

PACIFIC SEABIRD GROUP



Melinda Nakagawa

FORTY-SECOND ANNUAL MEETING: **A FUTURE FOR SEABIRDS**

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ABSTRACT BOOK

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STANDARDIZED MONITORING OF ASHY STORM-PETREL CAPTURE–RECAPTURE RATES IN THE CHANNEL ISLANDS NATIONAL PARK

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Channel Islands National Park (CINP) provides essential nesting habitat for greater than half the world's population of breeding Ashy Storm-Petrel (*Oceanodroma homochroa*). Currently, information is required to maintain, enhance, and standardize Ashy Storm-Petrel monitoring to determine trends in relative population size. Since 1975, capture-recapture efforts using mist-netting methods were conducted sporadically using varying techniques (i.e., mist-netting with and without broadcast vocalizations). No formal guidelines exist describing a standardized, repeatable approach. During 2004-07, I conducted mist-netting surveys (47 site-nights) targeting Ashy Storm-Petrels at three colony sites: Scorpion Rock off Santa Cruz Island, Santa Barbara Island, and Prince Island off San Miguel Island. I recorded 1,178 unique Ashy Storm-Petrel captures with 35 (2.9%) recaptures of previously banded storm-petrels. Power to detect 30% lesser mean standardized catch per unit effort (CPUEs) at equivalent sample size and $\alpha = 0.15$ (85% CI), was variable across islands and years, from 39% (Prince Island 2005) to 87% (Santa Barbara Island 2005). Overall, based on, I estimated power = 96% to detect a 30% lesser CPUEs. Five to 42 site-nights at individual islands/years, or a minimum 21 site-nights across islands would be required to achieve 80% power to detect a 30% lesser CPUEs. Among relatively dark nights, we found that moon index did not significantly affect capture rate. Proxy wind-speed also did not significantly affect capture rate. CPUEs can be further improved and used for evaluating trends in relative abundance—essential for tracking conservation status and restoration efforts aimed at providing a future for Ashy Storm-Petrel.

Talk



BIOLOGY AND DISTRIBUTION OF ASHY STORM-PETREL

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Current knowledge on the colony and at-sea distribution of the Ashy Storm-Petrel will be presented, with much new information. The issue of source vs sink populations will be discussed with regard to the two large colonies at the Farallones and Channel Islands, and dozens of smaller colonies along the coast.

Talk

ASHY STORM-PETREL RANGEWIDE SCIENCE AND CONSERVATION: INTRODUCTION

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The Ashy Storm-Petrel (*Oceanodroma homochroa*), similar to most other storm-petrels in the region (8 forms), is endemic and relatively rare (<15,000 breeding birds) occurring from northern California to central west Baja California (51 known breeding locations). Nesting habitat is limited, and at certain colonies may facilitate 'floating populations' of mature non-breeders. Five geographically-separated population concentrations contribute disproportionately to the total breeding population. The largest concentration is at the South Farallones off central California but similar numbers are spread through 4 smaller concentrations in the southern California Channel Islands (San Miguel Island Area, NW and NE Santa Cruz Island, Santa Barbara Island area). Little is known about small populations in Baja California and parts of the central and northern California coasts. This special paper session has been developed to share recent information about status, biology and conservation in different parts of its range.

Talk



MEXICAN SEABIRDS: THE WAY FORWARD

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Mexico occupies the third place in the world in number of seabird species breeding or using the territorial waters and second regarding endemics, with 115 and eight species respectively. In the country there are more than 4000 islands, many of them with seabird colonies. However, there is a general lack of information about the current status of seabirds and it is necessary to prioritize where to focus the conservation efforts. In this talk we identify the main information gaps and where knowledge is urgently required, especially in the Mexican North Pacific, Tropical Pacific, Gulf of California, Gulf of Mexico and the Caribbean. Urgent research is needed to determine the population trend of the Alcids and Procellariids, as the last estimate for many species was done more than a decade ago. There is also a gap in the knowledge of the interaction of seabirds and fisheries in Mexican waters. We also present data of the status of seabirds in Mexico. Finally, it is important to work on the social aspect of seabird conservation. Many communities are located in the breeding grounds of the seabirds, and it is necessary to make these communities to adopt and make them feel as their own, in order to preserve and protect them.

Talk



WHY DO SEABIRDS YAWN? STRESSORS AND YAWNING IN NAZCA BOOBIES

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Yawning is a familiar and phylogenetically widespread phenomenon, but no consensus exists regarding its functional significance. We tested the hypothesis that yawning communicates to others a transition from a state of physiological and/or psychological arousal (for example, due to action of a stressor) to a more relaxed state. This arousal reduction hypothesis predicts little yawning during arousal and more yawning (above baseline) during and after down-regulation of arousal. Experimental capture-restraint tests with wild adult Nazca boobies (*Sula granti*), a seabird, increased yawning frequency after release from restraint, but yawning was almost absent during tests. Natural maltreatment by non-parental adults also increased yawning by nestlings, but only after the maltreatment ended and the adult left. CORT (corticosterone) was a logical a priori element of the stress response affecting the stressor-yawning relationship under the arousal reduction hypothesis, and cannot be excluded as such for adults in capture-restraint tests but is apparently unimportant for nestlings being maltreated by adults. The arousal reduction hypothesis unites formerly disparate results on yawning: its socially contagious nature in some taxa, its clear pharmacological connection to the stress response, and its temporal linkage to transitions in arousal between consciousness and sleep.

Talk



WIDESPREAD BREEDING FAILURE IN GULF OF CALIFORNIA BROWN PELICANS IN 2014

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Did a 2014 breeding failure of California Brown Pelicans (CABRPE) and other seabirds in the Gulf of California (GOC) portend a coming El Niño event, or was there more involved? A GOC seabird breeding failure in 2014 was essentially similar to negative responses observed in past ENSO events; yet, the intensity of breeding failure in 2014 was the most extreme observed in 46 years of CABRPE monitoring. Age-ratio data in post-breeding, dispersing pelican aggregations corroborated range-wide lack of fledged young in the GOC. An extreme, local warming event in the east-central region of the Pacific (GOC and western Baja California) was, interestingly, described and coined by oceanographic researchers as a California El Niño event and described as having begun in the spring and summer of 2014. But extensive warming did not develop into a more typical, Pacific-wide ENSO event (although developing conditions were still predicted by NOAA as an ENSO event for 2015). Southern California Bight CABRPE breeding effort in 2014 was extremely poor, as well, but the best in CABRPE range. Broader, wide-scale warming in the Pacific, extending from Hawaii to the Gulf of Alaska also developed during this period and has likely exacerbated the expected large-scale effects expected of a more typical ENSO event.

Talk



TRACKING THE TRACKED: A GLOBAL REVIEW OF THE EVOLUTION OF TECHNOLOGICAL MEASURES USED TO DESCRIBE SEABIRD BEHAVIORS AT SEA

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To better understand seabird movement behavior, we analyzed peer-reviewed literature on seabird biology using ISI Web of Science and available literature cited in relevant journal articles. Our analysis revealed the development of various methods used for studying individual seabirds at sea and applied to numerous populations worldwide. We compiled biological results from >367 peer-reviewed studies into a singular database and tabulated information pertaining to seabird species, study locations, data types provided, and methods employed. Whereas land or ship based observations have been ubiquitous, such platform-based observations are limited by their inability to define individual-specific metrics (e.g., foraging range) or to measure complex seabird behaviors (e.g., time at depth). With the evolution of technologically sophisticated tracking devices, including VHF radio transmitters, satellite tags, geolocation sensors, and GPS loggers, complicated movement behaviors and the influence of environmental conditions can now be measured in great detail providing a more comprehensive understanding of oceanographic area utilization, flight and foraging patterns, and environmental interactions. We found most studies focused on foraging behavior (62%, n=228) and diving ability (40%, n=174). Excluding penguins, 211 seabird species from 17 families have been studied, with the largest species tending to be the most studied. Meta-analyses of the compiled data will provide better understanding of regional and taxonomic variability in at sea behaviors, and allow for better evaluations of risks, vulnerabilities, and habitat requirements for seabirds at sea.

Poster



BIRDS OF A FEATHER FEED TOGETHER: EXPERIMENTAL EVIDENCE OF INTERSPECIFIC DIFFERENCES AMONG THREE BREEDING SEABIRD SPECIES IN THE USE OF LOCAL ENHANCEMENT TO LOCATE PREY

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During the breeding season, seabirds may employ many behavioural strategies to reduce the time/energy spent searching for patchily distributed prey. Breeding seabirds at Funk Island (northeast Newfoundland coast), primarily common murres (*Uria aalge*) and northern gannets (*Morus bassanus*), predominantly feed on capelin *Mallotus villosus*. Within foraging ranges, large capelin aggregations can be predictably located at shallow water (< 30 m) spawning sites during the spawning period (mid-late July), before which capelin are distributed in small, ephemeral schools. We conducted a field-based experiment by deploying seabird-mimicking plastic models, or 'decoys', during July 2009 and 2013 to determine whether breeding murres, Atlantic puffins (*Fratercula arctica*), and gannets use local enhancement prior to capelin spawning and whether this strategy becomes less important during capelin spawning. We used three treatments: 'Murre' (n=75 decoys), 'Gannet' (n=15), and 'Hotspot' (n=75 murre, n=15 gannet). Seabirds responded proportionally more to treatment relative to control (i.e. no decoys) periods, suggesting that all species used local enhancement. Murres and gannets responded primarily to decoy treatments with conspecifics present. Murres responded proportionally less during capelin spawning relative to pre-spawning, suggesting that murres may shift from local enhancement to memory-based searches under changing prey conditions. This, however, was not the case for gannets or puffins. Overall, we provide experimental evidence that seabirds use a variety of search strategies and show varying degrees of behavioural flexibility under changing prey conditions.

Talk



RISK MANAGEMENT FOR AT-RISK SEABIRDS: ASSESSING BYCATCH EFFECTS ON THE POPULATION DYNAMICS OF BLACK-FOOTED ALBATROSS (*PHOEBASTRIA NIGRIPES*)

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Although Black-footed albatross (BFAL) numbers have increased since they were decimated by feather hunters in the early 1900s, recently growth has slowed. Mortality associated with fisheries bycatch is considered the greatest threat to BFAL, but estimating accurate bycatch rates is challenging as BFAL are wide-ranging and subject to encounters with fisheries from multiple nations. We used new data and analyses to evaluate the robustness of a conclusion that BFAL populations are resilient to current estimated bycatch levels and are experiencing negative density dependence as they near carrying capacity – a conclusion which has resulted in the weakened protective status for this species. We built a stochastic matrix model using estimates of demographic rates in the absence of anthropogenic mortality derived from the most recent available data. We then imposed estimated historical fisheries bycatch mortality and effects due to military activities. Finally, we investigated the effects on long-term population dynamics of uncertainty and increases in bycatch rates. Model output yielded patterns of stability similar to observed counts without density dependence. Our results indicate that fisheries mortality may be limiting the current growth rate of BFAL, and suggest caution is warranted in the management of this species, especially given the potential for lags in detecting declining population growth rates.

Talk



A CENTURY OF TROPHIC CHANGE: RETROSPECTIVE ANALYSIS OF SEABIRD DIETS IN THE CALIFORNIA CURRENT

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Overfishing has changed marine community structure, species dominance and ecosystem characteristics. Subsequently, trophic interactions observed today might be artifacts of recent structural changes to marine communities. However, the relative impacts of overfishing on avian predators are often difficult to distinguish from natural variability due in part to fluctuations in ocean climate that affects community composition. We investigate how the trophic level of five marine avian predators (Cassin's Auklet (*Ptychoramphus aleuticus*), Common Murre (*Uria aalge*), Marbled Murrelet (*Brachyramphus marmoratus*), Pelagic Cormorant (*Phalacrocorax pelagicus*) and Tufted Puffin (*Fratercula cirrhata*)), which differ in contemporary food habits (from planktivorous to piscivorous to omnivorous), has varied over the past century in the California Current by reconstructing their diets from changes in their stable isotopic signatures, and whether diet variation can be attributed to the overfishing of prey or cyclic changes in ocean temperature. Trophic-level declines (i.e., $\delta^{15}\text{N}$) occurred in all 5 seabirds examined. No diets exhibited an increase in trophic level. The magnitude of decline ranged from 0.43 to 2.10‰, representing a decline of 1/7 to 2/3rds of a marine trophic level (3.1‰). Declines differed by pre- and post-breeding seasons, and no species declined in both seasons. Linear declines were most common, making identification of the onset of decline unclear. Both bottom-up effects of changing ocean climate (regional and local) and top-down effects of commercial fish catch were related to trophic variation.

