameras on all potential burrows were checked to see if the chicks had emerged. If they had not, they were carefully removed from their burrows, placed in carrier boxes, and flown to the predator-proof enclosure at Kilauea Point National Wildlife Refuge. This work will continue in 2016 with a second cohort of Hawaiian Petrels. Newell's Shearwaters are planned to be added to the translocation effort - another first for Kaua'i. (Talk)

## WAKE ATOLL RESTORATION- A DECADE AFTER CAT ERADICATION

Mark J. Rauzon<sup>1</sup> (mrauzon@peralta.edu) John R. Gilardi<sup>2</sup>

<sup>1</sup>Laney College, Geography Dept. 900 Fallon St. Oakland, CA 94702.

<sup>2</sup>Marine Endeavours, 77 Stuart St. Davis CA. 95607.

While invasive mammal eradication is an increasingly common conservation tool, and has been attempted on >1100 islands, ecological benefits are likely under reported because of sporadic and limited monitoring. We have been able to visit Wake about 10 times to monitor the subsequent changes and recovery of seabird species. Introduced feral cats were formerly common at Wake Atoll but they were largely controlled and eventually eradicated in 2007. Over a decade has passed since feral cat impacts on birds ceased, and in this period, the most conspicuous changes have occurred in the Pelecaniformes family. Masked and Brown Boobies have increased several fold on Wilkes Islet; Red-tailed Tropicbirds experienced a significant increases on Wake Island, and Great Frigatebirds have resumed nesting after a long hiatus. In 2015, a record number of Laysan Albatross were counted (7), and 2 eggs were laid. Brown Noddies are nesting on the ground now; Gray-backed Terns have returned and nest in areas that threaten air traffic patterns and rodents have greatly expanded. In 2012, a rat eradication effort occurred that was unsuccessful on two of the three islands. Sooty Terns have been affected by rat predation on Wilkes, causing some significant impacts on the colony. Wedge-tailed shearwaters might be affected by rat predation but other species do not appear to be significantly affected. (Talk)

## KAUA'I SEABIRD HABITAT CONSERVATION PROGRAM: LIGHTS, CONSERVATION, ACTION!

Yuki Reiss<sup>1</sup> (kyreiss@hawaii.edu) Paul Belson<sup>1</sup> Jessica H. Behnke<sup>1</sup> Afsheen Siddiqi<sup>1</sup>

<sup>1</sup>DOFAW, 4272B Rice St, Lihue, HI, 96766.

Every fall, on the island of Kaua'i, hundreds of fledgling 'A'o, or Newell's shearwaters (*Puffinus newelli*), are attracted to artificial lights during their maiden voyage from their mountain burrows to the sea. These young birds will circle the lights until they become exhausted, land on the ground, and often cannot regain flight, frequently rendering them victims of vehicle collisions, predation and starvation. Under the U.S. Endangered Species Act (ESA) and Hawai'i State Law, such "incidental take" of threatened and endangered seabirds requires businesses to seek a permit through the creation of a Habitat Conservation Plan (HCP). An HCP outlines minimization and mitigation actions that will occur. The Kaua'i Seabird Habitat Conservation Program (KSHCP) is a unique program to facilitate the permitting of incidental take for multiple businesses island-wide whose lights are impacting threatened and endangered seabirds. The goal of this approach is to maximize the conservation benefit of mitigation, funding such actions as predator-proof fence enclosures, predator control, social attraction, and outreach to the community. This presentation will provide an update of the specifics of the actions proposed to take place. The KSHCP includes three ESA listed seabird species in Hawai'i: Newell's shearwater (*Puffinus newelli*), Hawaiian petrel (*Pterodroma sandwichensis*), and Band-rumped storm petrel (*Oceanodroma castro*). (Talk)



## ARE ALASKA'S SEABIRDS BUCKING GLOBAL TRENDS? POPULATION TRENDS OF ALASKAN SEABIRDS, 1970-2015

Heather Renner<sup>1</sup> (heather\_renner@fws.gov) Stephani Zador<sup>2</sup>

<sup>1</sup>Alaska Maritime NWR, 95 Sterling Highway, Suite 1, Homer AK 99603.

<sup>2</sup>NOAA Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle WA 98115.

A 2015 paper by Paleczny et al. in PLOS ONE suggested that the monitored portion of the global seabird population declined nearly 70% between 1950 and 2010. This analysis generated considerable press and public interest in the decline and possible factors influencing the decline, including changes in monitoring effort. This led us to ask which parts of this may be true for Alaskan seabirds. We compiled available population trend data (1970 to 2015) from 17 seabird species at 33 Alaskan colonies. Data types vary, from full colony censuses to counts of adults or nests on index plots (cliff and surface nesters), to counts of occupied burrows (burrow nesters), to birds socializing near to nesting colonies (crevice nesters). We adjusted each count of index plots for estimated colony size and applied multivariate autoregressive state-space (MARSS) modeling to estimate individual and overall population trends. As the MARSS models allows us to identify populations with similar trends, we discuss how different data types, contrasting bird natural history, and environmental exposure may come together to influence overall trends. As found in the Paleczny analysis of worldwide data, cormorants and terns appear to have large declines statewide but in Alaska those have the least monitoring data. (Talk)

## LONG-TERM CHANGES IN AT-SEA SEABIRD COMMUNITY AND DENSITIES IN THE SOUTH-EASTERN BERING SEA

Martin Renner<sup>1</sup> (mrenner@gmx.com) Sigrid A. Salo<sup>2</sup> Kathy J. Kuletz<sup>3</sup> Carol Ladd<sup>2</sup> Jarrod A. Santora<sup>4</sup> Lisa B. Eisner<sup>5</sup> George L. Hunt, Jr.<sup>6</sup>

<sup>1</sup>Tern Again Consulting, 811 Ocean Drive Loop, Homer, AK 99603, USA.

<sup>2</sup>NOAA Pacific Marine Environmental Laboratory, 7600 Sand Point Way NE, Seattle, WA 98144, USA.

<sup>3</sup>Migratory Bird Management, USFWS, 1011 E. Tudor Rd. Anchorage AK 99503, USA.

<sup>4</sup>Dept. Applied Mathematics and Statistics, Center for Stock Assessment Research, UCSC, University of California Santa Cruz 110 Shaffer Road Santa Cruz CA 95060, USA.

<sup>5</sup>TSMRI/Auke Bay Laboratories/NOAA, 17109 Pt. Lena Loop Rd. Juneau AK 99801, USA.

<sup>6</sup>SAFS, University of Washington, Box 355020 Seattle WA 98195-5020, USA.

We use data on seabird densities from the North Pacific Pelagic Seabird Database (NPPSD, compiled by the USGS) to analyze changes in the seabird community of the Southeastern Bering Sea over 40 years. We averaged densities over evenly spaced slices along a bathymetry gradient to standardize uneven survey effort. While some seabird species experienced modest increases over this time frame, many species saw substantial declines, especially short-tailed shearwater (*Puffinus tenuirostris*), northern fulmar (*Fulmarus glacialis*) and fork-tailed storm-petrel (*Oceanodroma furcata*). Increases were seen especially in short-tailed albatross (*Phoebastria albatrus*), rhinoceros auklet (*Cerorhinca monocerata*) and Cassin's auklet (*Ptychoramphus aleuticus*). During these 40 years, this region transitioned twice from a series of years with late ice retreat to a series of years with early ice retreat: 1977/78 (coinciding with the regime-shift of the Pacific Decadal Oscillation and Gulf of Alaska ecosystem) and again in 2013/14. During these transitions the at-sea densities of 24 of 31 species declined within the study area, 11 of them by over 50%. Canonical correspondence analysis shows that over the last 40 years, fluctuations in the timing of ice retreat were more than twice as important as long-term trends for the seabird community structure. (Talk)

## CONSERVATION NETWORKS OF ARTIFICIAL ISLANDS FOR BREEDING CASPIAN TERNS

Daniel D. Roby<sup>1</sup> (daniel.robby@oregonstate.edu) Donald E. Lyons<sup>2</sup> Timothy J. Lawes<sup>2</sup> Yasuko Suzuki<sup>2</sup> Kirsten S. Bixler<sup>2</sup> Ken Collis<sup>3</sup>

<sup>1</sup>U.S. Geological Survey-Oregon Cooperative Fish and Wildlife Research Unit, 104 Nash Hall, Oregon State University, Corvallis, OR 97331 USA.

<sup>2</sup>Department of Fisheries and Wildlife, 104 Nash Hall, Oregon State University, Corvallis, OR 97331 USA.

<sup>3</sup>Real Time Research, Inc., 1000 S.S. Emkay Drive, Bend, OR 97702 USA.

Terns (Sterninae), as a seabird taxon, frequently nest in habitats of ephemeral suitability, and have evolved special adaptations for finding and colonizing new nesting habitats. Conservation of the Caspian Tern (*Hydroprogne caspia*) population in the Pacific Flyway of North America, a globally significant population for this cosmopolitan species, has focused on providing a network of artificial islands as nesting habitat. These artificial islands are intended to provide suitable, secure, and persistent nesting habitat as compensation for habitat lost due to human development, changes in nest predator densities, and management to reduce impacts of tern predation on survival of salmonids listed under the U.S. Endangered Species Act. We assisted efforts to establish breeding colonies of Caspian Terns at newly constructed islands by using social attraction techniques pioneered by S.W. Kress and the Audubon Seabird Restoration Program. Caspian Terns attempted to nest on 15 of 16 colony sites in the first breeding season following island construction. Despite high rates of initial colonization, the main challenge to sustaining this conservation network of artificial nesting islands has been maintaining the intended suitability and security of these islands for nesting terns in the face of encroaching vegetation, nest predators, and climate change. Managers and stakeholders must be willing to allocate resources to monitor and adaptively manage colony sites over the long term for artificial islands, or other networks of breeding sites, to serve as an effective conservation approach for terns. Otherwise, terns will treat the sites as ephemeral habitat and leave in search of other nesting opportunities. (Talk)

## RODENT ERADICATIONS FOR SEABIRD CONSERVATION: IMPROVING THE EVALUATION OF AERIAL BAIT DISPERSION

Evaristo M. Rojas-Mayoral<sup>1</sup> (evaristo.rojas@islas.org.mx) Araceli Samaniego-Herrera<sup>1</sup> Federico Méndez-Sánchez<sup>1</sup> Alfonso Aguirre-Muñoz<sup>1</sup>

<sup>1</sup>Grupo de Ecología y Conservación de Islas, Av Moctezuma 836, Zona Centro, Ensenada, B.C., Mexico.