Talk



BASELINE MONITORING OF ASHY STORM-PETRELS AT POINT REYES NATIONAL SEASHORE, CALIFORNIA, IN 2012-2014

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The headlands and islets of Point Reyes National Seashore contain suitable breeding habitat for Ashy Storm-Petrels (*Oceanodroma homochroa*). Sporadic nest searches and overnight mist-netting between 1969 and 2001 confirmed breeding at two sites (Bird Rock and Stormy Stack) and likely breeding at a third site (Chimney Rock). During 2012-2014, we gathered baseline data for a PRNS long-term monitoring program, based on single annual visits to Bird Rock and Stormy Stack in late August or early September. About 5 nests were found each year at each colony, similar to previous surveys and likely providing an adequate sample size for measuring future changes in nest numbers. Single nights of mist-netting in 2012 and 2013 yielded 6 and 9 birds, respectively. In 2013, three of these birds were recaptures, two from 2012 and one from 2001. In 2013, we also conducted the first surveys at Point Reyes Headlands. Two birds with brood patches were caught in a mist-net near the lighthouse, indicating possible nearby breeding. Two museum specimens also had been obtained at Point Reyes in 1898, likely at or near the lighthouse. Future PRNS monitoring will focus on nest monitoring at Bird Rock and Stormy Stack, although mist-netting will be conducted periodically to gather data on survivorship, detect banded birds from other colonies, and find other breeding locations. This newly established monitoring program is the only such program for these species outside of its two major population centers, thus providing an important metric of the viability of this species in a small colony context.

Talk



MARbled MURRELET MOVEMENTS AND MARINE HABITAT USE DURING THE BREEDING SEASON ON THE APPROACH TO KITIMAT, B.C.

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The recent development of small solar satellite transmitters facilitate much needed investigations of marine habitat use in small birds seabirds like the Marbled Murrelet. We examine breeding and post-breeding movements and marine habitat use of breeding Marbled Murrelets on the approach to Kitimat, British Columbia, Canada, with reference to the proposed Northern Gateway tanker traffic route. Adult murrelets were captured at night on the water during the pre-laying period (April 2014) near Hartley Bay, BC. Six birds were tagged with 5g solar satellite transmitters. We had no detections from one bird, detections for two weeks from four birds, and one bird which continued to transmit signals throughout the breeding season and beyond. For the first two weeks, the birds generally stayed near the tanker route close to the capture area or westward to Hecate Strait. For the PTT which continued to transmit, the bird moved 60 km east to the Gilttoyes Inlet area and head of Douglas Channel near Kitimat where it remained during the chick rearing period from 5 May – 29 June before returning to the capture area where it remained for roughly two weeks. At the end of July the bird moved briefly into Hecate Strait near Banks Island, and then moved to SE Alaska and quickly north near Prince William Sound. From late August to November the bird has been near Kodiak Island with limited movements. Movement patterns suggest strong potential for interaction between tankers along proposed route, at least during the breeding season. Post breeding, individuals may migrate out of the area reducing likelihood of interaction occurring, based on movement data of one individual.

Talk



WHAT CAN PREY DELIVERY RATES TELL US ABOUT FOOD AVAILABILITY FOR CASPIAN TERNS?

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Prey delivery rates by nesting seabirds to dependent young can be useful indicators of foraging habitat quality and environmental variability. We investigated the use of prey delivery rates to characterize food availability for breeding Caspian terns (*Hydroprogne caspia*) across multiple years and sites. Specifically, we compared the number of prey items delivered to nests during 3-hour observation periods on East Sand Island, the world's largest colony of Caspian terns, near Astoria, Oregon to similar data from colonies with lower fledgling productivity in interior Oregon, Washington, and California. There was a mean of 1.85 prey items/observation period delivered to nests at East Sand Island across 9 years (SD = 1.33), and after accounting for brood size, there was no evidence of differences among years. Fewer prey were delivered to nests on East Sand Island than Crescent Island ($z = 0.002$, multiplicative mean = 0.76, 95% CI = 0.64-0.90) during 5 years when both colonies were sampled. There were 1.54 times as many prey delivered to nests at East Sand Island than at Crump Lake ($z = 0.003$, 95% CI = 1.15-2.04) during 3 years. There was no difference between the number of prey delivered to nests at East Sand Island and at colonies in the Upper Klamath Basin ($z = 0.063$, multiplicative mean = 0.78, 95% CI = 0.61-1.01) or at Malheur Lake ($z = 0.172$, multiplicative mean = 1.25, 95% CI = 0.65-2.41). These results suggest that prey delivery rates vary more among sites than among years within sites. Prey delivery rate was not a consistent predictor of fledgling productivity suggesting that other factors, such as prey size and quality, or predation pressure on eggs and young, may be more important to nest success.

Poster



TIDAL ACTIVITY AND SEABIRD ABUNDANCE AT FINE TEMPORAL SCALES

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Intricate tidal dynamics are the main drivers of ecosystem processes in coastal estuaries and complex coastlines. Previous studies have identified distinct patterns in the relationship between tidal activity and seabird abundance. The tidal coupling hypothesis found that faster current speed was directly related to availability of planktivorous fishes, and thus piscivorous predators. In this study we investigate fine scale temporal changes in seabird abundance over the flooding tidal cycle for two years in the same season, focusing on the timing in the tidal cycle rather than the current speed. Taxa specific responses to tides, and the influence of other environmental factors on variation among days and between years were also analyzed. The differences discovered in tidal response between taxa suggests that fine temporal scale sampling can provide more insight into previously undetected factors affecting seabird abundance. Based on the results of this study, fine scale sampling can provide better predicting power and thus more informed decisions for management and conservation.

Talk



AVIAN CHOLERA CAUSES MARINE BIRD MORTALITY IN THE BERING STRAIT REGION OF ALASKA

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Avian cholera has long been documented as one of the most significant infectious diseases of wild birds throughout North America, causing large scale mortality in waterfowl and other water birds throughout the lower 48 United States and Canada. The disease is caused by the highly contagious bacterium *Pasteurella multocida*. Here we describe an unusual mortality event in marine birds along the northern coast of Saint Lawrence Island, Alaska caused by infection with *Pasteurella multocida*. The event occurred in late November 2013 and involved Crested Auklet (*Aethia cristatella*), Thick-billed Murre (*Uria lomvia*), Northern Fulmar (*Fulmarus glacialis*) and Common Eider (*Somateria mollissima*). More species may have been involved but could not be confirmed. This mortality event was the first confirmed report of avian cholera in Alaska and the first case involving these species of seabirds. Many marine birds, including the entire world population of threatened Spectacled Eiders (*Somateria fischeri*) over winter around Saint Lawrence Island. Native Alaskans from the remote villages of Savoonga and Gambell were the first to report and respond to this event by gathering carcasses for diagnostic evaluation and disposal. These communities rely almost exclusively on marine wildlife, including seabirds, for food. To document the size and scope of the mortality event 21 km of shoreline was surveyed during which 912 bird carcasses were recorded. By extrapolation to the immediate area, a conservative estimate of 7,000 birds died, but given weather and shoreline conditions mortality may have been considerably higher.

Poster



GEOAVIR : AN R PACKAGE AND WEB APP FOR THE COMPUTATION OF DENSITIES OF SEABIRD AT-SEA MULTI-SPECIES DATASETS COLLECTED USING DISTANCE SAMPLING

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The Canadian Wildlife Service collects data on seabird at-sea on the eastern coast of Canada since 2006. New data is constantly added to the database. The Canadian Wildlife Service frequently receives requests for data and therefore new outputs presenting corrected densities of multiple seabird species must be prepared to respond to these requests. To facilitate and ensure that a standardized framework is used to prepare seabird at-sea density estimates, we developed the R package GeoAviR. This R package allows users to import data, and offers the option to either compute densities over a study area, predetermined spatial zones, or a spatial grid constructed via the package. Density estimates can be computed for data collected using the line-transect method and distance sampling, or the strip-transect method. GeoAviR allows subsetting the data by species to launch simultaneous analyses, and therefore facilitate the usage of multi-species datasets. From the options selected by the user, the package builds an input file that is sent to the MCDS engine of the Distance software. To facilitate the access to GeoAviR to scientists with little knowledge of R, we built a web app called GeoAviRWeb that allows the user to perform analyses through menus and buttons. GeoAviRWeb also allows the user to map seabird densities and save estimates in a shapefile for later use. GeoAviR and GeoAviRWeb are freely available at GeoAviRWeb.ddns.net.

Talk



NOCTURNAL SOUNDSCAPES OF SOUTHEAST FARALLON ISLAND: COMPARING SPECTRAL AND TRADITIONAL APPROACHES TO ACOUSTIC SEABIRD MONITORING

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Nocturnal seabird soundscapes (the collection of ambient sounds of a seabird colony) represent a wealth of ecological information if they can be accurately interpreted. However, the raucous soundscapes of large, multi-species seabird colonies represent a significant challenge in analysis and interpretation. Here we analyze changes in the soundscape of the largest seabird colony in the contiguous US, Southeast Farallon Island, over the 2010 breeding season. We find that soundscapes have distinct characteristics over time, influenced by moonlight, seabird breeding phenology and abundance. To measure the abundance of SEFI's most conspicuous nocturnal seabird, Cassin's Auklet (*Ptychoramphus aleuticus*) we tested two acoustic monitoring approaches in areas of known abundance. Widely used call specific approaches did not explain patterns in auklet burrow abundance, however spectral approach (relative amplitude and peak frequency) did (Adj. $r^2=0.87$, $p<.05$). While acoustic monitoring of seabirds is being applied at increasing scales, this highlights the need for caution and orthogonal analysis of acoustic datasets when using them as seabird monitoring tools. The field of soundscape ecology presents some new and exciting tools for seabird acoustic monitoring such as a de-emphasis of individual calls and an investigation of spectral and temporal entropy that can avoid many of the pitfalls of traditional acoustic monitoring. Soundscape concepts such as community acoustic diversity maybe useful for understanding how seabirds partition sonic environments as a shared resource, and how to accomplish community level monitoring in complex seabird colonies.

Talk



SEABIRD YOUTH NETWORK POSTER

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The Seabird Youth Network (SYN) is a partnership between the Pribilof School District, the Aleut Community of St. Paul Island, the St. George Traditional Council, the Alaska Maritime National Wildlife Refuge (AMNWR), and the wider scientific community. The network creates exciting opportunities for youth on the Pribilof Islands to learn about seabirds and contribute to long-term seabird monitoring programs. The network is dedicated to creating opportunities for Pribilof youth in four key areas: (a) Opening doors to careers in science and natural resource management; (b) Increasing sense of ownership and understanding of local resources; (c) Providing training in marketable multi-media skills, and (d) Providing education in seabird ecology, research and conservation. A website is used as a platform for sharing seabird lesson plans, posting project updates, and communicating stories of seabirds and marine conservation in the news. The network was initiated in 2012, and continued during 2014 with a summer Seabird Camp held on St. Paul Island and dedicated sessions on seabirds conducted during Bering Sea Days, a week-long annual program developed by the Aleut Community of St. Paul Island and the Pribilof School District where students of all ages learn about career routes and research projects from resident and visiting scientists. Activity highlights of the year included: learning about seabirds and marine debris, the cultural use of seabirds, and the Refuge's seabird population monitoring program, the creation of "Garbie" the marine debris tufted puffin, and participation in 4th of July celebrations.

Poster



FROM OIL SPILLS AND HAZARDOUS RELEASES TO RESTORATION: SEABIRD RESTORATION PROJECTS IMPLEMENTED THROUGH THE NATURAL RESOURCE DAMAGE ASSESSMENT (NRDA) PROCESS

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In the aftermath of an oil spill, federal and state agencies that are designated as natural resource trustees may assess the injuries and make a legal claim for monetary damages for injuries to wildlife and habitat. The goal of this process, known as Natural Resource Damage Assessment (NRDA), is to restore and compensate for the injuries. During the last three decades in California, the Trustees have played an active role in restoration for oil spill and hazardous releases impacts to seabirds. Over \$50 million has been recovered and invested in seabird restoration projects which span the entire State of California and in some cases include locations outside of the United States. The projects employ a diverse suite of restoration techniques. This poster presents an overview of these projects and the techniques used to benefit seabirds.

Poster



EVALUATING POPULATION IMPACTS OF PREDATION BY BURROWING OWLS ON ASHY STORM-PETRELS IN RELATION TO PROPOSED ISLAND MOUSE ERADICATION

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This study provides quantitative estimates of the anticipated demographic benefit to Ashy Storm-Petrels from the proposed eradication of introduced house mice on the South Farallon Islands, California. During 2000-2012, we found owl predation on storm petrels to be positively related to burrowing owl abundance and negatively related to house mouse abundance. During the fall, mice are the primary prey of owls, but when mouse populations crash during the winter, owls switch to preying upon storm petrels, which are arriving prior to breeding. Owl abundance and predation on storm petrels have significantly increased in recent years. Capture-recapture analyses of storm petrels caught during standardized mist netting from 2000 to 2011 revealed a significant decrease in annual storm petrel survival in relation to an increase in burrowing owl abundance. Change-point analysis indicated that between 2006 and 2007, the storm petrel population index changed from increase to decreasing; the recent decline (estimated at 5.91% /yr; $P = 0.050$) coincides with the recent increase in burrowing owl numbers. We considered three future “baseline trend scenarios” for Farallon storm petrels and developed Leslie matrix models and plausible future population trends for each, considering the impacts of changes in owl abundance. Reduction in owl abundance is projected to have strong positive population impacts in all scenarios examined. Our results suggest that a reduction in owl abundance resulting from the elimination of mice will have a substantial effect in reducing overall storm petrel mortality, thereby promoting stable or increasing future storm petrel population trends.

Talk



CHARACTERIZATION OF SEABIRD BREEDING ZONES IN SAN MARTÍN ISLAND, BAJA CALIFORNIA, MÉXICO

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San Martín is a volcanic island inhabited by sea lions, seals, land and seabirds, some reptiles and fishermen. As part of a seabird restoration project, we monitored breeding colonies during the entire reproductive season of 2014 (April to July). We found 8 waterbird species nesting in the island: *Ardea herodias*, *Hydroprogne caspia*, *Haematopus bachmani*, *H. palliatus*, *Phalacrocorax auritus*, *P. penicillatus*, *Larus occidentalis* and *Pelecanus occidentalis*. There is also evidence of *Ptychoramphus aleuticus* (Cassin's Auklets) breeding, but no active burrows were found, only carcasses. Using Geographic Information Systems (GIS) to analyze data geo-spatially, we will present maps of nests and colonies and their respective habitats to describe the possible relation between nest distribution and substrate. We also report nest densities and productivity data (fledglings per nest) for Brandt's and Double-crested Cormorants and Western Gulls. Predation, habitat characteristics, climatic conditions and fisheries are possible factors that influence these variables.

This study sets the basis to refine the manner in which we can intervene in order to restore seabird colonies in San Martín Island.

Talk



COASTAL MOULTING REGION FOR GREAT AND SOOTY SHEARWATERS – AN IMPORTANT AREA FOR PROTECTION

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Moult is energetically demanding, during which flight may be compromised and foraging ranges may become constrained. For long-distance migrant shearwaters, a rapid complete moult is required during the short non-breeding period. During non-breeding, thousands of great (*Puffinus gravis*) and sooty shearwaters (*Puffinus griseus*) aggregate on the northeast Newfoundland coast nearby annually persistent, shallow-water (< 30 m) spawning sites of capelin *Mallotus villosus*. It is unclear, however, whether shearwaters moult in this area, as sooty shearwaters have been observed with new flight feathers in other coastal regions of eastern Canada and, thus, were suggested to moult offshore. We investigated whether these coastal regions are important moulting areas for shearwaters. To do this, great (n=75) and sooty shearwaters (n=41) associated with spawning sites were captured during July and August, 2014 and moult scores of primary, secondary and tail feathers were recorded. Both species were moulting in the study area. Primary feather moult was sequential, starting with the inner primaries and ending with the outer primary (P10). Similar to Cory's shearwaters, secondary feather moult started at three points: S22 outward, S5 inward and S1 inward, with S4 being the last to moult. The tail moult was variable and asymmetrical. Interestingly, although both species had similar moult patterns, sooty shearwater moult was more advanced upon arrival in the study area (P1-P6 complete) relative to great shearwaters (P1-P4 complete). Overall, persistent capelin spawning sites represent important moulting areas for non-breeding shearwaters and, thus, may be good target areas for protection.

Talk



THE BIGGER THE BEAK, THE FASTER YOU SEEK: PROVISIONING PATTERNS OF PELAGIC CORMORANTS

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The purpose of this study was to investigate how frequently pelagic cormorant (*Phalacrocorax pelagicus*) chicks are fed by their parents. We tested the hypothesis that foraging time (time spent away from the nest looking for food) decreases with chick size (increased energy demand). We studied the provisioning behavior of seven pairs of pelagic cormorants nesting along shoreline cliffs within the Sea Ranch California Coastal National Monument. We collected data every other day from the same spot using binoculars for a period of two months. We recorded adult departure and arrival times, and classified chicks by size and plumage. We found that average adult foraging time decreased with chick size and that there was no relationship with environmental conditions such as tide height or time of the season. These results suggest that adults adjust their provisioning strategies in order to account for higher chick demands. The study is ongoing; we hope to repeat the study in future years to determine how provisioning behavior relates to variations in oceanographic conditions.

Poster



BRANDT'S CORMORANT (*PHALACROCORAX PENICILLATUS*) BREEDING POPULATION TRENDS AT SAN NICOLAS ISLAND, CALIFORNIA, 1991-2014

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Since 2010, the world's largest Brandt's Cormorant (*Phalacrocorax penicillatus*) breeding population has occurred at San Nicolas Island (SNI), the outermost of the southern California Channel Islands. Nest counts of all SNI colonies have been determined from aerial photographs annually since 1991. We examined trends in total numbers of nests during 1991-2014 and during two shorter periods when trends appeared to differ. During 1991-2003, population size declined by 6% per annum, with the highest count in 1993 (2,422 nests). Colony abandonments and colony shifting occurred during 1992-1993 due to human disturbance and predation of eggs by Island Foxes (*Urocyon littoralis dickeyi*), leading to greater efforts by US Navy to protect breeding colonies. Nest numbers were reduced due to strong El Niño conditions in 1992 and more so in 1998, when very few birds attempted to breed. During 2003-2014, population size increased by 12% per annum to 7,358 nests in 2014, the largest population size ever recorded at SNI. Road closures by 1996 eventually led to a widely expanded nesting distribution at Vizcaino Point, where about 70% of nests now occur. Human access to the south side of SNI also was no longer permitted, allowing a major colony to form at Dutch Harbor Area, beginning in 2000. Nest numbers were reduced during 2008-2009, similar to patterns in other regions of California, but rebounded in 2010. Recent dramatic population increase at SNI likely reflected: 1) reduced human disturbance; 2) high recruitment following the 1999-2000 La Niña; and 3) possible immigration of birds from other islands or regions. Some level of egg predation by Island Foxes still occurs, but feral cats (*Felis catus*) were eradicated during 2009-2010.

Poster



REEDING OF ASHY STORM-PETRELS IN CENTRAL MENDOCINO COUNTY, CALIFORNIA

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In August 2012, we confirmed breeding by an estimated 50 pairs of Ashy Storm-Petrels (*Oceanodroma homochroa*) at 4 nearshore rocks (Franklin Smith Rock, Wharf Rocks, Casket Rock and Stillwell Point Rock) along the central Mendocino County coast, California. All 4 rocks are found within the California Coastal National Monument managed by the Bureau of Land Management. Breeding in this area originally had been indicated in 1926 when four eggs were collected by Franklin J. Smith, but this information was not published until 2008. Breeding north of Bird Rock, Marin County (38.2° N), had not been detected during major seabird colony surveys in 1969, 1979-1980 or 1989 but few rocks were searched in Mendocino County. At Franklin Smith Rock, we found 12 dead birds in a deep crevice, apparently killed by predators. The close proximity of these nearshore rocks to the mainland may expose them to relatively high predation levels. We did not find Ashy Storm-Petrels breeding north of Stillwell Point Rock (39.3°N) which appears to be the current northern extent of the breeding range. Additional surveys and monitoring are needed to better assess the status of this population.

Talk



INTERCOLONY AND AGE RELATED DIFFERENCES IN GARBAGE USE BY WESTERN GULLS IN NORTHERN CALIFORNIA

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Located 48 km west of San Francisco, Western Gull (WEGU) colonies at Southeast Farallon Island (SEFI) are the largest in the world but breeding success has decreased compared to smaller populations elsewhere. Less than 90 km southeast of SEFI, Año Nuevo Island (ANI) is 1 km offshore, giving this colony easy access to refuse on the mainland. We compared gull diets obtained from regurgitations of adults and chicks at each colony in 2013. Blood and feathers were sampled from adults for stable isotope analysis. As expected, garbage made up a higher percentage of regurgitations from gulls at ANI (23%) compared to gulls at SEFI (7%). At ANI, there was more garbage in adult samples (43%) than from chick samples (28%). At ANI, we found more garbage in adult samples from 2012 (32%) than in 2013 (15%). $\delta^{13}\text{C}$ in blood showed good agreement with wet diet for ANI, where a terrestrial signal was stronger in 2012 compared with 2013. However, diets from both years were categorized as mixed based on the $\delta^{13}\text{C}$ signal. There was no inter-annual difference in $\delta^{15}\text{N}$ observed. No other isotope comparisons showed significant differences between years or locations. At ANI, $\delta^{13}\text{C}$ indicated a marine diet for chicks and a mixed diet for adults, suggesting that adults preferentially fed chicks a more natural marine diet while supplementing their own diets with terrestrial prey, likely refuse. Our results suggest that the higher breeding success measured at ANI compared to SEFI may be influenced by the ability of adults from ANI to supplement their diets with garbage during the breeding season.

Talk



OBSERVATIONS OF A RESTORED BREEDING COLONY OF CHINESE CRESTED TERNS IN THE JIUSHAN ISLANDS, ZHEJIANG PROVINCE, CHINA DURING THE 2014 BREEDING SEASON

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During the summer of 2013, a project to restore a former breeding colony of the critically endangered Chinese Crested Tern (*Thalasseus bernsteini*) was initiated at the Jiushan Islands, Zhejiang, China, and met with early success (at least one young Chinese Crested Tern was fledged). In 2014 the project continued with resident colony monitors living on the island throughout the nesting season. The presence of colony monitors successfully prevented one egg poaching attempt and other human disturbance. Up to 4,000 Greater Crested Terns (*T. bergi*) and at least 43 Chinese Crested Terns, likely over 90% of the surviving adults, were recorded on the island during the 2014 nesting season. At least 1,000 young Greater Crested Terns and 13 young Chinese Crested Terns were fledged. Breeding ecology and nesting behavior of Chinese Crested Terns was studied by the colony monitors in much greater detail than has previously been possible. Chinese Crested Terns were only observed pairing with conspecifics, although one apparent hybrid with a Greater Crested Tern was seen paired with a typical Greater Crested Tern. Detailed observations of breeding biology are useful in management planning for restoration of this critically endangered species.

Talk



CONSERVATION OF THE CRITICALLY ENDANGERED CHINESE CRESTED TERN: STATUS, PROBLEMS, AND FUTURE PLANS

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The Chinese Crested Tern (CCT, *Thalasseus bernsteini*) is likely the most threatened seabird species in the world. The Mazu Islands and Wuzhishan Islands in the East China Sea are the only known breeding sites; total number of breeding adults at the two sites never exceeded 30. Since the rediscovery of CCTs in 2000, the species has only been found nesting in large colonies of Greater Crested Terns (GCTs, *T. bergii*). Due to scarcity, CCTs are now apparently an obligate nester with GCTs. Monitoring mixed colonies of CCTs and GCTs has identified challenges for conservation of critically endangered CCTs, including egg harvest, human disturbance, breeding failure, and hybridization with GCTs. Consequently, we conducted a project in Jiushan Islands National Nature Reserve in 2013 and 2014 to restore a large breeding colony of GCTs in the hopes that CCTs would subsequently recruit to the colony. We used social attraction (tern decoys and audio playbacks), which has been successful in seabird restoration projects worldwide. We aimed to test: (1) whether social attraction could establish a breeding colony of GCTs at a site that could be monitored and protected, (2) whether a new colony of GCTs would attract breeding CCTs, (3) whether GCTs can serve as a conservation umbrella species for CCTs, and (4) the feasibility of creating a conservation network of breeding sites for GCTs that would help restore the CCT. In 2013, 2,600 GCTs and 19 CCTs were attracted to the new site, and in 2014 4,000 GCTs and 43 CCTs were attracted. The early success of this restoration attempt indicates that future conservation plans for CCTs should focus on establishing a well-protected and monitored conservation network for GCTs in the East China Sea.

Talk



MIGRATION AND WINTERING HABITS OF STREAKED SHEARWATERS (*CALONECTRIS LEUCOMELAS*) REVEALED BY SATELLITE TRACKING

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To recognize migratory and wintering habits of the Korean breeding population of Streaked Shearwaters (*Calonectris leucomelas*), nine adult shearwaters were tracked from Chilbaldo Islet (N 34° 47', E 125° 47') using 10.5-18.0g PTTs (Platform Terminal Transmitters) dorsally attached to five birds in Oct 2008 and four in Oct 2009. Starting in late October and early November, seven shearwaters migrated over $3,887 \pm 236$ km (range: 2,200-6,600 km) for 17.3 ± 13.4 days from the breeding colony to the coasts of the Philippines, northern Borneo, Singapore, Viet Nam, and northern Australia (between 20°N and 15°S). The 1,322 observed locations with high precision (<10 km in error radius) during non-breeding periods were concentrated in shallower waters on continental shelves (80.5m in 2008-09, 39.7m in 2009-10), closer to coast lines (65.0km in 2008-09, 24.7km in 2009-10), and higher net primary productivity (896.9 mgC/m²/day) than those in random sites within their overall MCP ranges (1,629.8m, 96.8km, and 436.9 mgC/m²/day). This is a completely different result from previous studies using light-sensing geolocators (GLS), which have emphasized the low productivity and deep water depth in the shearwaters' non-breeding areas. The reason of this difference is unclear, but may be caused by different spatial resolution between tracking devices (PTT and GLS) or by different breeding populations between Korea and Japan. Nevertheless, our finding suggests that non-breeding shearwaters selectively use neritic zones of high marine productivity, not depending on the possible aid of subsurface predators such as tuna or dolphins.