Invasive rodents have reached about 90% of the world's islands and represent one of the most serious threats to seabird colonies. Rodent eradication is a primary conservation tool and the aerial broadcast of rodenticide bait is the state-of-the-art method. During aerial bait broadcasts it is crucial to generate accurate bait density maps to ensure the complete and even coverage of the area. Creating such maps to estimate and visualize the spatial variation of bait on the ground has been done using GIS systems, a slow process based on several untested assumptions. To improve and speed the evaluation of the aerial work we developed a new tool: the Numerical Estimation of Rodenticide Dispersal (NERD). The NERD user-friendly software is a MATLAB implementation of a mathematical model which performs accurate calculations and displays the results almost in real-time. At its core the model is a probability density function describing bait density as a function of three variables: the aperture diameter of the bait bucket, the helicopter speed, and the wind speed. NERD also facilitates the planning of the helicopter's optimum flight paths and shows bait gaps instantly. NERD has been effectively used in the last two successful rodent eradications on Mexican islands: mice on San Benito Island (400 ha) in the Pacific and black rats on Cayo Centro, Banco Chinchorro (539 ha) in the Caribbean; the latter being the largest rodent eradication on a wet tropical mangrove island worldwide. The use of NERD in future large scale eradications has vast potential. (Talk)

## COMPUTATIONAL ANALYSIS TO ESTIMATE DISTRIBUTION OF SEABIRD SPECIES, AND DENSITY OF NESTS AND BURROWS ON MEXICAN ISLANDS

Evaristo M. Rojas-Mayoral<sup>1</sup> (evaristo.rojas@islas.org.mx) Julio Hernández-Montoya<sup>1</sup> Jorge David Martínez-Cervantes<sup>1</sup> Yutzil Lora-Cabrera<sup>1</sup> Alfonso Aguirre-Muñoz<sup>1</sup>

<sup>1</sup>Grupo de Ecología y Conservación de Islas, Av Moctezuma 836, Zona Centro, Ensenada, B.C., Mexico.

The successful management and conservation of vulnerable seabird species depends in part on the generation of accurate maps of their distributions and of their nest and burrow densities. Over time, these maps provide crucial information regarding their population dynamics, habitat and resilience. As such, they are a powerful tool to evaluate conservation and restoration efforts. To this end, a computational package was created, allowing for the automated generation of maps from census or sampling data. In addition, the package calculates an estimate of the total number of nests or burrows in a given area and recommends a future minimum sample size required to obtain a 10% margin of error, generating a map that indicates areas where future sampling efforts should be increased. The package uses a convention for reading and storing data in a specific format inspired by the Tidy Data guidelines as well as by the widely used Climate and Forecast Metadata Convention. By adopting these conventions databases are easily shared while facilitating the development of applications for data processing and analysis, as well as the representation of diverse results in the same format. From 2013 to 2015, the distributions of the Laysan Albatross (*Phoebastria immutabilis*), the Guadalupe Murrelet (*Synthliboramphus hypoleucus*), the Black-vented Shearwater (*Puffinus opisthomelas*), Leach's Storm-petrel (*Oceanodroma leucorhoa cheimomnestes* and *O. l. socorroensis*), Cassin's Auklet (*Ptychoramphus aleuticus*), the Black-vented Shearwater (*Puffinus opisthomelas*), and the Western Gull (*Larus occidentalis*), and the densities of their nests or burrows on key nesting islands off the Baja California Peninsula on the Mexican Pacific have been mapped. (Talk)

## ENIGMA OF THE ALEUTIANS: STATUS AND ECOLOGY OF WHISKERED AUKLETS IN THE NORTH PACIFIC

Nora A. Rojek<sup>1</sup> (nora.rojek@fws.gov) Jeffrey C. Williams<sup>1</sup> Carley R. Schacter<sup>2</sup>

<sup>1</sup>Alaska Maritime National Wildlife Refuge, 95 Sterling Highway, Suite 1, Homer, Alaska 99603.

<sup>2</sup>Memorial University of Newfoundland, 230 Elizabeth Ave, St. John's, NL, NL A1B3X9, Canada.

Whiskered auklets (*Aethia pygmaea*) are small diving plankton-feeding seabirds endemic to the north Pacific, Bering, and Okhotsk seas that forage primarily on copepods and euphausiids at tidal fronts and in rip-tide passes between islands where they are locally abundant. They nest in rock crevices on remote volcanic islands in the Aleutians, Commander, and Kuril island chains. Ornate facial plumes have a mechanosensory function that Seneviratne and Jones suggested aid whiskered auklets in their nocturnal behavior and underground navigation. Long-term productivity monitoring has been conducted only at Buldir Island (28 years between 1976 and 2015) and an update on studies will be provided. Recent genetic and morphometric work by Pshenichnikova et al. indicates three distinct whiskered auklet populations: the Sea of Okhotsk, Commander Islands, and Aleutian Islands, with the main gene flow barrier being the strait between the Commander and Aleutian Islands. Schacter's recent winter tagging study provides evidence of previously suspected year-round attendance near and on colonies, a unique behavior among auklets, which also makes this seabird particularly vulnerable to threats from oil spills. Information is lacking (but needed) regarding trends in whiskered auklet population numbers, due to difficulties in studying the species, except that observations of feeding flocks (the largest estimated at 40,000 birds) and colony sightings continue to increase in the last several decades with the continuation of fox removal from Aleutian Islands. We provide an updated guesstimate on the abundance of the species throughout its range. (Talk)

## HABITAT RESTORATION AT KURE ATOLL WILDLIFE SANCTUARY

Matthew K. Saunter<sup>1</sup> (msaunter@hawaii.edu) Naomi N. Worcester<sup>1</sup> Cynthia A. Vanderlip<sup>1</sup>

<sup>1</sup>State of Hawaii - DLNR, Division of Forestry and Wildlife, 2135 Makiki Heights Dr. Honolulu HI, 96822.

Kure Atoll State Wildlife Sanctuary is in the Papahānaumokuākea Marine National Monument and lies 1,400 miles northwest of Honolulu. Kure Atoll is the State of Hawai'i's most significant seabird sanctuary and provides habitat for 18 seabird species, the recently introduced Laysan teal (*Anas laysanensis*), the Hawaiian monk seal (*Monachus schauinslandi*) and serves as an over-wintering ground for several shorebird species. In 1995, the State successfully eradicated rats from Kure Atoll and created strict bio-security measures. Currently, the State's primary focus is invasive species control and the eradication of a noxious weed, Golden Crown-beard (*Verbesina encelioides*), which was first documented on Kure in 1959. *Verbesina* has severely threatened seabird recovery by degrading and displacing nesting habitat. A 10-year eradication program was initiated in 2010, with the implementation of year-round field camps. In 2012 field crews were able to maintain 120 acres of open habitat, thereby releasing the island from the most significant damage caused by stands of tall, mature *Verbesina* plants. Currently the entire vegetated portion of Kure Atoll (188 acres) is under active restoration. 2012-2015 censuses show an increase in Laysan albatross (*Phoebastria immutabilis*) nests from 21,036 to 38,307 (82.1% increase). Within the same timeframe Brown booby (*Sula leucogaster*) fledglings increased from 52 to 87 (65.5% increase). Project outcomes include improved habitat quality and expansion of a resilient native plant community to support seabird nesting and to mitigate effects of sea level rise and tsunami events. Challenges include efficiently extinguishing the *Verbesina* seed-bank while living and working in a remote location. (Talk)

## A COMPARISON OF WINTER DISTRIBUTIONS OF AETHIA AUKLETS DERIVED FROM TRACKING DATA AND SHIP-BASED SURVEYS

Carley R. Schacter<sup>1</sup> (crs634@mun.ca)

<sup>1</sup>Memorial University of Newfoundland, 230 Elizabeth Ave, St John's NL, NL A1B3X9, Canada.

For decades, ship-based surveys were the only method available for determining winter habitat use and at-sea behavior of seabirds. The rapid development of tracking technology has changed that, and now tracking has become the go-to method for these studies. However, both methods have pros and cons, and they are not necessarily interchangeable. Ship surveys (Eulerian approach) are expensive and limited in the area/timespan they can cover, but offer high spatial accuracy. They provide a good snapshot of the species composition in an area and are well-suited to population-level questions. Tracking (Lagrangian approach) accuracy is often low and usefulness may be limited by the logistics of how many colonies can be visited. However, it is cheaper, and provides full time-series for each bird, including behavioral information, making it better for individual-based questions. I compared tracking data and ship-survey data (NPPSD) for three species of auklet breeding in the Aleutian Islands, Alaska. Whiskered Auklets (*Aethia pygmaea*) remain near the colony all year, so distributions from tracking data are limited by the number of populations that can be tracked. Ship-based data provides a better overall picture of the species range, but could not have shown the distinct separation between colonies. Parakeet Auklet (*A. psittacula*) distributions were broadly similar for each method, although due to lack of survey effort in the Bering Sea Basin mid-winter, ship-based data missed an important wintering area for this species. Crested Auklet (*A. cristatella*) distributions showed the least difference between methods, since they mainly use rich coastal areas. (Poster)



## TUFTED PUFFINS SUCCEED DESPITE HIGH VARIABILITY IN DIET AND HABITAT

Sarah K. Schoen<sup>1</sup> (sschoen@usgs.gov) John F. Piatt<sup>1</sup> Mayumi L. Arimitsu<sup>2</sup> Gary S. Drew<sup>1</sup>  
Brielle M. Heflin<sup>2</sup> David C. Douglas<sup>2</sup> Martin Renner<sup>3</sup> Erica N. Madison<sup>1</sup>

<sup>1</sup>USGS Alaska Science Center, 4210 University Drive, Anchorage, AK 99508.

<sup>2</sup>USGS Alaska Science Center, 250 Egan Drive, Juneau, AK 99801.

<sup>3</sup>Tern Again Consulting, 388 E Bayview Ave Homer, AK 99603.

How seabirds compensate for variability in prey type and abundance is central to understanding population trends and demographics. We studied Tufted Puffin (*Fratercula cirrhata*) food webs at breeding colonies spanning >2,400 km from Kodiak Island to the Western Aleutian Islands during August 2012-2014. We quantified marine habitat characteristics (e.g. slope, tide), oceanographic conditions (temperature and salinity), forage nekton biomass, and seabird community composition and density near puffin colonies. At colonies, we collected puffin chick-meals to characterize prey communities, and measured chicks to obtain an index of their condition. Oceanographic conditions clustered into three distinct ecoregions: 1) Western Aleutians, 2) Eastern Aleutians, and, 3) Alaska Peninsula. Correspondingly, the primary principal component (PPC) encompassing environmental conditions (habitat and oceanographic data) was significantly different among ecoregions. The community composition, species richness, and biomass of forage differed markedly at the regional scale; however, seabird density and chick condition did not. At a local scale, the above PPC strongly predicted forage biomass. Further, both forage biomass and the PPC for the combination of forage biomass and select environmental variables predicted local puffin density. Our results provide evidence that Tufted Puffins can produce healthy chicks of similar condition across wide ranging environmental conditions, despite differences in prey abundance, richness, and composition. The ability of Tufted Puffins to successfully exploit differing prey communities and environmental conditions may be the key to their overall success and wide distribution across the North Pacific Ocean. (Talk)

## EVALUATING THE BREEDING ECOLOGY OF PIGEON GUILLEMOTS (CEPPHUS COLUMBA) ON ALCATRAZ ISLAND

Victoria L. Seher<sup>1</sup> (victoria\_seher@nps.gov) Barbara Holzman<sup>1</sup> Ellen Hines<sup>1</sup> Ben Becker<sup>2</sup>

<sup>1</sup>San Francisco State University, 1600 Holloway Ave. San Francisco, CA 94132.

<sup>2</sup>Pt. Reyes National Seashore, 1 Bear Valley Rd. Pt. Reyes Station, CA 94956.