Talk



CONSERVATION STATUS AND THREATS OF CHINESE CRESTED TERNS IN MATSU ARCHIPELAGO, TAIWAN

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Since the first confirmed breeding record of Chinese Crested Tern (*Thalasseus bernsteini*) in Matsu Archipelago in 1999, we have investigated the colony size and their breeding success. We found their breeding population in Taiwan did not exceed 20 and might be positively related with the Greater Crested Tern (*Thalasseus bergii*) population. From 2011 we started to deploy wireless real-time visual surveillance system, auto time lapse cameras and decoys in Matsu Islands Tern Refuge. The images of transmission system indicated the arrival time, population size and movement, and nest location of Chinese Crested Terns in 2011 and 2012. But unfortunately we found most of the mixed breeding population of Chinese Crested Terns and Greater Crested Terns abandoned their nests during the early breeding stage (May and June) in 2012, 2013 and 2014. Based on our investigation, we suggested the main threats to the tern colony including predator, human disturbance and pollutants. In order to restore the population of Chinese Crested Tern, we proposed conservation recommendations to the local authorities including habitat management, predator removal, decoys and wildlife surveillance system deploying.

Talk



BLACK-FOOTED ALBATROSSES HAVE HIGHER LEVELS OF INDIVIDUAL VARIABILITY IN BEHAVIOR AND DIET THAN THEIR SYMPATRICALLY-BREEDING CONGENER, THE LAYSAN ALBATROSS

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Laysan and black-footed albatrosses breeding synchronously in the Northwestern Hawaiian Islands are morphometrically and functionally similar, and appear to avoid competition through distinct at-sea spatial segregation. However, this spatial segregation breaks down in the short but critical chick-brood phase when adults are limited to shorter foraging trips near the breeding colony while experiencing a substantial increase in energetic demands to feed their rapidly growing chick. The aim of our research was to examine fine-scale behavioral and dietary mechanisms shaping resource partitioning during the chick-brood when competition (both inter- and intra-specific) is likely to be the fiercest. Here, we combine the results from two studies: a fine-scale behavioral study and a lipid analysis on albatross stomach oil. We used an individual-based analytical approach on both behavioral and dietary dimensions. GPS tracking data on 18 Laysan and 20 black-footed albatrosses revealed distinct behavioral partitioning between species, with Laysan albatrosses in an active forage mode 53% of the night and 39% of the day. The reverse was true for black-footed albatrosses: active forage mode made up 37% of night and 52% of day. Within-species partitioning was higher in black-footed albatrosses on both the behavioral and dietary dimensions, indicating that they may be under greater intra-specific competitive pressures. Laysan albatrosses showed less individual variability in behavior and diet, and behavioral partitioning within that species appears to be driven by size and sex. The contrasting structure of behavioral and diet variability in these two congeners suggests they may be experiencing different selective pressures.

Talk



LONG TERM STUDY OF KITTLITZ'S MURRELET BREEDING BIOLOGY ON KODIAK ISLAND

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The breeding biology of the Kittlitz's murrelet (*Brachyramphus brevirostris*) is poorly known because this secretive species nests solitarily in remote mountainous terrain. Until 1999, only 19 confirmed nests had been described, and only one nest had been studied from egg laying until fledging. Since 2008, we have studied the breeding biology of the Kittlitz's murrelet at 5-23 nest sites each year (114 nests in total) on southwestern Kodiak Island, where unusual outcroppings of scree and talus slopes at low elevation permit systematic monitoring of a relatively high number of nests. Apparent nest success was low but variable. During the first four years of the study, success averaged 17%, but increased to 45% from 2012-2013, before declining again in 2014 to 17%. Digital cameras placed at nearly all nests recorded incubation patterns, chick feeding rates, prey fed to chicks, fledging, and predation. Nests were visited regularly so that chick growth rates could be measured. Over seven years of field studies, we learned that Kittlitz's murrelets have the fastest growth rate documented for any semi-precocial alcid; birds selected nest sites that were less vegetated, had more gravel sized rocks, and were on steeper slopes compared to available habitat; Pacific sand lance (*Ammodytes hexapterus*) accounted for over 90% of identified chick meals; most nest failures were due to predation, primarily by red fox (*Vulpes vulpes*); and several chicks that died mysteriously on the nest tested positive for saxitoxin, one of the neurotoxins responsible for paralytic shellfish poisoning.

Poster



EFFECTS OF SEA-LEVEL RISE AND WAVE-DRIVEN INUNDATION ON COLONIAL SEABIRDS AT MIDWAY ATOLL

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Sudden inundation from severe winter storms and the 2011 Tōhoku tsunami highlighted the vulnerability of Midway Atoll, a globally important seabird rookery, and other Pacific islands currently providing refugia to colonial seabirds. Sea-level rise (SLR) is projected to reach 0.3–1.0 m by 2100 and high-water perturbations are expected to escalate with global SLR. To model SLR for Midway Atoll in the Hawaiian Archipelago, we acquired new high-resolution Digital Elevation Models (DEMs) to model inundation for a range of passive (i.e., "bathtub" model) and wave-driven SLR scenarios (+0.5, +1.0, +1.5, and +2.0 m). We identified the three seabird species (Laysan Albatross, *Phoebastria immutabilis*; Black-footed Albatross, *P. nigripes*; and Bonin Petrel, *Pterodroma hypoleuca*) most vulnerable to SLR in the Hawaiian Islands and quantified their atoll-wide distribution, abundance, and overlap with potential inundation. Potential impacts of SLR on this atoll include displacement breeding albatrosses and petrels. Our results highlight the importance of early climate change planning, mitigation, innovation, as well as restoration of higher elevation refuges for seabird colonies in order to prevent low-lying islands from becoming ecological traps.

Talk



TEMPORAL CHANGE IN A SUBARCTIC MARINE BIRD COMMUNITY THAT EXPERIENCED SIMULTANEOUS EFFECTS OF A MAJOR OIL SPILL AND CLIMATE VARIABILITY

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Over recent decades, the marine ecosystems of Prince William Sound (PWS), Alaska, have experienced concurrent effects of a major oil spill and climate change. The responses of marine bird taxa to environmental perturbations depend on their use of resources and habitats; therefore, community-level patterns may provide important insights regarding agents of ecological change. We used boat-based surveys of marine birds conducted during 1989-2012 to investigate patterns of distribution, abundance, and change over time in the marine bird community of PWS. First, we found the strongest spatial pattern of marine bird community composition occurred along a gradient linked to distance from shore and water depth, paralleling the organization of marine food webs along a gradient from the littoral to the oceanic realm. Second, we evaluated changes in the abundance of 18 genera of marine birds over the study period, and found that seven had declined in abundance (storm-petrels, Bonaparte's gull, terns, jaegers, pigeon guillemot, murrelets, and puffins) and three had increased (cormorants, great blue heron, and harlequin duck). Rates of decline were greater among genera associated with habitats that were deeper and farther from shore than those associated with habitats that were shallower and closer to shore. Furthermore, most of the genera that declined primarily feed on forage fish or macrozooplankton. This pattern of community change is indicative of shifts in pelagic components of PWS food webs. Our findings suggest that changes in food webs have likely contributed to the lack of population recovery of some piscivorous marine bird species, including pigeon guillemot and marbled murrelet, following the Exxon Valdez oil spill.

Talk



INFLUENCE OF PREY BEHAVIOUR ON THE FORAGING BEHAVIOUR OF NORTHERN GANNETS IN COASTAL NEWFOUNDLAND, CANADA

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Marine predators must expend considerable time/energy searching for patchily distributed prey and, thus, may employ a variety of strategies to minimize costs. Breeding northern gannets (*Sula bassana*) at Funk Island (northeast Newfoundland coast) primarily feed on capelin *Mallotus villosus*. Within foraging ranges, high density capelin shoals are predictably located at shallow (< 30 m) spawning sites during spawning (mid-late July), before which capelin are distributed in small, ephemeral schools. We investigated whether gannets consistently concentrate foraging at capelin spawning sites during spawning (i.e. memory) relative to pre-spawning. We integrated repeated vessel-based surveys to quantify capelin distribution and behaviour during July-August, 2011 with long-term (6-18 d) deployments of GPS loggers on breeding gannets (n=12). Gannet diets were primarily composed of capelin (98%) during logger deployment (Jul 6) and retrieval (96%, Jul 31-Aug 9). Prior to spawning (Jul 6-14, n=8 individuals), foraging trips were long (80-120 km) and routes varied among consecutive trips by an individual. During spawning (Jul 15-27), foraging trips were short (<60 km, n=3) and focused consistently nearby capelin spawning sites, but there was much variation among individuals. Variation may result from a higher reliance of some gannets on other strategies, such as cueing to the foraging activities of other predators (e.g., conspecifics, whales). As some individuals did not shift behavioural strategies when prey conditions changed, resulting in different individual-level responses to similar conditions, population-level predator-prey relationships will likely show considerable variability.

Talk



IF WE DON'T TAKE SEABIRDS SERIOUSLY THEN WHO WILL? RECONCILING THE DESIRE TO STUDY, CONSERVE, AND ADVOCATE FOR MARINE BIRDS WITHOUT LOSING CREDIBILITY

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At a time of unprecedented ongoing and predicted threats to the integrity of the world's oceans, the technology used to study marine birds is entering a "golden age." Data loggers now provide previously unimagined detail on at-sea activities, biochemical analyses allow investigation of trophic relationships and hormonal states, and genetic analysis offers a range of insights, from taxonomic relationships to frequency of extra-pair copulations. Additionally, online availability of oceanographic databases and satellite imagery now provide information needed to allow examination of seabirds in their marine environment.

Unfortunately these new opportunities in seabird research come at a time of a concurrent decline in interest and effort in the actual "management" of seabirds. Regular monitoring of colony size, demographic parameters, and trophics, all of which are needed for determining and understanding population status, now frequently take a back seat to research focused on interesting but narrow-focused questions with minor application at the population level.

The lack of regular monitoring of the numbers and status of the majority of the world's seabirds complicates the task of those attempting to assess current trends or provide agencies and the public with information on world or local populations. Too often these assessments fail to reveal the inadequacy of the data sets that inform their conclusions.

The seabird research community needs to address the asymmetry between the increasingly detailed technology-based insights into seabird biology and the paucity of data needed to accurately assess the status of seabird populations during a time of increasing changes in the world's oceans.

Talk



THE BLUE-BANDED PELICAN PROJECT

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International Bird Rescue (IBR) is a non-profit organization dedicated to the rehabilitation of aquatic birds, and operates two year-round wildlife clinics serving the Los Angeles and San Francisco Bay Areas. Since 1979, IBR has federally banded and released more than 20,000 rehabilitated birds. In 2009, IBR began applying easily-read blue plastic auxiliary leg markers to California Brown Pelicans prior to release, and has since banded more than 1150 Brown Pelicans with these bands. Several large influxes of Brown Pelicans have occurred at IBR since the program began, including events in 2009 (frost-bite), 2010 (starving, plumage -contaminated breeding age adults) and 2012 (starving or fishing hook/line injured juveniles and adults). Most birds treated during these events were blue banded. The banding program provides concrete evidence about post-release survival and valuable clinical data regarding the post-release survival of birds with specific medical problems. Public reporting of encounters with banded pelicans are encouraged through the use of IBR's website, social media, blue-banded pelican photography contests, and posters at public fishing piers. Encounters can be reported either by telephone or through an online form. Submission of photographs displaying the bird's band is also encouraged. Since beginning this program, there have been more than 600 resightings of 380 individual birds, and many sightings have been substantiated with photodocumentation. Most re-encounters have been of live birds, several resighted many times over as many as 5 years. Resightings have been reported from Ensenada, Mexico to Vancouver, BC.

Talk



THE EFFECTS OF DISPERSANT AND CHEMICALLY DISPERSED OIL ON THE BEHAVIOR OF CAPTIVE COMMON MURRES (*URIA AALGE*)

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The use of chemical dispersant is widely assumed to dramatically reduce the impacts of spilled oil to seabirds by reducing exposure to hydrocarbons. Seabirds rely upon the interlocking geometry of their feathers to maintain core body temperature. When contaminated, feather geometry is disrupted, water penetrates to the skin, and the ability to maintain core temperature is severely compromised to potentially lethal effect. We investigated the behavioral effects of chemical dispersant and chemically dispersed oil on common murres (*Uria aalge*). Thirty-six common murres were captured, and housed in pools in a controlled environment at UC Davis. The birds were exposed to one of seven treatment groups of varying levels of chemical dispersant and/or oil, or a control group, and washed three days post exposure. Behavioral observations were made using a scan sampling technique both before and after exposure of the birds to their treatments, and before and after cleaning the birds post-exposure. We will present differences in behavior amongst treatment groups, particularly in preening behavior and the ability to stay afloat unaided in pools. The study of the behavior of birds exposed to dispersant or chemically dispersed oil is important, in order to provide data to allow informed decision-making to occur regarding the use (or non-use) of chemical dispersant and the potential impacts to seabirds during oil spills.

Talk



ACCELEROMETRY, ACTIVITY COSTS AND DAILY ENERGY EXPENDITURE OF PELAGIC CORMORANTS

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Cormorants occupy a unique niche as the deepest foot-propelled diving birds. Whereas other deep-diving birds rely on their wings to move efficiently in water, and either have very high flight costs (auks) or have foregone flying altogether (penguins), cormorants have potentially overcome the energetic barrier of optimizing a single appendage (wing) for both swimming and flying by using different appendages (feet, wing) for each activity. We investigated the energetics of diving in 21 male, chick-rearing pelagic cormorants (*Phalacrocorax pelagicus*) by simultaneously attaching triaxial accelerometers/depth recorders and measuring daily energy expenditure using doubly-labelled water. We used a modified two-sample approach to measure daily energy expenditure where the second sample was obtained only 12 minutes after injection to reduce the effect of capture and handling. We captured the birds at the unique Middleton Island radar tower, where pelagic cormorants nested behind one-way glass, and could be easily captured with a hook. Average daily energy expenditure was 2294 ± 547 kJ/d. Average dive depth was 16 ± 11.6 m and maximum dive depth was 66 m. Flight costs were 168 ± 51 W, the highest recorded for any bird to date, and dive costs were 66 ± 11 m, much higher than similarly-sized wing-propelled divers. Rather than optimizing locomotion for both swimming and flying, cormorants had very high energy costs in both activities. We speculate that these high energy costs restrict cormorants to foraging nearshore from small colonies relative to other seabirds.

Talk



EVALUATION OF CASSIN'S AUKLET (*PTYCHORAMPHUS ALEUTICUS*) NOCTURNAL ACTIVITY IN THREE PACIFIC ISLANDS OF BAJA CALIFORNIA, MEXICO

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Documenting activity patterns in some seabird species is a valuable tool in monitoring and conservation activities. We assessed the nocturnal activity of Cassin's Auklet (*Ptychoramphus aleuticus*) during breeding season in three Pacific islands of Baja California, Mexico: San Jerónimo, San Roque and Asunción. We recorded activity once a week, for 4 weeks (April to May), by placing tongue depressors in the entrance of 30 natural burrows on each island that were checked every hour (from 21:00 to 06:00hrs). We detected activity in all monitored burrows. On average a nest was visited 1.85 times per night, and in some burrows up to seven times. The percentage of active burrows varied throughout the season, with more activity recorded at the beginning (86%) compared to the end (72%). We also detected common patterns shared by all three islands, especially in relation to the percentage of visible moon light and the time that moon sets. The mean number of events detected per night was higher during the new moon phase (SJ=1.46, SR=2.3, AS=2.9), whereas activity decreased in all islands on nights with high percentages of moon light (SJ=0.06, SR=1.43, AS=1.4). The number of entrances to the burrow per night may be indicative of feeding frequency. That activity changes throughout the season suggests that frequency of attendance may be related to the stage of chicks in the burrow. Evaluation of nocturnal activity represents an alternative method to assess burrow occupancy and breeding success in natural burrows where it is infeasible to investigate the nest content directly.

Talk



FORAGING ECOLOGY AND SPATIAL OVERLAP AT SEA AMONG THREE PELECANIFORM SEABIRD SPECIES BREEDING ON LEHUA ISLET, HAWAII

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In 2013, we initiated at-sea tracking studies of main Hawaiian island seabirds to help assess potential risks of proposed offshore energy developments. As part of a larger multispecies and multicolony study, we equipped nesting Red-footed Boobies (*Sula sula*), Brown Boobies (*S. leucogaster*), and Red-tailed Tropicbirds (*Phaethon rubricauda*) with global positioning unit (GPS) tracking devices and time-depth recorders (TDRs) on Lehua Islet (32 km west of Kaua'i). Herein, we present preliminary results that quantify several foraging parameters for each species. Additionally, we evaluated intra-seasonal parameter variation and the degree of inter-specific spatial overlap at sea. In 2014, deployments ranged from 2 to 7 days during three breeding-season sessions (May, June, and July). The sympatric boobies primarily conducted single day foraging trips during daylight hours. Brown Boobies generally foraged closer to Lehua (≤ 55 km maximum range) and often utilized nearshore habitat, whereas Red-footed Boobies ranged farther offshore (≤ 240 km maximum range) and foraged in pelagic waters. Red-tailed Tropicbird trip durations were more variable and lasted from a few hours to 7 days, ranging up to 475 km from the colony. Novel tracking data will support management directives to delineate spatially and temporally important marine areas for seabirds and commensal predators (pelagic fishes and cetaceans) in waters surrounding the main Hawaiian islands.

Poster



ARTS AND SEABIRD CONSERVATION WITH LOCAL COMMUNITIES ON THE BAJA CALIFORNIA ISLANDS, MÉXICO

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Cultural community values are an essential component of our seabird restoration program on the islands off the Baja California peninsula. Some inhabited, they provide livelihoods for abalone and lobster fishermen cooperatives and their families. The California Current waters influence these islands, offering a rich productivity reflected in artisanal fisheries, abundant seabirds and marine mammals. To raise awareness about the value of the islands and their seabirds, we combine participatory artistic experiences linked to nature, a novel and formative approach for the social construction of a local identity. In collaboration with local communities we conduct “Environmental Culture Weeks”, where children and teenagers are motivated to express their connection with islands and seabirds. Renowned artists work closely with conservation biologists to develop diverse activities and workshops: mural painting, engraving, drawing, song-writing, short-story telling, theater, and sculpture. Songs are composed and performed; murals in public spaces featuring seabirds are developed; plays about invasive species and their threats to seabirds are written and acted; and beautiful seabird masks are elaborated. There are also workshops for adults, like urban agriculture and island biosecurity. The communities, being isolated, take advantage of these events and cherish the whole experience. People gain knowledge and respect for seabirds, making commitments to conserve them, and wanting to know more about conservation actions. The impact on the communities is evident, resulting in a strong cultural platform that, built networks, contributes to a long-term project oriented to seabird and island conservation in this region of México.

Talk



EVALUATING ACOUSTIC MONITORING OF BREEDING WEDGE-TAILED SHEARWATERS AND BLACK NODDIES ON NORTH WEST ISLAND, AUSTRALIA AS A LOW COST AND REPEATABLE LONG TERM MONITORING METHOD

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The Great Barrier Reef Marine Park (GBRMP) hosts breeding populations of 22 seabird species potentially breeding on over 900 islands. A 2012 review of seabird monitoring data from the Great Barrier Reef Marine Park concluded that existing survey data were insufficient to meet a monitoring goal of detecting a 10% change in seabird populations over a 20-year period. Given the scale of the GBRMP, the review concluded that managers would need to adopt new monitoring technologies to meet these survey goals. We compared data from automated acoustic surveys to traditional seabird surveys (2 nest counts/season) for Wedge-tailed Shearwaters (*Ardenna pacifica*) and Black Noddies (*Anous minutus*) on North West Island, in the Capricornia Cays, Queensland, Australia, to evaluate the utility of automated acoustic surveys for long term monitoring in the park. While traditional surveys give a snap shot of nesting activity, acoustic surveys have the potential to provide information on phenology, daily activity patterns, relative abundance, and a statistically robust metric to compare through time. The strongest correlations resulted when call rates were calculated from +/- 2 weeks around the count date. Wedge-tailed Shearwater call rates were significantly correlated with burrow density in 2012/2013 and 2013/2014 ($r^2 = 0.69$, $p < 0.05$ and $r^2 = 0.84$, $p < 0.05$ respectively). Black Noddy call rates are also correlated with nest densities +/- 2 weeks from when nest counts were conducted in 2014 ($r^2 = 0.6$, $p < 0.05$). Acoustic activity showed consistent seasonal patterns across breeding sites for both species. Our results indicate that acoustic monitoring can be an effective tool for monitoring seabirds at scale required for the GBRNP.

Talk



COMMON MURRE (*URIA AALGE*) BREEDING POPULATION TRENDS IN CENTRAL CALIFORNIA, 2000-2014

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We examined population trends of Common Murres (*Uria aalge*) during 2000-2014 at eight colonies in central California from Point Reyes to Point Sur, using counts from annual aerial photographic surveys. Central California colonies declined in the 1980s, and Devils Slide Rock was extirpated in 1986, due largely to morality from gill-net fishing and oil spills. Limited recovery began in the early to mid-1990s. During 2000-2014, murre counts increased significantly (5.1 – 22.7 percent per annum) at all colonies, except Millers Point Rocks, which decreased (-6.0 percent per annum). The greatest increase was observed at Devils Slide Rock, which was the focus of a successful restoration project that began in 1996 using social attraction. By 2014, Devils Slide Rock and nearly all other central California colonies had recovered to levels near or exceeding those recorded in the early 1980s. The largest murre colony, at the South Farallon Islands, now far outnumbers any other murre colony south of Alaska. Murre population increases in central California likely reflect a combination of good prey availability, legislation limiting fishery practices that were causing high levels of seabird mortality, and other restoration actions including social attraction and reduction of human disturbance. A long-term aerial survey program is needed to monitor central California colonies of murres and other seabirds, which can serve as effective indicators for marine conservation purposes. Aerial photographic surveys are invaluable aides in the effective and timely management of the marine environment over broad temporal and spatial scales.

Talk



HABITAT SELECTION OF CASSIN'S AUKLET IN SAN JÉRONIMO ISLAND, BAJA CALIFORNIA, MEXICO.

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Cassin's auklet (*Ptycoramphus aleuticus*) is present in about one-third of Isla San Jerónimo, however there are differences in the densities of burrows per area, these may be influenced by the preference of certain characteristics in the habitat. The objective of this paper is to identify which features are preferred by the bird to establish its burrow. We divided the island into different areas and measured burrow density in 225 plots of 2 x 2 meters, noting the characteristics of each plot. The relationships between the Cassin's Auklet burrow density and habitat variables were determined by linear analyses. The zone with the highest density of burrows was the south with 1.89 burrows per m², followed by the north with 1.23 burrows per m² and finally the center area with 1.21 burrows per plots. Highest densities occurred on areas with shrubby vegetation, sandy soil, lower slope and lower presence of gulls. Although other areas of the island provide suitable burrow conditions (according to characteristics in the area with higher density), the presence of ice plant (*Mesembryanthemum crystallinum*) obstructs the entrance to burrows or impedes the building of new burrows. These areas often also have a greater presence of gulls. In testing the characteristics of the area are related to the number of burrows per area, we are expanding the information on Cassin's Auklet in the region; addition, the information can be used to create areas for this species restored.

Talk



COASTAL OR OFFSHORE, WARM OR COLD WATER: INDIVIDUAL VARIABILITY IN FORAGING PATTERNS OF NORTHERN GANNETS IN THE GULF OF ST. LAWRENCE, EASTERN CANADA

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To study their foraging patterns in the western Gulf of St. Lawrence, eastern Canada, we equipped adult Northern Gannets (*Morus bassanus*) from the colony on Bonaventure Island with GPS and dive data loggers. Field work took place from late May to late August 2014. Data could be obtained from 32 individuals over a few weeks each, covering substantial parts of the long incubation and chick-rearing periods. A total of 469 foraging trips could be identified from the data set. Birds foraged over the entire western half of the Gulf. Throughout the study period, coastal sites south of the breeding colony were visited most often. Foraging trips lasted up to 7 days and total distances travelled per foraging trip exceeded 1,000 km in a few cases. Birds preyed upon Capelin, Mackerel, Sandlance and Herring. Detailed information will be given on how foraging trip characteristics were influenced by progressing season and breeding stage, and how increasing sea surface temperatures affected the location of foraging trips.

Talk



DEVELOPING A BASELINE OF HEALTH FOR MARINE AND ESTUARINE BIRDS EXPOSED TO FRESHWATER ALGAL TOXINS ALONG THE MONTEREY BAY COAST

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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 invertebrates and fish prey items used for food. We are investigating new methodology to establish a baseline of central coast bird health. Characterization of potential population-level impacts of microcystin will be achieved through collaboration with the Monterey County Society for the Prevention of Cruelty to Animals (SPCA) Wildlife Center. Blood was collected from all marine and estuarine birds admitted to the SPCA wildlife center between 2011 and 2014, and was transferred to Whatman® FTA® blood sample collection cards. Blood cards were subsequently analyzed via competitive enzyme-linked immunosorbent assay (ELISA). The preliminary results of the ELISA will be evaluated to determine if the birds using central California coast waters exhibit signs of exposure to microcystin, and a current measure of health will be assessed. Current available data on the effects of HABs on marine and estuarine birds is sparse, and better surveillance and detection techniques are needed. This work is intended to help address this deficiency and provide a method to determine microcystin burden on coastal birds.