Pigeon guillemots (*Cephus columba*) began breeding in small numbers on Alcatraz Island in 1982 and their population has slowly grown to approximately 40 pairs. Little is known about the reproductive success, breeding phenology or diet of guillemots on Alcatraz since their cavities are largely inaccessible. In April, 2015, we began comparing the breeding success of pigeon guillemots on an urban island (Alcatraz) with guillemots breeding on a remote and protected island (Southeast Farallon Island). This season, we placed video cameras inside 11 active nest sites (six natural cavities and five artificial nest boxes) to monitor breeding ecology and diet of guillemots on Alcatraz. We monitored an additional 6 sites without the use of cameras. Preliminary results show that 13 out of 17 sites successfully fledged at least one chick. None of the 7 sites with two chicks fledged both chicks. The mean date eggs were laid was June 8, and the mean date chicks fledged was August 11. On average, the incubation period was 29 days and chicks fledged at 42 days. Video cameras recorded food provisioning rates and prey type in three artificial nest boxes. Food provisioning rates and diet are still being analyzed but preliminary data show sculpin, flatfish, anchovy, and shrimp as the primary prey items delivered to sites. Future analysis will compare the breeding success and diets of guillemots on Alcatraz with the colony on Southeast Farallon Island. (Poster)

## TRACKING THE NON-BREEDING MOVEMENTS OF MID-COAST MAINE ATLANTIC PUFFINS

Paula S. Shannon<sup>1</sup> (pshannon@audubon.org) Stephen W. Kress<sup>1</sup> Susan E. Schubel<sup>1</sup>

<sup>1</sup>National Audubon Society Seabird Restoration Program, 12 Audubon Rd. Bremen, ME 04551.

Potential threats of commercial fishing, offshore wind, and climate change have prompted the need for information on the non-breeding movements and wintering locations of seabirds that nest in the Gulf of Maine. Little is known about the movements and distribution of Maine's Atlantic Puffins (*Fratercula arctica*) outside of the breeding season. We attached geolocators to leg bands on puffins breeding at Matinicus Rock (n=15) and Seal Island National Wildlife Refuge (n=13) in Penobscot Bay, Maine, during the 2013 and 2014 breeding seasons. Preliminary analysis of data from 21 recovered geolocators suggests two temporally distinct regions important for Maine puffins during the non-breeding season: a post-breeding dispersal northwards to the western Gulf of St. Lawrence in August and a wintering area around the continental shelf break southeast of Cape Cod, where puffins spend much of November-February. The wintering region on the continental shelf break is known for its high marine biodiversity and nutrient-rich waters, and is in an area that has been proposed for designation as the first Atlantic marine national monument in the United States. (Poster)

## MANAGING INVASIVE VEGETATION TO CREATE IMPROVED TERN NESTING HABITAT ON THE MAINE COAST, USA

Paula S. Shannon<sup>1</sup> Stephen W. Kress<sup>1</sup> (skress@audubon.org) Susan E. Schubel<sup>1</sup>

<sup>1</sup>National Audubon Society, Seabird Restoration Program, 12 Audubon Road, Bremen, Maine 04551.

Successful projects to restore nesting populations of Common Terns (*Sterna hirundo*), Arctic Terns (*S. paradisaea*) and Roseate Terns (*S. dougallii*) along the Maine Coast have resulted in persistent, concentrated nesting populations. Presently, nearly all Maine terns nest in protected sanctuaries guarded from predators and intruding public. The build-up of guano deposited nutrients from more than thirty years of continued tern breeding combined with an increasing trend for wet summers favors dense stands of invasive perennials such as quackgrass (*Elymus repens*) and timothy (*Phleum pratense*) as well as woody shrubs such as red raspberry (*Rubus idaeus*) and annuals such as wild radish (*Raphanus raphanistrum*). Left unmanaged, dense vegetation overgrows rock outcrops and gravel beaches, degrading tern nesting habitat, leading to increased intraspecific competition, aggression and ultimately lower productivity. Dense vegetation also forces nesting closer to the shoreline, increasing vulnerability to extreme tides, storms and predators. We review many of the methods used to create a preferred matrix of about 50/50% open substrate to vegetation. Such methods include controlled fire, rock salt, imported gravel and herbicides (organic and artificial). Of the many practices employed, vegetation barriers and low growing native grasses show the most promise for improving coastal Maine tern nesting habitat, but even these require ongoing maintenance and continued trials. (Talk)

## REMOVAL OF MARINE DEBRIS FROM MAINE COAST SEABIRD NESTING ISLANDS

Paula S. Shannon<sup>1</sup> (pshannon@audubon.org) Susan E. Schubel<sup>1</sup> Stephen W. Kress<sup>1</sup>

<sup>1</sup>National Audubon Society Seabird Restoration Program, 12 Audubon Rd. Bremen, ME 04551.

Islands acquire marine debris throughout the year, and high tides push debris up onto shorelines, depositing derelict items onto habitat where they become trapped. In Maine, the majority of marine debris comes from the lobster industry in the form of derelict traps, rope, and buoys. This debris washes up on islands, posing direct threats of entrapment and entanglement to seabirds, as well as reducing habitat available for nesting. There has been little effort to target islands for marine debris removal due to the logistics involved in organizing cleanups in remote locations that are difficult to access, and that require a variety of equipment and many people to achieve success. In 2015, the Audubon Seabird Restoration Program, along with the Gulf of Maine Lobster Foundation, initiated an effort to remove accumulated marine debris from seabird nesting islands in the Gulf of Maine, with the cooperation of local lobstermen and community volunteers. Outreach activities in conjunction with the cleanup effort also served to increase community awareness of the problem of marine debris. This model for island marine debris cleanups can be replicated to clean up other important seabird nesting islands in Maine, or among different communities of marine resource user groups to involve them in conservation of island or shoreline habitats. (Poster)

WATER TEMPERATURE CHANGE ACROSS YEARS AND BODY MASS: RELATED-  
NESS AND EFFECTS

Leslie Slater<sup>1</sup> (leslie.slater@fws.gov) Brie A. Drummond<sup>1</sup> Marc D. Romano<sup>1</sup>

<sup>1</sup>Alaska Maritime NWR, 95 Sterling Hwy., #1, Homer, AK 99603-7472.

~~NO ABSTRACT SUBMITTED~~ (Poster)

Unusually warm water anomalies were recorded throughout the North Pacific and southern Bering Sea beginning in late 2013 and continuing through 2015. We hypothesized that anomalously high water temperature could have cascading effects, i.e., changes in prey availability, quality, and/or quantity that would be reflected in the body mass of adults. We used mean adult body mass of a range of seabird species (planktivores and piscivores) to examine the potential effects of this broad environmental perturbation.

## USING BIRDLIFE MARINE IBAS TO INFORM ZONING IN SEYCHELLES

Joanna L. Smith<sup>1</sup> (joanna.smith@tnc.org) Rick Tingey<sup>2</sup>

<sup>1</sup>TNC Canada, PO Box 535, Smithers, BC V0J 2N0 Canada.

<sup>2</sup>Spatial Support Systems, Salt Lake City, UT 84109.

The Republic of Seychelles is an archipelago of 115 islands within a rich tropical marine ecosystem in the Western Indian Ocean. The Exclusive Economic Zone is 1.37 million km<sup>2</sup>, with a land area of only 455 km<sup>2</sup>. The islands have high rates of species endemism and their global importance for biodiversity highlighted by two UNESCO World Heritage Sites. Seychelles contains important nesting habitat for 18 breeding seabirds and 42 other seabirds breed irregularly or are visitors or migrants. The government has committed to a 30% marine protection goal from the UN Convention of Biological Diversity Aichi target, up from 0.04% in marine protected areas. The Seychelles Marine Spatial Planning (MSP) Initiative began in 2014 to develop a draft zoning design and marine plan for the entire Exclusive Economic Zone that integrated the 30% goal with economic and other uses of the ocean. The Nature Conservancy is facilitating the process and developing a marine plan. To date, we have gathered or created spatial data for the four main economic themes and partnered with UNDP to compile more than 100 biodiversity layers including the 2014 draft BirdLife Marine Important Bird Areas (IBAs) in Seychelles. The nine draft Marine IBAs in Seychelles (six nearshore and three pelagic) depict key foraging areas. These and other biodiversity data were used by UNDP to develop marine protected area expansion scenarios and we are using them to propose zones for high and medium biodiversity protection. In this presentation, we discuss our methodology for a zoning design and advantages and challenges of using coarse-scale spatial data such as Marine IBAs. (Talk)

# WHERE HAVE ALL THE AUKLETS GONE? SEA SURFACE TEMPERATURE AS A FACTOR IN THE REPRODUCTIVE FAILURE OF CRESTED AUKLETS ON GARELOI ISLAND IN 2015

Lucy Smith<sup>1</sup> (lucy.smith@unb.ca) Christy N. Wails<sup>1</sup> Heather L. Major<sup>1</sup>

<sup>1</sup>University of New Brunswick, Saint John, PO Box 5050, Saint John NB E2L 4L5.

Changes in oceanic climate conditions such as sea surface temperature (SST) resulting from an increased frequency of El Niño Southern Oscillation (ENSO) events can have a devastating effect on seabirds. Previous studies indicate that higher than average SST has a negative effect on the reproductive success and survivorship of planktivorous alcids due to changes in prey availability, however the effects of SST at feeding sites during the breeding season on the reproductive success of Crested Auklet (*Aethia cristatella*) has not been examined. In 2015, we observed complete reproductive failure of Crested Auklets at Gareloi Island, AK and hypothesized that this event was related to higher than average local SST during the breeding season. We compared productivity data from previous studies on Kasatochi, Kiska, and Buldir Islands between 1991 and 2015 to SST for the breeding period using GLMMs in R. Mean weekly SST data were obtained from the NOAA ESRL database for locations coinciding with Crested Auklet feeding sites around each island. We then used the model that best explained the relationship between SST and reproductive success to predict the 2015 Gareloi reproductive failure. To date, analysis of the SST data suggests higher than average temperature conditions for all regions examined in 2014-2015; however, we have not identified a relationship between reproductive success and SST for the breeding period, suggesting the presence of a temporal lag associated with plankton productivity and movement. (Poster)



# MONITORING AND CONSERVATION OF THE TOWNSEND'S SHEARWATER AT ITS LAST KNOWN BREEDING SITE, SOCORRO ISLAND, REVILLAGIGEDO ARCHIPELAGO, MEXICO

Fernando Solís-Carlos<sup>1</sup> (fernando.solis@islas.org.mx) Antonio Ortiz-Alcaraz<sup>1</sup> David Cosio-Muriel<sup>1</sup> Fernando Pérez-Castro<sup>1</sup> Federico Méndez-Sánchez<sup>1</sup> Eduardo Iñigo-Elías<sup>2</sup> Alfonso Aguirre-Muñoz<sup>1</sup>

<sup>1</sup>Grupo de Ecología y Conservación de Islas, A.C. , Moctezuma 836, Zona Centro, Ensenada, Baja California, México 22800.

<sup>2</sup>Cornell Lab of Ornithology, 159 Sapsucker Woods Rd, Ithaca, NY 14850.

Townsend's Shearwater (*Puffinus auricularis*; TOSH) is a critically endangered species, endemic to the Revillagigedo Archipelago. Our work with this seabird stems from an overarching and long-term program for the ecological restoration of the archipelago, including the recent completion of the feral sheep eradication, and the ongoing eradication of feral cat both on Socorro Island. We present insights of a monitoring program to assess TOSH's population status and to better understand its biology and ecology. We conducted four field trips in 2014-2015 to search for nesting colonies in previously recorded sites. Methods and equipment used where: direct searches for burrows and rafts, radar monitoring, night vision goggles and spotlights, automatic recording units, camera traps, and detection dogs. In April 2014 we recorded vocalizations southwest of Cerro Evermann. In November 2015, we located two different sites north of Cerro Evermann with a high frequency of vocalizations. We recorded these vocalizations, as well as TOSH individuals flying by, between 18:30-21:00 and 03:30-05:00. Different burrows and cavities were found at these sites but none individuals within. Dense vegetation of *Dodonaea viscosa*, introduced grasses and weeds were present in both sites. We did not observe the presence or predation by feral cat. The removal of feral sheep, and the 70% progress in the feral cat eradication represent a dramatic habitat improvement for the Townsend's Shearwater and other endemic birds. (Talk)

## LEND ME YOUR EAR (BONES): FISH CONSUMPTION AND BREEDING SUCCESS IN SOUTH POLAR SKUAS ON KING GEORGE ISLAND, ANTARCTIC PENINSULA

Miranda P. Starr<sup>1</sup> (mps02011@mymail.pomona.edu) Nina J. Karnovsky<sup>1</sup> Joel K. Llopiz<sup>2</sup>  
Madeline C. Cowen<sup>1</sup> Sue Trivelpiece<sup>3</sup> Wayne Z. Trivelpiece<sup>3</sup>

<sup>1</sup>Pomona College, Department of Biology, 175 W. 6th Street, Claremont, CA 91711.

<sup>2</sup>Woods Hole Oceanographic Institution, Biology Department, 266 Woods Hole Road MS#33, Woods Hole, MA 02543.

<sup>3</sup>Antarctic Ecosystem Research Division, NOAA-NMFS, 3333 Torrey Pines Court, La Jolla, CA 92037.

On the Antarctic Peninsula, climate warming, large-scale changes in ice conditions, and declining krill populations have greatly impacted the marine food web. South Polar skuas (*Catharacta maccormicki*) are predatory seabirds whose reproductive success is tightly linked to food availability. The purpose of this study was to examine the relationship between the sizes and ages of fish consumed and the reproductive success of skuas breeding on King George Island. We hypothesised that low reproductive success occurs when South Polar skuas consume smaller and younger fish. We extracted fish ear bones (otoliths) from guano samples collected over 7 breeding seasons (2004-2005 through 2010-2011) and identified them to species, then used measurements and regressions to determine the size of each fish. We also determined the ages of a subset of the otoliths isolated from each year. We found that two fish species dominated their diets (>95% of all fish consumed): *Electrona antarctica* and *Pleuragramma antarcticum*. A downward trend in the size of fish consumed preceded a large drop in reproductive success in the 2007-2008 breeding season. Reproductive success recovered in 2009-2010, when skuas ate larger, older fish. These findings suggest that the reproductive success of South Polar skuas is impacted by the availability of older and larger fish prey, especially *P. antarcticum*. (Talk)

## USING HIGH-RESOLUTION DIGITAL VIDEO TO GATHER BROAD-SCALE BASELINE DATA ON THE DISTRIBUTION AND ABUNDANCE OF MARINE WILDLIFE

Iain J. Stenhouse<sup>1</sup> (iain.stenhouse@briloon.org) Kathryn A. Williams<sup>1</sup> Andrew T Gilbert<sup>1</sup>  
Melissa Duron<sup>1</sup> Emily E. Connelly<sup>1</sup> Wing Goodale<sup>1</sup>

<sup>1</sup>Biodiversity Research Institute, 276 Canco Road, Portland, ME 04103.

Marine spatial planning requires in-depth knowledge of baseline conditions at the regional scale, including information on the distribution and abundance of wildlife species and their use of marine habitats. Developed in Europe, aerial surveillance using high resolution digital video cameras has become an accepted, cost-effective method for broad-scale surveys of seabirds, marine mammals, and other taxa, and for detailed monitoring of the effects of development. An array of digital video cameras mounted on the underside of small aircraft capture extremely high resolution images ( $\leq 2$  cm ground spatial distance per pixel), which are examined and reviewed onscreen by experienced biologists. Each video frame is georeferenced with GPS, and the flight heights of targets can be estimated. Compared with traditional observational aerial surveys, the advantages of this technique are many, including: safer flying at higher elevations, faster coverage, reduced disturbance, improved quality control, and auditable, archived data. This novel method also presents several challenges, however, which can be addressed through project management, technological advances, and analytical approaches. The first broad-scale use of this survey technique in North America examined the distribution and abundance of seabirds, marine mammals, and sea turtles in the offshore waters of the mid-Atlantic United States in 2012-2014, as part of a broader project to inform siting and permitting processes for offshore wind energy development. Here, we discuss the advantages and challenges of this innovative survey method, based on our experience in the mid-Atlantic, and provide recommendations on future application of this technique for marine spatial planning. (Talk)

## RESPONSE OF CASPIAN TERNS TO REDUCTIONS IN AVAILABLE NESTING HABITAT

Yasuko Suzuki<sup>1</sup> (yasuko.suzuki@oregonstate.edu) Daniel D. Roby<sup>2</sup> Donald E. Lyons<sup>1</sup> Peter J. Loschl<sup>1</sup> Timothy J. Lawes<sup>1</sup> Kirsten S. Bixler<sup>1</sup>

<sup>1</sup>Oregon Cooperative Fish & Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR 97331 USA.

<sup>2</sup>U.S. Geological Survey-Oregon Cooperative Fish & Wildlife Research Unit, Oregon State University, 104 Nash Hall, Corvallis, OR 97331 USA.

We investigated the responses of Caspian Terns (*Hydroprogne caspia*) to widespread anthropogenic changes in the distribution and availability of suitable nesting habitat in the Pacific Flyway of North America, based on resighting of color-banded individuals at breeding colonies throughout the Flyway. The majority of banded terns exhibited strong site fidelity to their breeding colony site or to nearby nesting habitat, despite major reductions in nesting habitat at their former colony. Philopatry was especially prominent in individuals with a history of successful nesting at a colony. Some individuals responded to loss of nesting habitat by quickly dispersing to new nesting habitat, frequently hundreds of kilometers from their former colony site, and recruiting to new breeding colonies. In many cases, however, these new recruits attempted to move away from their new colony back to established colonies in response to declining conditions for successful nesting at the new colony site. Although in a small minority, some banded terns dispersed long-distances from their breeding or natal colony, up to 3,000 kilometers. These results indicate that (1) the high vagility of Caspian Terns enables them to promptly discover newly available nesting habitat far beyond the foraging range of their current breeding colony, (2) long-term adaptive management is necessary to sustain newly established Caspian Tern colonies due to the strong nest site fidelity of most established breeders to their former colonies, and (3) the effects of nesting habitat loss at the local scale should be considered at the scale of the entire tern breeding population because of their ability to disperse to colonies over great distances. (Talk)

ECOLOGICAL SEGREGATION AMONG TWO CLOSELY RELATED SPECIES, THE ATLANTIC PUFFIN (*FRATERCULA ARCTICA*) AND THE RAZORBILL (*ALCA TORDA*)

Stephanie C. Symons<sup>1</sup> (stephanie.c.symons@gmail.com) Tony Diamond<sup>1</sup>

<sup>1</sup>University of New Brunswick, PO Box 4400, Fredericton NB Canada E3B 5A3.

Niche theory states that a species range is restricted first by physiological tolerances and second by biotic interactions. The competitive exclusion principle builds on niche theory, remarking that two species cannot coexist if they overlap in all dimensions of their niche. Machias Seal Island is a migratory bird sanctuary bordering the Gulf of Maine and the Bay of Fundy. This island is home to several seabird species during the breeding season, including the Atlantic Puffin and Razorbill. Puffins and Razorbills, belonging to the auk family, are long-lived, pursuit-diving, central place foragers that feed on a similar diet. Relatively little is known about how these two species are partitioning resources in the Gulf of Maine/Bay of Fundy area. Generally, seabirds partition resources by foraging habitats, foraging depths, and/or interspecific differences in prey. Using a mix of GPS technology and long term data collected over the past 20 years, my thesis project aims to determine which of these strategies are being used by these seabirds in order for them to exist sympatrically during the breeding season. In addition, locating and describing foraging hotspots will serve as a valuable base for delineating marine protected areas in the Gulf of Maine and the Bay of Fundy. (Talk)

## YEAR-ROUND OCCURRENCE AND MOLTING OF JAPANESE MURRELETS IN THE KAMINOSEKI AREA OF THE SETO INLAND SEA, JAPAN

Midori Takashima<sup>1</sup> (midori.t@crocus.ocn.ne.jp)

<sup>1</sup>Murotsu 836, Kaminoseki Township, Kumage County, Yamaguchi Prefecture 742-1403, Japan.

In 2008-2015, the Kaminoseki Nature Conservation Association (KNCA) conducted at-sea surveys to determine the status of the Japanese Murrelet (*Synthliboramphus wumizusume*; IUCN Vulnerable) in the Kaminoseki area, a semi-closed portion of the west end of Seto Inland Sea. Murrelets in this area may originate from colonies in NW/E Kyushu, W/S Shikoku, or undetected colonies nearby in the Seto Inland Sea. Numbers of murrelets vary but they occur almost year-round in this area. Birds in breeding plumage (adults or subadults) are observed in December to April. Family groups of adults with chicks are observed in May. Molting murrelets are observed in June-July and October-November. Adults, subadults and juveniles seem to be present from June to November but their plumages can be difficult to tell apart. Plans to build a nuclear power plant in this area are currently on hold, after the 2011 Fukushima nuclear power plant disaster and opposition by one third of Kaminoseki residents related to expected impacts to natural and cultural environments. KNCA opposes this power plant because of expected higher water temperatures and changes to prey resources for Japanese Murrelets and other marine wildlife, as well as impacts to shoreline and benthic environments. Special protection of this unique area, one of the last remaining natural areas of the Seto Inland Sea, is needed (e.g., UNESCO world heritage site). Many scientific organizations support protection of this area, including the Japan Seabird Group and Pacific Seabird Group. (Talk)

# REFINING REMOTE OBSERVATION: TECHNIQUES OF MONITORING BLACK-LEGGED KITTIWAKES (*RISSA TRIDACTYLA*) IN RESURRECTION BAY IN THE NORTHERN GULF OF ALASKA

Sarah A. Tanedo<sup>1</sup> (satanedo@alaska.edu) Tuula Hollmén<sup>2</sup>

<sup>1</sup>School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, PO Box 757220, Fairbanks, AK 99775.

<sup>2</sup>Alaska SeaLife Center, 301 Railway Ave, Seward, AK 99664.