Poster



COLLABORATING WITH FISHERMEN TO REDUCE SEABIRD BYCATCH IN WEST COAST SABLEFISH FISHERIES

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Streamer lines are an essential part of best practices to protect longline fishing gear against seabird attacks, save bait and reduce incidental seabird mortality. Regulations and performance standards for streamer lines in the U.S. were designed for demersal longline fisheries in Alaska and required there since 2004, but only recently required in the U.S. west coast demersal longline fishery for larger vessels (>55 ft). In 2008, we initiated a research and outreach program for the west coast sablefish fleet with the objective of adapting Alaska streamer lines to the west coast sablefish longline fishery. We worked collaboratively with fishermen to characterize vessels and gear, quantify fishing gear sink profiles, and seabird interactions while increasing awareness of seabird conservation. Unlike Alaska, some vessels in the west coast fleet use a combination of floats and weights along the groundline to keep baits off the bottom and increase the catch quality. Our measurement of sink rates showed that longlines with floats sank beyond the reach of albatrosses (depth 2 m) 2.4 times further astern than Alaskan style gear (without floats). The delayed sink rate associated with floats extends the seabird attack zone beyond the protection of streamer lines and increases concern about streamer lines entanglements with fishing gear. Evidence suggests that west coast longlines without floats can be protected from bird interactions using existing Alaska streamer line specifications. We continue to work with the west coast fleet to further refine safe and effective seabird mitigation strategies suited to fishing gear and expect to present recommendations to the fleet in Spring 2015.

Talk



PREDICTING THE OFFSHORE DISTRIBUTION AND ABUNDANCE OF SEABIRDS FROM SHIPBOARD SURVEYS, USING A COMMUNITY DISTANCE SAMPLING MODEL

¹Holly Goyert*, ¹Beth Gardner, ¹Rahel Sollmann, ²Richard Veit, ³Andrew Gilbert, ³Kathryn Williams

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Recent interest in wind energy development on the Atlantic Outer Continental Shelf has brought attention to the need for baseline studies identifying the vulnerability of marine wildlife in this region. From April 2012 to April 2014, we collected line transect data from 16 shipboard surveys, along with associated remotely-sensed habitat data, off the coast of Delaware, Maryland, and Virginia. We detected 47 marine bird species over the course of the study and used these observations to inform a hierarchical Bayesian community distance sampling model, in order to estimate detection and abundance of each species. We hypothesized that avian benthivores (bottom-feeders) respond more to seafloor variability and that piscivores (fish-eaters) respond more to surface productivity. Treating each season separately, we found that six standard oceanographic parameters predicted high seabird abundance: distance to shore, primary productivity, salinity, sea surface temperature, sediment grain size, and slope. We compared the variation in species-specific responses to these habitat features, and predicted the abundance for each observed species across the study area. Our results show the importance of quantifying detection and the ecological drivers of avian abundance in order to assess potential exposure of marine birds in offshore development areas.

Talk



DAILY ACTIVITY BUDGETS REVEAL A QUASI-FLIGHTLESS STAGE DURING NON-BREEDING IN HAWAIIAN ALBATROSSES

¹Sarah Gutowsky*, ²Ian Jonsen, ³Marty Leonard, ⁴Scott Shaffer

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Seabird activity budgets during breeding and migration are generally well studied but the “overwinter” phase of non-breeding has received less attention. Yet this is a critical time for recovery from breeding, plumage replacement and gaining energy stores for return migration and the next breeding attempt. We identified patterns in daily activity budgets (time in flight, floating and foraging) and distributions during overwinter for the Laysan (*Phoebastria immutabilis*) and black-footed (*P. nigripes*) albatrosses using positional and immersion-state time-series. Both species exhibited a consistent ‘quasi-flightless stage’ beginning ~30 days after initiating migration and lasting ~40 days, characterized by frequent long floating bouts, little sustained flight, and infrequent active foraging. Minimal daily movements were made within localized areas during this time; Laysans concentrated into the NW Pacific while black-footeds spread out widely. Activity gradually shifted toward increased flight and foraging, less floating, and greater daily movements until colony return. Our results demonstrate that these species make parallel adjustments to overwinter activity budgets despite different distributions. The ‘quasi-flightless stage’ likely reflects compromised flight from moult while the subsequent increase in activity may occur as priorities shift toward mass gain for breeding. The GAMM-based approach developed here identifies population-level patterns in activity over extended periods while allowing for individual variation in the timing of events. This information can help to elucidate the whereabouts of areas important at different times across life history phases.

Talk



SEABIRDS AS POSSIBLE INDICATING FACTOR FOR AN “EL NINO” (ENSO) EVENT

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The local Ecuadorean coastal based seabird Survey project “SEAWATCH DEL PACIFICO” has been collecting data on the presence, migration and behavior of 90 species during 1400 hours of sea watching, from the years 2010 to 2013 under “normal” oceanic conditions. Apart from introducing the relatively simple study method of sea bird watching, this presentation focuses on the comparison of results of 2014 and previous years, showing a noticeable difference in numbers and species.

Since the latest strong El Niño (ENSO) in 1997-98, now (Nov 2014) conditions indicate another event, possible indicated by several seabirds species from the Ecuadorean-Peruvian Coastal zone. Starting as early as March 2014, some species have appeared earlier than usual and especially in much higher numbers, and showed different behavior. In 2014 thousands of seabirds have died or have show a spread-out strategy to the north.

Species that are characteristic for the Humboldt Current such as the Peruvian Booby (*Sula variegata*) and Inca Tern (*Larosterna inca*) have reacted to the different oceanic conditions and were registered in high numbers, indicating that this year s oceanic conditions are different, and therefore may be considered as possible indicator factors for the coming of an El Niño (ENSO) event.

Talk



FROM CONTAMINATION TO RESTORATION: THE NATURAL RESOURCE DAMAGE ASSESSMENT (NRDA) PROCESS

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In the aftermath of an oil spill or other pollution event, federal and state agencies that are designated as natural resource trustees may assess the injuries and make a legal claim for monetary damages for injuries to wildlife and habitat. The goal of this process, known as Natural Resource Damage Assessment (NRDA), is to restore and compensate for the injuries. During the last three decades in California, the Trustees have recovered over \$50 million for restoration projects to benefit impacted seabird populations. The basis for the monetary amounts is the estimated cost of the proposed restoration projects. This poster describes the NRDA process from its legal foundations, thru the injury assessment phase, to the public comment and ultimately the restoration phase, illustrating how projects are selected and implementers and contractors are chosen.

Poster



INVESTIGATION OF CASSIN'S AUKLET MORTALITY IN THE EASTERN PACIFIC DURING THE 2014 POST-BREEDING SEASON

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During autumn 2014, surveyors conducting routine standardized beached-bird surveys (COASST, Beach Watch, and BeachCOMBERS) recorded unusually high numbers (>10 times baseline) of dead Cassin's Auklets (*Ptychoramphus aleuticus*) on beaches from Washington through central California. Unusual numbers of dead and debilitated auklets on some beaches, and observations of dead auklets floating at-sea off the California coast also prompted numerous inquiries from the public. To determine the probable cause of death, internal examinations were performed on a sample of birds. The majority of birds examined were hatch-year birds, and almost all birds were emaciated. At major breeding colonies in California (Farallon Islands) and British Columbia (Scott Islands), breeding success in 2014 was very high. It is clear that an unusually large cohort of hatch-year auklets dispersed south from breeding colonies, and initial findings from carcass examinations are consistent with starvation. However, at this time (December 2014) the event is ongoing and we are still investigating potential contributing factors to the die-off, including a possible decrease in prey (krill) availability, severe weather, and disease. This event highlights the benefit of standardized monitoring of seabird mortality, and the need for cooperative effort across the migratory ambit of coastal seabirds to investigate unusual mortality events.

Poster



NEST-SITE PREFERENCES IN BRANDT'S CORMORANT (*PHALACROCORAX PENICILLATUS*)
OVER TWO MEXICAN PACIFIC ISLANDS: ASUNCIÓN AND SAN ROQUE, BIOSPHERE RESERVE EL
VIZCAINO IN THREE BREEDING SEASONS

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The habitat selection of birds can show how certain environmental features influence their abundance or other features of their biology. Asunción and San Roque islands have similar characteristics in terms of topography. The two island systems are important areas for refuge, resting and nesting of seabirds. Some of these nesting birds are: Brown Pelican (*Pelecanus occidentalis*), Herrmann's Gull (*Larus heermanni*), Western Gull (*Larus occidentalis*), Double-crested Cormorant (*Phalacrocorax auritus*) and Brandt's Cormorant (*P. penicillatus*) these species are named in the IUCN. The Brandt's Cormorant colonies were monitored over three years during the breeding seasons of 2012-2014 (April-July). Three groups of variables were selected for analysis of nest-site: topographic variable (elevation and proximity between islands), weather variable (wind exposure and sun exposure) and anthropogenic variable (beacon influence, visibility of anthropic zones and distance to anthropic zones). The orientation of the two islands varies from one another, but cormorants preferred in Asuncion Island the west side and in San Roque Island the northwest side for building their nests. This is important information, as knowledge about the preference for nesting sites allows better management and protection of these areas.

Talk



ALBATROSSES, MURRELETS AND STORM-PETRELS ON GUADALUPE ISLAND: POPULATION STATUS, DISTRIBUTION, AND ADVANCES TOWARDS THE ERADICATION OF FERAL CATS

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Guadalupe Island and its surrounding islets, off the Baja California peninsula in México 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, particularly to surface- and burrow-nesting seabirds like the Laysan Albatross (*Phoebastria immutabilis*), the Guadalupe Murrelet (*Synthliboramphus hypoleucus*), and the Leach's Storm-petrels (*Oceanodroma leucorhoa cheimomnestes* and *O. l. socorroensis*). To protect these species we have a permanent control program for feral cats around seabird colonies in the northeast and the southern tip of the island. The positive impact of these actions has been closely monitored for the albatross. This seabird colony has grown steadily during the last 30 years, increasing from 4 to 143 breeding pairs by 2013. To evaluate the present distribution and population status of the Guadalupe Murrelet and the Leach's Storm-petrels we conducted nest monitoring on the island and islets, and at-sea spotlight surveys to assess population size during the 2013-14 nesting season. Murrelets were found nesting on the islets but not on the main island, where only predated individuals were found, as previously recorded. A similar scenario was recorded for petrels, being the signs of predation overwhelming on the main island. By combining control efforts with seabird monitoring, we are not only minimizing the predation pressure over seabirds while moving forward to the cat eradication, but also finding out the needs of further intervention —such as social attraction techniques— to improve the populations of these seabirds on Guadalupe once cats are eradicated.

Talk



SEXUAL SIZE DIMORPHISM AND SEXUAL SEGREGATION IN FORAGING DISTRIBUTIONS IN LAYSAN ALBATROSS FROM GUADALUPE ISLAND, MEXICO

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Most seabird species are sexually size dimorphic and this feature is often mirrored in their distribution at-sea as observed in giant petrels, shearwaters and albatrosses. We investigated the relationship between sexual size dimorphism and sexual segregation in foraging distributions in Laysan albatross *Phoebastria immutabilis* from a colony established on Guadalupe Island, off the Mexican Pacific coast. During the breeding season of 2013-2014, we fitted satellite transmitters to 17 individuals to record their foraging trips. Individuals were sexed using biometrics and DNA analysis from blood samples. We used analysis of variance and discriminant function analysis to test whether biometrics were a good predictor of the sex of individuals. We built linear models to investigate whether a difference between foraging areas used by males and females existed, particularly during brooding and early chick rearing periods. We used oceanographic variables such as bathymetry, chlorophyll-a concentration, sea surface temperature, salinity and net primary productivity as well as distance from the colony. During the brooding period there were no significant differences in sea surface temperature, while bathymetry, chlorophyll-a, salinity, primary productivity and distance from the colony differed. Foraging areas of males were characterized by shallower, saltier and more productive waters, and individuals were closer to the colony compared to female foraging areas. During chick rearing period, foraging areas were more similar between males and females, differing only in bathymetry, salinity and distance from the colony. In this case, males foraged in deeper and saltier waters and at larger distances from the colony compared to females.

Poster



CONSERVATION AND NESTING SEABIRDS AT TODOS SANTOS ARCHIPELAGO, MEXICO.

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Populations of some seabird species have declined during the previous decades due to a number of factors including oil spills, introduced mammals and human disturbance. Conservation management of breeding sites is a priority for the recovery of their populations. After the control of some of these negative factors, we need to establish monitoring programs as well as to continue to identify possible threats. On 1998 cat eradication was successfully achieved at Todos Santos archipelago, Baja California, Mexico. The feral population of cats was a major threat for the seabird species that breed on the islands. Some species diminished their populations and were almost extirpated. Sixteen years later we survey the nesting seabirds on the islands. Field work took place during Spring 2014 (Apr - Jul). We found eight nesting seabird species (Families: Hydrobatidae, Alcidae, Phalacrocoracidae, Pelecanidae, Laridae). Potential nesting sites and an active nest of Cassin's Auklet (*Ptychoramphus aleuticus*) were found, this is an unreported event since 1930. Spatial and temporal distribution are shown, as well as reproductive success and observations of predation for some species. We detect conservation issues and elaborate recommendations to improve future management of the area.