Remote sensing methods have been used increasingly as a monitoring tool for observing seabirds, as many species inhabit remote locations and can be difficult to observe throughout the breeding season. As each seabird species exhibits different reproductive strategies, identifying a monitoring frequency and type of equipment to use is an important consideration for specific species and locations. To investigate this question for cliff-nesting colonial seabirds, we used remote observation techniques to monitor a sub-colony of black-legged kittiwakes (*Rissa tridactyla*, kittiwake) in Resurrection Bay in the Northern Gulf of Alaska. Remote video and photographic methods were used to monitor kittiwakes throughout the breeding seasons (May-August) of 2013 and 2014. The first objective of this project was to determine the effect of monitoring on productivity estimates. Observations were systematically reduced from daily to 2-, 3-, 4-, 5-, 6-, and 7-day intervals between observations. The second objective was to determine the effect of remote method on estimates of productivity by comparing video and photographic methods of observation. Results indicated that frequency (Friedman rank sum test,  $t=2.83$ ,  $p=0.07$ ) and type (Zero-inflated generalized linear mixed effects model,  $z=1.07$ ,  $p=0.287$ ) of observation did not significantly influence estimates of productivity, though increased time between monitoring periods indicated a declining trend in estimates of productivity. The results of this study support the use of video or still-image remote observation techniques as an excellent method for monitoring reproductive health of cliff-nesting seabirds. (Talk)

ON THE IMPORTANCE OF GELATINOUS PREY FOR ADÉLIE PENGUINS (PYGOSCELIS ADELIAE) FROM DUMONT D'URVILLE (EAST ANTARCTICA), AS REVEALED BY BIO-LOGGING TECHNIQUES

Jean-Baptiste Thiebot<sup>1</sup> (jbthiebot@gmail.com) Kentaro Ito<sup>1</sup> Thierry Raclot<sup>2</sup> Timothee Poupart<sup>2</sup> Yan Ropert-Coudert<sup>3</sup> Akinori Takahashi<sup>1</sup>

<sup>1</sup>National Institute of Polar Research, 10-3 Midori-cho, Tachikawa, 190-8518 Tokyo, Japan.

<sup>2</sup>Institut Pluridisciplinaire Hubert Curien, Département Ecologie, Physiologie et Ethologie, Université de Strasbourg - CNRS UMR7178, 23 rue Becquerel, 67087 Strasbourg, France.

<sup>3</sup>Centre d'études Biologiques de Chizé, Station d'écologie de Chizé-La Rochelle, CNRS UMR 7372, 79360 Villiers-en-Bois, France.

The development of video loggers is revolutionizing the study of wild animals' foraging behaviour, allowing unprecedented detail on events such as prey capture. We deployed video loggers on Adélie penguins (*Pygoscelis adeliae*) from Dumont D'Urville station, East Antarctica, during the 2014-2015 chick guard stage. A total of 59 hours of exploitable video footage were collected from 21 penguins. Among other prey items, 101 encounters with gelatinous organisms (mainly jellyfish) were observed. Observations were made in 62% of birds and both genders. Importantly, 65.3% of the encountered jellyfish were attacked by the penguins. Whether the penguin captured prey or not during the previous dive significantly affected the decision to attack or not the encountered jellyfish. Concurrent data from acceleration-depth recorder on 17 birds showed that interactions with jellyfish occurred mostly during the bottom phase, but surprisingly, also during the descent and ascent phases. Concurrent GPS location for 4 birds indicated that jellyfish were captured at 35.1 km north from the colony, where sea-ice concentration was high ( $\approx 88\%$ ). So far, penguins were not known as jellyfish consumers. From our single-year study we cannot tell whether this behaviour is recent and related to changes in the marine food webs, or whether it is more common than previously known. Nevertheless our data demonstrates the unique potential for video loggers to enable identifying prey items that cannot be sampled otherwise. These results may change our perception of seabirds' range of responses to the alteration of marine trophic webs. Data from other ecosystems would allow investigating the significance of this phenomenon at a more global scale. (Talk)



TWO BREEDING REGIONS, ONE WINTERING AREA: RHINOCEROS AUKLETS (*CERORHINCA MONOCERATA*) FROM DAIKOKU ISLAND, PACIFIC OCEAN, OVERWINTER WITH THEIR CONSPECIFICS FROM TEURI ISLAND, JAPAN SEA

Jean-Baptiste Thiebot<sup>1</sup> (jbthiebot@gmail.com) Nobuhiko Sato<sup>1</sup> Jumpei Okado<sup>2</sup> Nobuo Kokubun<sup>1</sup> Yutaka Watanuki<sup>2</sup> Akinori Takahashi<sup>1</sup>

<sup>1</sup>National Institute of Polar Research, 10-3, Midori-cho, Tachikawa, Tokyo 190-8518, Japan.

<sup>2</sup>Graduate School of Fisheries Sciences, Hokkaido University, Minato-cho 3-1-1, Hakodate 041-8611, Japan.

Ideal-free distribution theory predicts that animals should exploit a foraging area if the possible foraging gains may offset local competition. Empirical studies showed that parapatric seabirds may indeed segregate over distinct foraging sites during the non-breeding season, presumably so as to maximize foraging gains per capita. However, for seabirds with comparatively reduced foraging range such as auks, the choice of foraging sites during winter may be restrained. To investigate whether parapatric auks would either aggregate or segregate during winter, we surveyed Rhinoceros auklets (*Cerorhinca monocerata*) from Teuri (Japan Sea) and Daikoku (Pacific Ocean) islands, Japan. During the 2014 breeding season, 9 and 14 light-based geolocators were deployed on birds from Teuri and Daikoku, respectively. The loggers were recovered during the following 2015 breeding season and enabled to reconstruct the movements of 6 auklets from Teuri and 8 from Daikoku. The birds from Teuri, as previously known, headed north to the Sea of Okhotsk after breeding and then moved to the southwestern Japan Sea where they spent winter. The birds from Daikoku left their colony about two weeks later (28 July) than at Teuri (15 July), but nevertheless aggregated with the birds from Teuri on the post-breeding and wintering areas. These results suggest the importance of the Tsushima warm current (Japan Sea side) for foraging auklets, since birds originating from another system (the Oyashio cold current for Daikoku birds) switch to the former during winter, after the release of breeding constraints. Habitat modelling may help understanding whether no other adequate foraging area would be available to the wintering birds from Daikoku. (Poster)

## PATTERNS OF DISTRIBUTION AND RELATIVE ABUNDANCE OF PROCELLARIIFORM SEABIRDS ON TA'U ISLAND, AMERICAN SAMOA

Andrew J. Titmus<sup>1</sup> (ajtitmus@gmail.com) Christopher A. Lepczyk<sup>2</sup> Abram B. Fleishman<sup>3</sup>  
David Savage<sup>3</sup> Matthew McKown<sup>3</sup>

<sup>1</sup>University of Hawaii at Manoa, Department of Biology, Honolulu, HI 96822.

<sup>2</sup>Auburn University, School of Forestry and Wildlife Sciences, Auburn, AL 36849.

<sup>3</sup>Conservation Metrics, Santa Cruz, CA 95060.

Ta'u is a forested high volcanic island in American Samoa where multiple species of procellariiform seabirds are known to breed within the summit montane region. Little is known about their biology, thus our goal was to determine the bird's distribution, relative abundance, and temporal patterns in colony attendance. We conducted long-term acoustic surveys in the summit region of Ta'u to quantify vocal activity of nocturnally active petrels and shearwaters with Songmeter SM2+ acoustic sensors. Acoustic surveys were conducted between February and May, 2014 at eight different sites that ranged in elevation from 793 m to 960 m. Tahiti Petrels (*Pseudobulweria rostrata*) had the greatest call activity and widest distribution, being detected at all monitoring sites. At the most active site, mean call activity was 2.57 calls/min. Tropical Shearwaters (*Puffinus bailloni*) were restricted to seven sites, with higher call activity on the the summit's west side. Call activity was lower, with a mean activity of 0.21 calls/min at the most active site. Both species were detected throughout the survey period. Herald Petrels (*Pterodroma heraldica*) were detected at two sites on the summit's west side. Call rates were very low and only detected before sunset. Both Tahiti Petrels and Tropical Shearwaters showed temporal patterns in colony attendance, with spikes in activity approximately every 14 days for Tahiti Petrels, and approximately 45 days for Tropical Shearwaters. Call rates were generally low and coupled with burrow surveys indicates that densities of nesting procellariiforms are likely low, a possible result of predation from introduced species. (Talk)

## FIRST LIVE CAPTURE AND CARE OF INJURED SHORT-TAILED ALBATROSS (PHOEBASTRIA ALBATRUS) IN THE CONTINENTAL UNITED STATES

Laura L. Todd<sup>1</sup> (laura\_todd@fws.gov) John R. Huckabee<sup>2</sup> Edward F. Melvin<sup>3</sup>

<sup>1</sup>U.S. Fish and Wildlife Service, 2127 SE Marine Science Drive, Newport, OR 97365.

<sup>2</sup>Progressive Animal Welfare Society, PO Box 1037, Lynnwood, WA 98046.

<sup>3</sup>University of Washington, Washington Sea Grant & School of Aquatic & Fishery Sciences, Box 355020, Seattle, WA 98105.

The first live short-tailed albatross (*Phoebastria albatrus*) rescued in the continental U.S. was found by recreational fishermen August 15, 2015, off the NW coast of Washington State. The incapacitated bird was captured and eventually brought to the Progressive Animal Welfare Society north of Seattle, where it received critical care for its dehydration, emaciation, and inability to stand or bear weight. Web lesions were present on both feet, particularly the right. The right tarsus was inflamed, had limited mobility, and apparently was quite painful resulting in marked lameness. The tarsal swelling and leg lameness resolved following antibiotic therapy. Radiographs showed the right leg (tibiotarsus) with a healed fracture and a functionally remodeled callus, consistent with observations from Yamashina Institute for Ornithology in March. Despite initial improvements, the bird died unexpectedly on August 30. The necropsy revealed the albatross was an immature female showing signs of chronic stress, traumatic injury, and immune suppression. Presumptive cause of death was attributed to chronic and acute stress, compounded with the stresses of captivity. Further histopathological examination revealed findings consistent with a combination of emaciation, stress, and trauma. Parasitism may have contributed partially to the emaciated condition. Tissue samples were supplied to researchers, and the carcass will be preserved for educational use. Several challenges arose during this event that elucidated need for improved protocols for response and communication; tissue collection and distribution; emergency care; necropsy documentation; and public identification. (Poster)

## PREVENTING POWER LINE COLLISIONS - USING NOVEL TECHNIQUES TO HELP PROTECT ENDANGERED SEABIRDS ON KAUAI

Marc S. Travers<sup>1</sup> (marc.s.travers@gmail.com) Andre F. Raine<sup>1</sup>

<sup>1</sup>Kauai Endangered Seabird Recovery Project, PO Box 81, Hanapepe 96716, Kauai, HI.

After four years of seabird monitoring on Kauai we have determined that Newell's Shearwaters and Hawaiian Petrels regularly collide with power lines. Furthermore, the vast majority of these incidents are focused on discrete and defined areas, meaning that minimization efforts can be concentrated in these areas with maximum effect. A primary reason for the collisions is that these seabirds fly over land in near or complete darkness, making it difficult for the birds to detect and avoid the wires. Allowing the birds to see the lines, while not being attracted to them in the process, is therefore key to ameliorating the problem. To this effect we have begun experimenting with LASER 'fences' and bird diverters to allow the birds to detect and avoid the power lines. A prototype LASER was developed that projects 7 beams, stacked vertically, between two poles, making a visible obstruction that the birds should detect and avoid. Similarly, we have begun experimenting with mounting bird diverters (reflective plates) on the wires to increase wire detection and avoidance. Here we will report the preliminary results of this experimental minimization work and discuss future directions for these efforts. (Talk)

## REEVALUATING HATCH DATE AS A PROXY OF INDIVIDUAL QUALITY: A CASE FROM THE LEACH'S STORM-PETREL

Chris W. Tyson<sup>1</sup> (cwtyson@ucdavis.edu) Brian A. Hoover<sup>1</sup> Sarah L. Jennings<sup>1</sup> Gabrielle A. Nevitt<sup>1</sup>

<sup>1</sup>University of California, Davis, One Shields Ave Davis, California 95616 USA.

A seasonal decline in reproductive performance is thought to be common among seabirds. Based on this relationship, hatch date is frequently used as a proxy for individual quality. If hatch date is a meaningful indicator of quality, then pairs should display low interannual variation in this trait, yet few studies have assessed within-pair consistency across multiple years. We evaluated this hypothesis using five years of hatch date data from 436 pairs of Leach's storm-petrels (*Oceanodroma leucorhoa*) breeding on Bon Portage Island, Nova Scotia. Hatch dates were earliest in all years for pairs that fledged five chicks (two way repeated measures ANOVA:  $F = 2.819$ ,  $Df = 4$ ,  $p\text{-value} = 0.025$ ). Within-pair variation in hatch dates, however, was not significantly different between the most productive pairs and the pairs with only two chicks (two sample t-test:  $t = 0.417$ ,  $df = 18.163$ ,  $p\text{-value} = 0.681$ ). In light of the observed low hatch date consistency, we examined the relationship between hatch date and the rate of the first two weeks of chick growth. Hatch date was only weakly, negatively correlated with growth curve slope when controlling for year (linear model hatch date coefficient estimate =  $-0.013 \pm 0.002$ ,  $t = -7.767$ ,  $p\text{-value} < 0.001$ ). This suggests that while the most productive pairs typically hatch chicks earlier as a group, the within-pair consistency of this trait is similar to less productive pairs. Leach's storm-petrel hatch dates on Bon Portage are highly asynchronous compared to other colonies, suggesting that hatching is less constrained on this island. These findings highlight the importance of ecological context when using reproductive measures, such as hatch date, as metrics of individual quality. (Talk)

## ORNITHOLOGY FOR THE BLIND BY TOUCH CARVING (TOOLS TO RECOGNIZE BY TOUCHING)

Haruo Uchiyama<sup>1</sup> (rakudowd78@mocha.ocn.ne.jp)

<sup>1</sup>Japan Bird Carving Association, 636-2, Furudo, Abiko, Chiba 270-1111 Japan.

My name is Haruo Uchiyama, creator of the original decoy of the Short-Tailed Albatross (*Diomedea albatrus*). I am authorized as the Modern Master Craftsman by the Japanese Government in 2006. In 2011, I received a letter of appreciation from the USFWS for work with the endangered Short-tailed Albatross (*Diomedea albatrus*) in Midway Island. I will first introduce how I work with middle school students to produce the carvings that help to expand safe nesting areas for Little Tern (*Sterna albifrons*). Over the past 35 years I have provided carvings for museums all over Japan, to protect wild birds from being killed for the making of stuffed bird exhibits. In the museums the exhibits are behind glass cases and cannot be accessed by those who are blind. Learning about wild birds by touching is a very rare opportunity for blind people. Being able to experience scientifically accurate carvings opens the door to the world of ornithology. At the school for the blind, I made “Yardstick Birds” which are used in the class to teach them about common backyard birds. Through a general understanding of the shape of these birds, the students can then go on to learn about other birds. I have been developing this project for the blind for over 23 years and it has incorporated concepts of evolution using Charles Insectivorous Tree Finch (*Camarhynchus pauper*). Through discussing how the birds continue to evolve, I hope to inspire the students to explore their own skills and keep expanding their own paths in life. (Talk)

## DEVELOPMENT OF A MAP OF SEABIRD VULNERABILITY TO POTENTIAL OFF-SHORE WIND FARMS

Tatsuya Ura<sup>1</sup> (ura@wbsj.org)

<sup>1</sup>Wild Bird Society of Japan, 3-9-23 Nishi-gotanda, Shinagawa-ku, Tokyo 141-0031 Japan.

Wind power is attracting attention as a renewable energy source and is developing worldwide. In Japan, private businesses are planning to build large-scale offshore wind farms in Hokkaido, Aomori, Ibaraki, Niigata, and Yamaguchi. Japanese conservation groups argue that the vulnerability of seabirds to offshore wind farms should be taken into account when choosing the farm location. Thus, the Wild Bird Society of Japan developed and released a vulnerability map of seabirds to offshore wind farms in Nemuro and Haboro in Hokkaido. A species sensitivity index (SSI) consisting of the following nine variables, each assigned five levels, was developed: (a) flight maneuverability, (b) flight altitude, (c) percentage of time flying, (d) nocturnal flight activity, (e) disturbance by ship and helicopter traffic, (f) flexibility in habitat use, (g) biogeographical population size, and (h) adult survival rate. Variables (a), (b), and (c) comprise measurement data, while the remaining are secondary data. SSIs are then incorporated into seabird distribution data obtained from field studies to determine a wind farm sensitivity index (WSI) for each observation point, which can then be used to develop a vulnerability map. We found that SSIs are high in ducks, loons, shearwaters, cormorants, seagulls, and white-tailed sea eagles. The WSIs calculated based on these SSIs show that the proximity of wind farms to the coast increases the vulnerability of the seabirds. Because of the significant seasonal variation in the species inhabiting Japan, monthly field studies should be conducted to obtain accurate WSIs and develop a reliable vulnerability map. (Talk)

## TRANSLOCATION OF LAYSAN ALBATROSSES FROM THE PACIFIC MISSILE RANGE FACILITY ON KAUAI TO JAMES CAMPBELL NATIONAL WILDLIFE REFUGE ON OAHU

Eric A. VanderWerf<sup>1</sup> (ewerf@hawaii.rr.com) C. Robby Kohley<sup>1</sup> Lindsay C. Young<sup>1</sup> Tom Savre<sup>2</sup> Jared Underwood<sup>3</sup> Joe Schwagerl<sup>3</sup>

<sup>1</sup>Pacific Rim Conservation, P.O. Box 61827, Honolulu, HI.

<sup>2</sup>U.S. Navy, Pacific Missile Range Facility, Kekaha, HI.

<sup>3</sup>U.S. Fish and Wildlife Service, Oahu/Maui NWR Complex, P.O. Box 429, Kahuku, HI.

Over 99% of Laysan Albatrosses nest on atolls < 2 meters in elevation, where they are at risk from sea level rise. Establishing new high-island colonies is among the highest priority conservation actions for this species. Laysan Albatross began nesting on the U.S. Navy Pacific Missile Range Facility (PMRF) on Kauai in the 1970s, where they are a bird air strike hazard and their eggs are legally removed. Of 76 eggs collected from PMRF in 2014, 51 were viable; we placed eight eggs in foster nests on Kauai and translocated 43 to Oahu in an attempt to create a new colony at James Campbell National Wildlife Refuge (JCNWR), where a parcel of coastal land is managed as seabird nesting habitat. We incubated the eggs in an incubator, and then a few days before hatching we placed them temporarily with foster parents at Kaena Point. We moved the chicks to JCNWR when they were four weeks old and raised them by hand until fledging. Chicks were fed daily on a diet of pureed fish, squid, pedialyte, fish oil, and vitamins. Hatching rate of eggs on Oahu was low (10/41 eggs), but every chick raised at JCNWR fledged. We expect these birds to begin returning to JCNWR in 3-5 years and to start nesting there in 5-8 years. We also used social attraction involving decoys and a sound system at JCNWR, which resulted in 119 visits by up to five adult albatross. This project represents an opportunity to accomplish an important conservation action for the Laysan Albatross and to help solve a human-wildlife conflict. (Talk)



## INCREASE IN WEDGE-TAILED SHEARWATERS AND CHANGES IN SOIL NUTRIENTS FOLLOWING CONSTRUCTION OF A PREDATOR-PROOF FENCE AT KAENA POINT, HAWAII

Eric A. VanderWerf<sup>1</sup> (ewerf@hawaii.rr.com) Lindsay C. Young<sup>1</sup> Susan Crow<sup>2</sup> Eryn Opie<sup>2</sup> Hironao Yamazaki<sup>2</sup> Chris Miller<sup>3</sup>

<sup>1</sup>Pacific Rim Conservation, P.O. Box 61827, Honolulu, HI 96839.

<sup>2</sup>University of Hawaii, Dept. of Natural Resources and Environmental Management, Honolulu, HI 96822.

<sup>3</sup>Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife, Honolulu, HI, USA.

A predator-proof fence was built at Kaena Point Natural Area Reserve, Hawaii in 2010 as part of an ecosystem restoration project. All non-native mammalian predators were removed and are now excluded. Non-native plants are being removed and native species are being outplanted. We monitored abundance and reproduction of Wedge-tailed Shearwaters (*Puffinus pacificus*), collected soil samples before and after fence construction, and examined the relationship between changes in shearwater numbers and soil nutrients. Shearwater numbers have increased over time, from 11 young produced in 1994 to 3,419 in 2015. The average number of shearwaters produced during the three years before and after fence construction increased from  $614 \pm 249$  to  $2359 \pm 802$  (384%). The average number of shearwater pairs attempting to nest also increased during the same periods, from  $3,265 \pm 827$  to  $4,726 \pm 826$  (45%). Soil samples from 2010 and 2013 showed an overall decline in concentration of ammonium ( $\text{NH}_4^+$ ) and no change in concentration of nitrate ( $\text{NO}_3^-$ ) or orthophosphate ( $\text{PO}_4^{3-}$ ). However, there was a positive relationship between changes in shearwater numbers and changes in ammonium. Examination of spatial patterns in nutrient abundance using GIS showed that the highest nutrient concentrations occurred in areas dominated by the non-native nitrogen-fixing plants *Leucaena leucocephala* and *Prosopis pallida*. Removal of these plants caused local nutrient declines, but increases in shearwater numbers have countered this at some points. We anticipate that shearwaters and other seabirds will replace non-native plants as the dominant source of nitrogen and phosphorous and facilitate recovery of a native-dominated plant assemblage. (Talk)

## SPATIAL ASSOCIATION AMONG SEABIRDS AND ACOUSTICALLY DETECTED PREY OFF THE MID ATLANTIC COAST

Richard R. Veit<sup>1</sup> (rrveit23@gmail.com)

<sup>1</sup>College of Staten Island/CUNY, 2800 Victory Boulevard, Staten Island, NY 10306.

<sup>2</sup>Biodiversity Research Institute, 652 Main St., Gorham, ME04038.

We surveyed seabirds from a 55-foot charter vessel off the coasts of Delaware, Maryland, and Virginia over two years (April 2012 to April 2014), and quantified abundance of their prey using a hull-mounted echo sounder. Our objective was to identify areas of importance to foraging birds. As part of this objective, we sought to identify areas where seabirds concentrated due to the abundance or availability of prey. Most of the area we surveyed was within 75 km of the coast, and within the 30 m isobath, allowing us to collect hydroacoustic data in all but roughly the top 5 m of the water column. We found strong association between Northern Gannets (*Morus bassanus*) and Laughing Gulls (*Leucophaeus atricilla*) and acoustically detected prey; and significant but less consistent association for Common and Royal Terns (*Sterna hirundo* and *Thalasseus maximus*). Distribution and relative abundance of prey fishes are clear drivers affecting seabird distributions. This analysis supplements our other modeling efforts by explicit consideration of the role of seabird prey in determining the spatial distribution of birds. The time series methods presented here yields patterns not evident in the models because we allow for spatial lags between seabirds and prey. Further, this analysis is the only one in which all data were collected in real time from the boat, rather than from remote sensing (which averages over time periods much larger than that of the surveys). (Talk)

## TEMPORAL VARIATION IN COLONY ATTENDANCE OF CRESTED AUKLETS

Christy N. Wails<sup>1</sup> (C.Wails@unb.ca) Heather L. Major<sup>1</sup> Ian L. Jones<sup>2</sup>

<sup>1</sup>University of New Brunswick, Saint John, PO Box 5050, Saint John NB E2L 4L5.