Talk



USING CO² CONCENTRATIONS AS A NON-INVASIVE TECHNIQUE TO DETERMINE OCCUPANCY OF BURROWS IN LEACH'S STORM-PETRELS, *OCEANODROMA LEUCORHOA*

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Field surveys of storm-petrel colonies are typically performed by physically touching or 'grubbing' the occupant of each burrow. For sensitive species, or in colonies with a fragile substrate, a less invasive technique may be useful. We tested whether occupied burrows could be distinguished from empty burrows on the basis of CO₂ concentration, due to respiration by the occupant(s). We predicted that occupied burrows would show a higher concentration of CO₂. To test this, we measured temperature, humidity and CO₂ concentration in 92 Leach's storm-petrel burrows on Bon Portage Island, Nova Scotia Canada, during the 2014 breeding season. We measured CO₂ concentrations in randomly selected burrows using a low-cost handheld air quality sensor (Supco IAQ55), modified to house a 1/2" tube through which air from deep inside the burrow could be drawn directly over the infra-red (NDIR) sensor element. For each burrow, readings were taken from outside the burrow entrance and from a depth of approximately 30 cm inside the burrow. The burrow was then grubbed to determine occupancy. Occupied burrows showed a significant increase in CO₂ concentrations compared to unoccupied burrows. This non-invasive technique may have future implications for conservation surveys, allowing more extensive and frequent surveys to be conducted with reduced disturbance to nesting adults and chicks.

Poster



ENGAGING LOCAL COMMUNITIES TO ADVANCE SEABIRD CONSERVATION: LESSONS FROM A DECADE OF COMMUNITY-BASED PROJECTS

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Community-based outreach and engagement programs are essential components of long-term conservation strategies in places where humans co-exist with wildlife, especially for long-lived and slowly reproducing species like seabirds. With increasing threats from anthropogenic impacts, there is a great value and willingness amongst some local communities to engage in efforts to conserve seabird populations. Several projects from the last decade in New Zealand, Chile and the USA emphasize the paramount importance of establishing and maintaining partnerships and a trust relationship amongst the relevant constituencies and contributors, including managers, scientists, Traditional and Local Knowledge holders, conservation practitioners, and local communities. The creation of meaningful opportunities to engage actively in artistic, educational and/or technical training activities leads to ownership of the process by the community and to co-discovery and implementation of system-level solutions at the appropriate governance and ecological scales. Clearly defined and agreed seabird conservation goals are also fundamentally important, but so too is how those goals are achieved. Passionate leadership and regular presence of conservation scientists and facilitators in local communities build trust and credibility but also require more time than external agencies and individual scientists may realize. Ultimately, effective community engagement requires a trans-disciplinary approach that changes conservation professionals and their science, as well as the local environmental stewards. Engagement builds local capacity and confidence in the community to act and helps change values and build commitment for long-term conservation efforts.

Talk



TOP-DOWN INFLUENCE OF BALD EAGLES ON THE COMMON MURRE BREEDING POPULATION IN OREGON

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Over the past two decades, increased levels of avian predation have been observed at Common Murre (*Uria aalge*) colonies in Oregon, where over two thirds of the U.S. west coast population breeds. We investigated changes in the distribution and abundance of Common Murres over a period (n=19 years) of Bald Eagle (*Haliaeetus leucocephalus*) recovery in Oregon, and quantified impacts of disturbance and predation at three focal breeding sites (n=1 -7 years) with varying amounts of eagle predation. Changes in the number and size of murre colonies on the north and central coast were associated with regional eagle nest density and initial murre colony size, rather than proximity of eagle nests to murre colonies. Between 1998 and 2006, counts of murres declined by 50% on the north coast where eagle nest density was highest, while counts and number of occupied breeding sites increased on the central coast where eagle nest density was lower. At individual murre breeding sites, eagles caused the majority of disturbances (~55%), but secondary nest predators (gulls, corvids, and vultures) had a greater impact on murre reproductive loss, causing ~5X more egg/chick loss than eagles. We found higher rates of disturbance and colony disruption at sites with higher eagle densities vs. the site with the lowest eagle density. Additionally, we observed a negative association between mean murre reproductive success and mean eagle disturbance rate ($R^2 = 0.6981$, $p=0.01$). Our observations provide some evidence for top-down regulation of murres in Oregon, mediated by a recently delisted native, avian predator.

Talk



FROM RAT TO HAWADAX ISLAND: CHANGES IN BIRD COMMUNITIES AFTER RAT ERADICATION

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The number and scale of island invasive species eradications is growing, but quantitative evidence of conservation efficacy is limited. We compare relative abundances of breeding birds on Hawadax Island (formerly named Rat island), Aleutian Archipelago, Alaska, pre- and post- rat eradication to examine short-term (<1 year post) changes due to rodenticide application, and medium-term (five years post) changes due to the absence of invasive rats. Bald Eagle (*Haliaeetus leucocephalus*) numbers decreased from 24 individuals pre-eradication to two individuals <1 year post-eradication, but recovered to 10 individuals (42% of pre-eradication) five years post-eradication, with all individuals nesting (63% of the pre-eradication nesting). Five years post-eradication relative abundances of most terrestrial birds either significantly increased (Lapland Longspur (*Calcarius lapponicus*), Pacific Wren (*Troglodytes troglodytes*), Snow Bunting (*Plectrophenax nivalis*), Song Sparrow (*Melospiza melodia*)) or did not differ (Gray-crowned Rosy Finch; *Leucosticte tephrocotis*). Shorebirds also increased five years post-eradication with Black Oystercatchers (*Haematopus palliatus*) increasing 5-fold, and Rock Sandpiper (*Calidris ptilocnemis*) nesting increasing from one to five nests. We confirmed two species of ground nesting seabirds (Tufted Puffin (*Fratercula cirrhata*) and Leach's Storm-petrel (*Oceanodroma leucohoa*)) as nesting (puffin) or engaged in courtship behavior (Storm-petrel) five years post-eradication. Our results indicate that despite the apparent short-term impact on Bald Eagles, most terrestrial and marine birds have newly-colonized, re-colonized, or increased in abundance following the eradication of invasive rats.

Talk



USING PROFESSIONAL AND CITIZEN SCIENCE MONITORING TO GUIDE COMMUNITY-BASED SEABIRD CONSERVATION

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The Seabird Protection Network (SPN) was established to reduce the impacts of human-caused disturbance to breeding and roosting seabirds throughout coastal California. The SPN is organized into geographic chapters managed by stakeholders with varying backgrounds and motivations for seabird conservation. While approaches differ, each chapter attempts to use scientifically produced information to guide outreach and law enforcement activities. Here, we present the Point Sur to Point Mugu (PSPM) chapter as an example of how science can guide community-based seabird conservation. The PSPM chapter was established in 2011 with initial efforts focused on characterizing seabird disturbance within the chapter's jurisdiction and targeting outreach to areas with high disturbance rates. Baseline rates were documented at eight sites with a wide range of potential human-caused disturbance: two state parks, two coastal towns, two trails with docent-guided access, and two areas closed to the public that served as controls. Monitoring was primarily accomplished with trained biologists and augmented with a citizen science program established at the two state parks. Disturbance rates at the docent-guided trails were low and similar to those at control sites. Rates were highest at one coastal town that is a popular tourist destination for multiple user groups. Targeted outreach at this site produced effective but short-term results, illustrating the need for a long-term approach. Moderate disturbance rates were recorded at the two state parks with sources and levels of disturbance varying among years. Outreach programs at these sites will need to take a long-term approach aimed toward both park users and park managers.

Talk



SCRIPPS'S MURRELET REPRODUCTIVE MONITORING ON SANTA BARBARA ISLAND,
CALIFORNIA, 2009 - 2014

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The Scripps's Murrelet (*Synthliboramphus scrippsi*) is a small alcid that nests exclusively on islands in southern California, USA and northern Baja California, Mexico. The California state threatened Xantus's Murrelet subspecies were recently split in 2012 as heterospecific Scripps's Murrelet and Guadalupe Murrelet (*S. hypoleucus*). The Scripps's Murrelet population will undergo a species assessment by the U.S. Fish and Wildlife Service in 2015. We present results from nest monitoring surveys conducted from 2009 – 2013 on Santa Barbara Island, which has the largest breeding colony of Scripps's Murrelets. Murrelet hatching success (as defined by at least one egg hatching in a nest) varied from a high of 70% in 2010 to a low of 51% in 2013. Depredation of murrelet eggs by the island subspecies of deer mouse (*Peromyscus maniculatus elusus*) had the greatest impact on reproductive success. The highest annual depredation rates were observed at Cat Canyon (27-77%), which consists of mostly rocky crevice habitat, and the lowest annual depredation rates were observed at Landing Cove (0-25%), which consists of mostly shrub habitat. 2013 was a high year for egg depredation, with more eggs depredated than hatched within the monitored plots. This program is supported by the Montrose Settlements Restoration Program and Channel Islands National Park.

Poster



BREEDING SOOTY SHEARWATERS PREDICT THE ONSET OF EL NIÑO BY OVER A YEAR

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The Pacific population of Sooty shearwaters (*Puffinus griseus*) breed on the southern islands around New Zealand and are subject to harvesting by the local indigenous people. In the last decade, work on the populations of sooty shearwaters as elucidated by information gathered from the harvest, has shown lagged correlations with the Southern Oscillation. More recently, it has been shown that harvest indices can predict shifts in the Southern Oscillation by 4 - 14 months. In order to understand the mechanism by which this occurs, the spatial distribution of sooty shearwaters during the breeding season was examined via previously collected GLS tracking data. I then used a series of spatial modeling techniques to examine which oceanographic regions best explained variation in the derived indices, and correlated those regions to areas that also corresponded to shifts in the Southern Oscillation. I found that in years when wind speeds in the Sub-Antarctic water region were low, the harvest indices were low and the formation of an El Nino was more likely. Studies such as this highlight seabirds as predictors (not just indicators) of climate events.

Talk



AMBON – A US ARCTIC MARINE BIODIVERSITY OBSERVING NETWORK THAT INCLUDES SEABIRDS

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The new Arctic Marine Biodiversity Observing Network (AMBON) project is one of three national pilot efforts, and will build an operational marine biodiversity observing network for the Chukchi Sea continental shelf in the US Arctic. Seabird distribution and abundance relative to physical and biological conditions will be one component of the project. The AMBON has four main goals: 1. To close gaps in taxonomic and spatial coverage in biodiversity observations on the Chukchi shelf, 2. To integrate and link past and ongoing research programs on the US Arctic shelf, 3. To demonstrate how a biodiversity observing network could be developed in other marine ecosystems, and 4. To link with international programs on the pan-Arctic level, e.g., through the Circumpolar Biodiversity Monitoring Program. The AMBON aims to develop a sustainable model of continuous biodiversity observation, from genetic to organismal to ecosystem. The AMBON will fill spatial and temporal gaps of other field programs, including taxonomic (from microbes to seabirds and marine mammals) and functional (food web structure) studies and time series. It will also link to environmental oceanographic observing systems. AMBON is a 5-year partnership (2015 – 2019) between university and federal researchers, funded through the National Ocean Partnership Program, with contributions from the National Oceanographic and Atmospheric Administration, the Bureau of Ocean and Energy Management, and Shell Exploration and Production Company. AMBON will allow us to better coordinate, sustain, and synthesize research efforts, and will make data available to a broad audience of local to global users and stakeholders.

Poster



WHAT IS THE PHYSIOLOGICAL INDICATORS OF THE SEABIRD BODY CONDITION IN BLOOD COMPONENTS AND HORMONES?

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Since the body condition affects breeding success in seabird species, it is important information for considering their life history and their conservation. In the last two decade, it has been revealed how the blood component is related to the body condition. During fasting, individuals consume firstly glucose, secondly accumulated fat and finally protein. It had been reported that depending on degraded material, metabolic products were released in the blood. However, in *Larus* species, there is no research testing thyroid hormone. The secretion of thyroid hormone might decrease during fasting in order to reduce metabolism and body temperature. The aim of this study is to investigate the change of blood component and hormone under the limit of food supply in order to obtain the indicators of body condition from living body.

The Black-tailed gull *Larus crassirostris* was captured and fed ordinary for 2 week in the cage (training period). After training period, the food was limited till their body mass become 15% less and then food was supplied till the body mass has recovered. The blood was collected on a routine schedule. Amylase, glucose, urea nitrogen, creatinine, uric acid, total cholesterol, triglyceride, calcium, inorganic phosphorus, total protein, magnesium, beta-hydroxybutyric acid, corticosterone and thyroxin in the plasma were measured.

Their body mass was decreased rapidly in first day of the food limitation. The body temperature was slightly decreased in the experiments. We will discuss the indicators of body condition in blood components and hormones.