<sup>2</sup>Memorial University, 230 Elizabeth Ave, St. John's, NL A1B3X9 Canada.

Seabird colony attendance during the breeding season is driven by reproductive obligations, resulting in regular and predictable attendance patterns. However, less is known of visits to colonies outside of the breeding season and the factors influencing them. This project explores the annual colony attendance of Crested Auklets (*Aethia cristatella*) at Gareloi Island, AK between 2013 - 2015. In 2013 and 2014, 95 Crested Auklets were fit with uniquely coded radio tags and radio receivers recorded the duration of visits to the colony from July 2013 to June 2015. In total, 40 Crested Auklets were detected regularly and we compared the duration of their colony trips in R using GLMMs. On average, adults spent more than twice as much time at the colony during evening hours than during the day (43 hr 35 min and 17 hr 12 min, respectively). During the breeding season, females spent more time total at the colony than males (52 hr 22 min and 35 hr 37 min, respectively) and average trip length duration varied with nesting chronology and between sexes. A smaller subset of these individuals ( $n = 13$ ; 69.2% female and 23.1% male) were detected during the winter and the length of time spent at the colony was shorter than during the breeding season (10 min and 45 hr 56 min, respectively). Our preliminary results suggest colony attendance of adult auklets differs temporally and may be related to sex-specific roles in life history strategies for this species. (Talk)

# TAGGED, TRACKED, AND MODELED: HOW TECHNOLOGICAL ADVANCES CAN IMPROVE OUR UNDERSTANDING OF ARCTIC SEABIRD DISTRIBUTION ON MULTIPLE SPATIOTEMPORAL SCALES

Travis B. White<sup>1,2</sup> (twhite@savewildlife.com) H. Grant Gilchrist<sup>1,2</sup> Michael Janssen<sup>2</sup> Kyle Elliott<sup>3</sup> Thomas Lazarus<sup>3</sup> Graham Sorenson<sup>4</sup> Lenore Fahrig<sup>1</sup> Mark L. Mallory<sup>5</sup>

<sup>1</sup>Department of Biology, Carleton University, 1125 Colonel By Dr, Ottawa, Ontario, K1S5B6, Canada.

<sup>2</sup>Environment Canada S&T, National Wildlife Research Center, 1125 Colonel By Drive, Ottawa, Ontario, K1A0H3, Canada.

<sup>3</sup>Department of Natural Resource Sciences, McGill University, 2111 Lakeshore Road, Ste. Anne de Bellevue, Quebec, H9X3V9, Canada.

<sup>4</sup>Department of Biology, University of Windsor, 401 Sunset Ave., Windsor, Ontario, N9B3P4, Canada.

<sup>5</sup>Department of Biology, Acadia University, 15 University Ave, Wolfville, Nova Scotia, B4P2RC, Canada.

Many marine spatial planning (MSP) initiatives are underway to protect wildlife resources while allowing sustainable development in the Canadian Arctic. Industrial interest in the Arctic is increasing, yet our knowledge of the spatiotemporal distribution of marine wildlife in this region is generally poor. Scientific survey data to inform credible habitat assessments are limited in number or outdated. Recent advancements in miniature telemetry technologies are providing new ways to derive data and help address this information gap. In this paper, we highlight three key areas of ongoing research. First, we present a comprehensive assessment of spatiotemporal marine habitat use by seabirds in the Canadian Arctic representing 12 species tracked between 1999-2013 allowing hotspot analyses on a foraging guild level (i.e. Pelagic Divers, Pelagic Surface-feeders, Seaducks). Second, we show an inter-colony comparison of foraging ranges of Thick-billed Murre (*Uria lomvia*) tracked (GPS) at four arctic colonies between 2012-2015. Lastly, we investigate space partitioning by subcolonies of Thick-billed Murre during chick-provisioning at Digges Island, Canada. Results to date have implications for MSP in the Canadian Arctic across varying spatiotemporal scales, principally, in relation to increased shipping traffic. We discuss the need for multi-year and multi-colony studies using large samples of telemetered individuals whenever conducting research on Arctic seabirds. Coupled with ever improving environmental data, movement and distribution data will collectively improve the capacity of scientists and marine planners to make informed decisions on how Arctic waters should be managed. (Talk)

## THE MURRELET FORMERLY KNOWN AS XANTUS: CURRENT RANGEWIDE DISTRIBUTION AND ABUNDANCE OF SCRIPPS'S MURRELET

Darrell L. Whitworth<sup>1</sup> (darrellwhitworth@ciesresearch.org) Harry R. Carter<sup>1</sup> Josh S. Koepke<sup>1</sup>

<sup>1</sup>California Institute of Environmental Studies, 3408 Whaler Avenue, Davis, CA 95616, USA.

In 2002-2015, we assessed the distribution and population size of Scripps's Murrelet (*Synthliboramphus scrippsi*; SCMU) at all known or suspected breeding islands off southern California and northwestern Baja California. We found SCMU at 12 of 16 islands surveyed using: (1) nocturnal spotlight surveys of murrelets attending at-sea congregations beside nesting areas; (2) at-sea captures; and (3) nest searches. SCMU population estimates at southern California islands were: Anacapa (550-725 breeding pairs [bp]; 2014), Santa Barbara (475-650 bp; 2010), Santa Cruz (125-550 bp; 2004), Santa Catalina (125-175 bp; 2012, 2014), San Miguel (40-60 bp; 2015), and San Clemente (50-75 bp; 2008, 2013-2015). Small numbers of Guadalupe Murrelets (*S. hypoleucus*; GUMU) consistently occurred at San Clemente, but nests were not found. In Baja California, population estimates were: Coronado (525-700 bp; 2005), Todos Santos (125-175 bp; 2005) and San Jeronimo (< 25 bp; 2008). GUMU and/or Craveri's Murrelets (CRMU; *S. craveri*) occurred with SCMU at San Benito (150-225 bp; SCMU, GUMU; 2002), San Martin (25-50 bp; SCMU, GUMU, CRMU; 2008), and Cedros (50-275 bp; SCMU, CRMU; 2007). SCMU were not found at Santa Rosa (2004), Guadalupe (2007; GUMU only), Asuncion (2007; CRMU only) or San Roque (2007; CRMU only). SCMU nests were found at 10 of the 12 islands, but not Cedros and San Martin. Spotlight surveys have established baseline data for determining future population trends at many islands. Except for population increases at Anacapa after the eradication of Black Rats (*Rattus rattus*) in 2002, trends at most other islands are poorly known. (Talk)

DO FISHERY CONSERVATION MEASURES REALLY WORK? A STORY OF GILLNET FISHERIES AND MARBLED MURRELETS (*BRANCHYRAMPHUS MARMORATUS*) IN THE SOUTHERN SALISH SEA

Amilee Wilson<sup>1</sup> (Amilee.Wilson@noaa.gov)

<sup>1</sup>NOAA FISHERIES, 510 Desmond Dr SE, Suite 103, Olympia, Washington 98512.

A Geographic Information Systems (GIS) mapping project was initiated among various Federal, State and Tribal entities to examine whether there may be a correlation between declining marbled murrelet (*Branchyramphus marmoratus*) population trends and increasing gillnet fishery landings in the Southern Salish Sea within Washington State. The GIS project compared marbled murrelet population densities with commercial and recreational gillnet fisheries catch area landings provided by the Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife. From 2001 to 2014, analyses showed that catch effort for both tribal and non-tribal gillnet fisheries has generally decreased in areas with high historical presence of marbled murrelet. In marine catch areas with historically low fishery catch effort and low presence of marbled murrelet, gillnet fishery efforts have increased overall but interactions with marbled murrelets have decreased over time. Furthermore, review of gillnet fishery information has shown that implementation of both mandatory and voluntary conservation measures in tribal and non-tribal gillnet fisheries have contributed to lowering the risk of interactions with marbled murrelets in the Southern Salish Sea. (Talk)

## DUAL MIGRATION PATTERNS OF ANCIENT MURRELETS BREEDING IN HAIDA GWAI, CANADA

Laurie Wilson<sup>1</sup> (laurie.wilson@ec.gc.ca) Yuriko Hashimoto<sup>1</sup> Erika Lok<sup>1</sup> Dan Shervill<sup>1</sup> Anthony Gaston<sup>2</sup>

<sup>1</sup>Environment Canada, Canadian Wildlife Service, Delta, BC, Canada, V4K 3N2.

<sup>2</sup>Environment Canada, Science and Technology Branch, Ottawa, ON, Canada, K1A 0H3.

The Haida Gwaii archipelago in British Columbia, Canada supports about half of the world's breeding population of Ancient Murrelets, *Synthliboramphus antiquus*. Migration routes and staging areas were determined using tracklogs from geolocators deployed on breeding adults from 4 colonies in 2014. Forty-eight were recovered (23 from Susk Gwaii and Hippa Island on the west coast of Graham Island, and 25 from George and Reef Islands on the east coast of Moresby Island). Initially, most birds moved to the Bering Sea in July-August. Thereafter, two distinct migration strategies were observed. About two-thirds of adults from most colonies continued to the west, via the Kuril Islands and the Sea of Okhotsk, to spend December-February in the Yellow Sea or Sea of Japan. The remainder returned south along the west coast of N America in October to over-winter in waters from British Columbia south to California. Both sets of birds returned to Haida Gwaii in March, when breeding commences. This species is the only one known to migrate across the entire width of the North Pacific. The reason for the existence of different wintering areas, about 8000 km apart, among birds from the same colony warrants further investigation. Our findings help to assess potential risks for the Haida Gwaii population and have implications for recovery planning for this Species of Concern. (Talk)

## ASSESSMENT OF THE AT-SEA DISTRIBUTIONS OF SEABIRDS IN THE MAIN HAWAIIAN ISLANDS TO INFORM SPATIAL PLANNING

Arliss J. Winship<sup>1 2</sup> (arliss.winship@noaa.gov) Brian P. Kinlan<sup>1 2</sup> Matthew Poti<sup>1 2</sup> Bryan M. Costa<sup>1 2</sup> Lisa T. Ballance<sup>3 4</sup> Trevor W. Joyce<sup>4</sup> Timothy White<sup>1 2</sup> Robert W. Rankin<sup>5</sup> Peter I. Miller<sup>6</sup> Simon J. Pittman<sup>1 2 7</sup>

<sup>1</sup>NOAA NOS NCCOS Biogeography Branch and CSS-Dynamac, Silver Spring, MD, USA.

<sup>2</sup>CSS-Dynamac, Inc., Fairfax, VA, USA.

<sup>3</sup>NOAA NMFS Southwest Fisheries Science Center and Scripps Institution of Oceanography, UC San Diego, La Jolla, CA, USA.

<sup>4</sup>Scripps Institution of Oceanography, UC San Diego, La Jolla, CA, USA.

<sup>5</sup>Murdoch University Cetacean Research Unit, Perth, Australia.

<sup>6</sup>Plymouth Marine Laboratory, Plymouth, UK.

<sup>7</sup>Marine Institute, Plymouth University, Plymouth, UK.

As part of a marine Biogeographic Assessment of the Main Hawaiian Islands (MHI) to inform spatial planning for renewable energy development, we characterized the at-sea spatial distributions of 24 species of seabirds around the MHI, including 19 breeding species and 5 non-breeding visitors. We analyzed visual sightings data from U.S. National Oceanic and Atmospheric Administration ship surveys conducted between 1989 and 2012. For 14 species with sufficient numbers of sightings we developed environmental-based spatial models of their at-sea distribution throughout the U.S. Exclusive Economic Zone surrounding the MHI. A range of geographic, bathymetric, oceanographic, atmospheric, and biological predictor variables were considered. For each model we evaluated its statistical performance, assigned it a quality class, and quantified uncertainty in its predictions. For the other 10 species we combined the at-sea sightings data with information about terrestrial site locations and foraging ranges to characterize their at-sea distribution. We will present results for example species and discuss how the information can be interpreted to help guide marine spatial planning and minimize potential conflict between human activities such as renewable energy development and seabirds. We will also discuss data gaps where future research effort could be focused. (Talk)



## DIFFERENCES IN BREEDING STRATEGY OF DOVEKIE MALES AND FEMALES

Katarzyna Wojczulanis-Jakubas<sup>1</sup> (biokwj@univ.gda.pl) Dariusz Jakubas<sup>1</sup>

<sup>1</sup>University of Gdańsk, Wita Stwosza 59, 80-308 Gdańsk, Poland.

Bi-parental care is an obligatory breeding system in seabirds, with usually males and females contributing equally to raise the offspring successfully. However, basic sex differences in anatomy and physiology impose difference in selective pressure on the two sexes, so males and females are expected to behave differently, and exhibit different parental strategies. To resolve this apparent paradox, detailed behavioural studies that might reveal subtle but meaningful differences in parental performance are needed. We studied parental investments of males and females in a pelagic Arctic seabird, the dovekie (little auk, *Alle alle*). To evaluate total parental investments we examined not only basic parental activities (incubation, chick feeding) but also time-budget (duration of foraging trips and time spent in the colony) and body condition of the birds throughout the whole breeding season. We found that although the two sexes shared the basic activities equally, females tended to engage less with the progress of the breeding season. The males also spent more time than females in the colony (less at the foraging grounds) at each of the breeding stages. Despite apparently male-biased parental efforts, we did not observe significant sex differences in body condition. In fact, we found females to be in a worse shape in some seasons. That suggests sex-specific response to environmental variability, and we that explored in detail. (Talk)

## FLIGHT PATHS OF SEABIRDS SOARING OVER THE OCEAN SURFACE ENABLE MEASUREMENT OF FINE-SCALE WIND SPEED AND DIRECTION

Yoshinari Yonehara<sup>1</sup> (yonehara@aori.u-tokyo.ac.jp) Yusuke Goto<sup>1</sup> Ken Yoda<sup>2</sup> Yutaka Watanuki<sup>3</sup>  
Lindsay C. Young<sup>4</sup> Katsufumi Sato<sup>1</sup> Henri Weimerskirch<sup>5</sup> Charles-André Bost<sup>5</sup>

<sup>1</sup>The University of Tokyo, Atmosphere and Ocean Research Institute, 5-1-5 Kashiwanoha Kashiwa, Chiba, Japan.

<sup>2</sup>Nagoya University, Furo, Chikusa, Nagoya, Japan.

<sup>3</sup>Hokkaido University, Minato, Hakodate, Japan.

<sup>4</sup>Pacific Rim Conservation, Honolulu, HI 96822, USA.

<sup>5</sup>Centre d'Etudes Biologique de Chize, Centre National de la Recherche Scientifique, 79360 Villiers en Bois, France.

Ocean surface winds are one of the essential factors in understanding physical interactions between the atmosphere and ocean. Surface winds measured by satellite scatterometers and buoys cover most of the global ocean, however, there are still spatial and temporal gaps and finer scale variations of wind might be overlooked. Here we show that flight paths of soaring seabirds can be used to estimate fine-scale (every 5 min, <5 km) ocean surface winds. Fine-scale GPS positional data (1 point/sec) of streaked shearwater (*Calonectris leucelas*), Laysan albatross (*Phoebastria immutabilis*), and wandering albatross (*Diomedea exulans*) revealed that soaring seabirds flew tortuously and ground speed fluctuated due to tailwinds and headwinds. Taking advantage of the ground speed difference in relation to flight direction, we reliably estimated wind speed and direction that the bird experienced. These bird-based winds were significantly correlated with wind estimated by satellite-borne scatterometers. Furthermore, extensive travel distances and flight durations enabled a wide range of high temporal resolution wind observations, especially in coastal areas. Our study suggests that seabirds can be a new platform to measure ocean surface winds potentially complementing conventional wind measurements by covering spatial and temporal measurement gaps as a living anemometer. (Talk)

## RENOVATING THE ROOST: RESULTS FROM THE FIRST HAWAIIAN PETREL TRANSLOCATION AT KILAUEA POINT NATIONAL WILDLIF REFUGE

Lindsay C. Young<sup>1</sup> (lindsay@pacificrimconservation.com) Andre F. Raine<sup>2</sup> C. Robby Kohley<sup>1</sup>  
Michael Mitchell<sup>3</sup> George Wallace<sup>4</sup> Jessica H. Behnke<sup>5</sup> Kimberly Uyehara<sup>3</sup> Eric A. VanderWerf<sup>1</sup>  
Marilou Knight<sup>1</sup>

<sup>1</sup>Pacific Rim Conservation, PO Box 61827, Honolulu, HI, 96839.

<sup>2</sup>Kauai'i Endangered Seabird Recovery Project, 3900 Hanapepe Rd, Hanapepe, HI, 96716.

<sup>3</sup>US Fish and Wildlife Service, Kauai National Wildlife Refuge Complex, Po Box 1128, Kilauea, HI, 96754.

<sup>4</sup>American Bird Conservancy, PO Box 1128, The Plains, VA, 20198 .

<sup>5</sup>Kauai Seabird Habitat Conservation Program, 4272B Rice Street, Lihue, HI 96766.

The Hawaiian Petrel (*Pterodroma sandwichensis*) is listed as Endangered under the US Endangered Species Act and is declining due to habitat degradation, predation by introduced mammals and Barn Owls (*Tyto alba*), and collisions with structures often exacerbated by light attraction. Translocation to protected breeding sites with social attraction was proposed in the 1983 recovery plan and was ranked as priority one in the 2011 interagency 5-year Action Plan. In 2012, funding became available to begin preparing for translocations to Kilauea Point National Wildlife Refuge. A peer-reviewed translocation plan was developed based on protocols used in New Zealand. A predator proof fence was completed in September 2014 and all non-native mammals were removed from the 7-acre fenced area by January 2015. In August 2015 habitat restoration began and 50 artificial burrows were installed. In November 2015, 10 petrel chicks that had not emerged from their montane burrows were removed by hand and transported via helicopter to the refuge and were hand-fed a fish, oil, Pedialyte and squid mixture until they fledged; fledging rate in year one was 90%. In subsequent years, 20 petrels will be translocated for a minimum total of 90 birds. In 2016 Newell's Shearwater (*Puffinus newelli*) translocations are planned to begin. Once complete, this project is expected to result in a new, secured and accessible breeding population of Hawaiian Petrels that will be crucial along with other protected and managed colonies in helping to prevent the extinction of this species and restoring a missing component of the coastal ecosystem in Hawaii. (Talk)

## CHINESE CRESTED TERN BREEDING POPULATION IN MATSU ISLANDS, TAIWAN

Hsiao-Wei Yuan<sup>1</sup> (hwyuan@ntu.edu.tw) Chung-Hang Hung<sup>1</sup> Le-Ning Chang<sup>1</sup>

<sup>1</sup>School of Forestry & Resource Conservation, National Taiwan University, Taipei, Taiwan.

The Chinese Crested Tern (*Thalasseus Bernsteini*) is listed as rare and endangered species in the world Red Data Book. Matsu, Wuzhishan and Jiushan Archipelagos are their three confirmed breeding sites. We have investigated their population size and breeding success at Matsu Islands Tern Refuge since 2000. We found the Chinese Crested Tern breeding population were always with the Greater Crested Terns (*T. bergii*), and they changed breeding islands frequently. In 2011 we started to deploy wireless real-time visual surveillance system, auto time lapse cameras and decoys at Matsu Islands Tern Refuge. In 2011-2014 we found both Chinese Crested Terns and Greater Crested Terns abandoned their nests at the beginning of the breeding season with the possible reasons of predation stress from mice, weather condition and human disturbance. With the predator removal and habitat management conducted before the breeding season in May 2015, we had the most successful Chinese Crested Tern breeding season (13 adults and 4 chicks) on Tiejien Island since 2011. In order to restore the cross-strait Chinese Crested Tern population, we proposed conservation recommendations to the local authorities including habitat management, predator removal, satellite tracking and deploying decoy with audio playback devices. (Talk)

## DEVELOPING QUANTITATIVE MEASURES OF RISK USING SPATIAL AND TEMPORAL OVERLAP IN MARINE DATA SETS FROM NEARSHORE OREGON AND WASHINGTON - AN ECOLOGICAL EXAMPLE WITH SEABIRDS AND SALMON

Jeannette E. Zamon<sup>1</sup> (jen.zamon@noaa.gov) Brian Burke<sup>1</sup> Mary Hunsicker<sup>1</sup> David Teel<sup>1</sup>  
Elizabeth M. Phillips<sup>2</sup>

<sup>1</sup>NOAA Fisheries - NWFSC, PO Box 155, Hammond, OR 97121 USA.

<sup>2</sup>University of Washington - School of Aquatic and Fisheries Sciences, Box 355020 Seattle, WA 98195-5020 USA.

One common, practical objective of marine spatial planning analyses is to integrate multiple, spatially-explicit data sets to assess the probability that two or more potentially conflicting distributions or activities will overlap in space and time. Ideally, quantitative measures of risk from such analyses will inform management decisions so as to avoid or minimize undesirable effects of ocean energy development or fisheries activities. We present an example quantifying risk for an analysis investigating predation on juvenile salmon by seabird predators. Although this work is motivated by a need to understand risk factors affecting early marine survival of fish, we believe this approach may be useful for measuring other types of risk relevant to estimating impacts of stressors in a marine spatial planning context. We applied two-stage, spatially-explicit models to measure overlap between seabirds and salmon and to assess environmental covariates (e.g. distance from shore, salinity, chlorophyll-a, distance to seabird colony) for association with spatial structure. Synoptic seabird and salmon surveys in May and June of 2003-2012 revealed that two species of seabirds (common murre *Uria aalge* and sooty shearwaters *Puffinus griseus*) accounted for  $\geq 80\%$  of birds counted between Newport, OR and the US-Canadian border in northern Washington. Model results provide a quantitative index of predation risk for the region of interest and more broadly offer indices of multi-species interactions which may be applicable in marine spatial planning contexts. (Talk)

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