Poster



DRIVERS OF INTER-COLONY AND INTER-ANNUAL VARIABILITY IN THE DIET OF COMMON MURRES (*URIA AALGE*) IN THE NORTHERN CALIFORNIA CURRENT SYSTEM

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We examined spatial and temporal variability in Common Murre (*Uria aalge*) nestling diets among six colonies spanning the northern California Current System (nCCS) over a 16-year time period. We found high spatio-temporal variation in murre diets, with inter-regional differences between colonies located at the northern and southern boundaries (British Columbia and Central California, respectively) and those within the central portion (northern California to Washington) of the study. We found a substructure of similarities in proportions of prey among sampling years, which indicated a degree of congruence in diet composition despite inter-colony differences. Observed diet variability among colonies was correlated with a combination of spatial factors reflecting marine habitat availability, with latitude and continental shelf habitat availability being the most significant. These factors helped explain patterns involving individual prey types that persisted in nestling diets over time, including northern anchovy (*Engraulis mordax*), juvenile rockfish (*Sebastes* spp.), Pacific sand lance (*Ammodytes hexapterus*), and smelt (*Osmeridae*). Our findings provide insight into the relationship between spatio-temporal variability in forage fish availability for murres and marine habitat, which has a variety of implications for forage fish consumers within the nCCS.

Talk



EL NIÑO/LA NIÑA–SOUTHERN OSCILLATION OCEANOGRAPHIC VARIATION AND THE AT-SEA DISTRIBUTION AND FORAGING ECOLOGY OF PISCIVOROUS SEABIRDS IN THE OCEANIC EASTERN PACIFIC

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Negative effects of strong El Niño events on seabird foraging success have been established in numerous studies of breeding success and survival, particularly among coastal upwelling-associated seabirds. The influence of both positive and negative phases of El Niño–Southern Oscillation (ENSO) climatic and oceanographic variability on the distribution and foraging ecology of oceanic seabirds at sea, however, remains less substantiated. Using NOAA/NMFS transect surveys of seabirds and feeding flocks associated with subsurface predators (tunas and dolphins) in the eastern tropical Pacific, Hawaii, and California Current we begin to address this information gap through empirical characterizations of abundance and occurrence changes across a spectrum of ENSO states. Using anomaly maps generated by contrasting density surfaces estimated via generalized additive models, we found displacements of dolphin-associated seabird feeding flocks and associated seabirds away from the core of the eastern Pacific warm pool a during positive phase ENSO event. We also examined changes in community and flock composition across a range of oceanographic conditions related to ENSO states.

Talk



NEW METHOD TO REMOVE EQUINOX-AFFECTED FIXES IN LIGHT-GEOLOCATION DATA

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Light-level geolocation is now a widespread technique both across the globe and the vertebrate phylogenetic tree. This success has been possible thanks to its light weight and despite a very fundamental problem of the method: latitude estimation around equinoxes. This is not a minor problem as it invalidates several weeks of data in March and September, precisely the time in which many animals undertake their yearly migrations. Dealing with the problem is not straightforward and different authors have dealt with it differently. Most authors delete erroneous-looking fixes or several weeks around the equinox. These methods are either not systematical or too blunt, getting rid of otherwise useful data. In this study we have developed several new methods to systematically determine necessarily erroneous data points in the dataset. This allows us to determine the amount of effect the equinox has had for a given species of birds on a given year, thus tailoring the removal of equinox-affected fixes to each dataset. Comparison among previous and new methods have been carried out in real Manx shearwater (*Puffinus puffinus*) data as well as on stationary geolocators. The results show the newly developed methods remove a higher proportion of wrong locations while preserving greater amount of data. Our aim is to provide researchers in the future with new tools to confront this problem effectively, quickly and in a standardized way.

Talk



DELVING INTO DOVEKIE DIVING; WINNERS OR LOSERS IN A WARMING ARCTIC

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The Greenland Sea is characterized by diverse water masses that have physical and biological characteristics that reflect their origin. We hypothesized that Dovekies (*Alle alle*) nesting on the East coast of Greenland that forage in the cold East Greenland Current for large Arctic zooplankton (*Calanus hyperboreus*), benefit from the abundance of energy-rich zooplankton prey close to their colony. We predicted that these birds would have shorter foraging trips, would make fewer dives and would spend less time searching for prey. We compared their diving behavior to dovekies nesting on the island of Spitsbergen where they forage in water masses that have warmer temperatures and smaller prey (*C. glacialis* and *C. finmarchicus*). To test our hypothesis we attached small Time Depth Recorders to dovekies in three breeding colonies. We found that dovekies foraging in warmer water masses worked harder to provision their chicks. They made longer trips, dove more often, spent more time underwater and made more searching dives for their prey. The impact of foraging habitat differences was reflected in the divergent corticosterone levels of provisioning birds at each colony. Dovekies foraging in the warmer water on smaller prey had higher stress hormone levels. Despite the pronounced differences in foraging effort, dovekies at all three colonies showed similar chick growth rates and reproductive success. Future increases in warm water conditions in the Arctic may lead to declines in this keystone species.

Talk



ASSESSING THE POTENTIAL IMPACT OF OFFSHORE WIND FARMS ON SEABIRDS IN THE CALIFORNIA CURRENT SYSTEM

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Offshore wind power is considered a viable alternative energy source for the United States west coast. The implementation of offshore wind energy infrastructure will affect the marine environment, including marine bird life. Marine birds risk collision with and displacement by offshore wind energy infrastructure. Based on similar assessments quantifying marine bird vulnerability to offshore wind facilities in the North Sea, UK, and western Atlantic, we are creating a comprehensive index of seabird vulnerability to offshore wind farms in the California Current System (CCS). Using published data on natural history and demography, flight heights and flight styles, and avoidance behavior observed at existing offshore wind power sites; we quantified collision and displacement risk for 62 seabird and 17 marine water bird species in the CCS. Pelicans, cormorants, and terns have the greatest collision risk due to low avoidance rates and a high percentage of time flying at the height of turbine blades. Alcids, terns, and loons have the greatest risk of displacement by offshore wind power infrastructure due to their high disturbance sensitivity and low habitat flexibility. The levels of risk generated using this database can readily be applied to areas in the CCS where offshore renewable energy development is being considered and can be used to help inform decisions that will impact seabird conservation.

Poster



TURN OF EVENTS: ENVIRONMENTAL TEMPERATURES AND ARTIFICIAL NEST HABITATS INFLUENCE INCUBATION BEHAVIORS OF A BURROW NESTING SEABIRD

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Nest attendance behaviors, egg turning and temperature maintenance are critical to hatching success for most bird species. The details of avian incubation behaviors are not well understood, especially for species that nest in burrows and crevices, such as the Cassin's auklet (*Ptychoramphus aleuticus*). On Southeast Farallon Island, California (SEFI) a subset of the Cassin's auklet (hereafter auklet) population nest in artificial nest boxes for scientific monitoring purposes. Temperatures in un-shaded nest boxes can increase significantly during extreme heat events. In previous studies, the effects of these elevated temperatures on auklet incubation behaviors and egg viability have not been clear. In this study, egg data loggers were used to measure the egg temperatures and egg turning rates of auklet eggs in natural burrows, shaded nest boxes, and un-shaded nest boxes on SEFI. Nest temperatures were highest and most variable in un-shaded nest boxes. Egg temperatures were also highest in un-shaded boxes. Egg turning rates and egg temperatures decreased at night. During the day, egg turning rates increased with increasing nest temperatures. The results of this study show that, in artificial nest boxes, increasing environmental temperatures can influence auklet incubation behaviors and egg temperatures. The egg loggers used in this study were successful in monitoring these changes and can be applied to future studies of incubation behaviors and artificial nest box design.

Talk



MERCURY CONCENTRATIONS IN TISSUES OF KITTLITZ'S MURRELET FROM GLACIATED AND NON-GLACIATED REGIONS IN ALASKA

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Kittlitz's murrelet (*Brachyramphus brevirostris*) is an endemic species of conservation concern found in Alaska and the Russian Far East. Mercury (Hg) is a non-essential, toxic metal that is increasing worldwide. Due to biomagnification within marine food webs, many piscivorous seabirds are at risk of exposure to Hg. We compared total Hg (THg) concentrations in eggshells, chick guano, blood, and breast feathers of adults and chicks from two glaciaded regions in southeastern Alaska (Icy Bay and Glacier Bay) to two non-glaciaded regions in the Aleutian Islands (Adak Island and Agattu Island). All sites sampled support breeding populations of Kittlitz's murrelets. We found significant differences in THg concentrations among tissues across sites. The pattern of THg concentrations in murrelet tissues was: adult breast feathers > chick breast feathers >> blood >> eggshells ≈ chick guano. Adult Kittlitz's murrelet mean breast feather THg concentrations from Adak Island and Glacier Bay were above the toxic threshold value (5,000 ppb) hypothesized for other birds and were significantly greater than those from Agattu Island or Icy Bay. Two individuals from Glacier Bay had Hg levels high enough (≥ 30,000 ppb) to warrant concern for direct Hg exposure to predators. Hg concentrations in chick guano, eggshells, and blood do not appear to represent levels of concern, but more information on the physiological effects of Hg on Kittlitz's murrelets is needed. Importantly, based upon feather THg concentrations, our findings suggest that Kittlitz's murrelets from Adak Island and Glacier Bay may approach levels associated with impaired reproduction in other bird species and merit further study.

Talk



SPITTING KOILINS: A POTENTIAL COUNTERMEASURE AGAINST THE PARASITIC LOAD IN CHINSTRAP PENGUINS (*PYGOSCELIS ANTARCTICUS*)

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Koilin membrane, formed by the secretions of the ventricular and pyloric glands, functions as a protective layer in the gizzards of most bird species. However, the ecological functions of koilin have been rarely studied in free-ranging populations of wild birds, especially in penguins. During the two austral summers from 2012 to 2014, we observed the koilin regurgitating behaviour of chinstrap penguins (*Pygoscelis antarcticus*), and detected the significant difference in the daily regurgitation rate between the pre-hatching and post-hatching periods in the chinstrap penguin's rookery. However, few regurgitated koilins were found at the pathway of gentoo penguins (*P. papua*) while those were common in the pathway of chinstrap penguins, suggesting specific difference in the koilin replacement strategy. We also found 233 gastrointestinal parasites, *Stegophorus macronectes* (Nematoda, Acuariidae) from 26 out of 45 freshly regurgitated koilins of chinstrap penguins. Based on the results, we suggest that adult chinstrap penguins may gain benefits from the regurgitation of koilins by reducing associated parasitic loads during their fasting periods for incubation and may also help decrease the risk of parasite transmission to their chicks. The detailed strategy and functions of koilin replacements across penguins remain for further studies, but our results present the first observation of koilin regurgitating behaviour in breeding chinstrap penguins, which is a potential countermeasure against parasite loads.

Poster



APPLICATIONS OF A MODEL-BASED U.S. ATLANTIC COAST-WIDE SYNTHESIS OF AT-SEA MARINE BIRD DISTRIBUTIONS TO OCEAN ENERGY SPATIAL PLANNING

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The rapid increase in interest in and development of ocean-based renewable energy sources worldwide, along with technological advances that allow these installations to be placed further and further offshore, have sparked a number of efforts to map and model marine bird distributions in order to avoid conflicts between ocean energy installations and important bird areas. Here we present the results of an ongoing effort to synthesize and model all science-quality at-sea marine bird datasets available for the U.S. Atlantic coast, from the Straits of Florida to the northern Gulf of Maine, from nearshore to the 200 nautical mile U.S. Exclusive Economic Zone, and from the late 1970's to the present, for the purpose of making spatial predictions of seasonal long-term relative occurrence probability and relative abundance distributions of more than 40 species of marine birds of particular concern for non-governmental, state, and federal entities. We discuss how these models have been and are anticipated to be used in a variety of marine spatial planning processes with a focus on siting and environmental assessment of offshore renewable ocean energy installations. We discuss specific examples of the role these models have played in planning processes and environmental assessments at the state, federal, and regional level, and consider additional roles that models may play in future planning processes. We also discuss the limitations of models and the importance of using multiple approaches to identify and confirm important bird areas, determine habitat usage, migration, and behavioral patterns, and anticipate changes; all important considerations in planning processes.

Talk



COMPARATIVE FORAGING ENERGETICS OF BREEDING CAMPBELL AND GREY-HEADED ALBATROSSES

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Measurements of energy expenditure provide important clues about patterns of energy use and efficiency of breeding species within in their environment. We compared the foraging energetics of endemic Campbell albatross (*Thalassarche impavida*, CAAL) and endangered grey-headed albatross (*T. chrysostoma*, GHAL) breeding on Campbell Island, New Zealand sub-Antarctic territories. During the early chick-rearing stage, we used doubly labeled water to measure field metabolic rates at sea. Individuals dosed with DLW were weighed before and after foraging trips and equipped with GPS data loggers so that we could evaluate activity-specific energy expenditures. Our results show that GHAL travelled nearly twice the total distance of CAAL (GHAL: 2657 ± 1013 km vs. CAAL: 1572 ± 686 km; $p < .0001$), but daily energy expenditure at sea was not significantly different between species (GHAL: 693 ± 170 kJ kg⁻¹ d⁻¹ vs. CAAL: 657 ± 176 kJ kg⁻¹ d⁻¹). These results are consistent with known lower flight costs in albatrosses. Grey-headed albatross also gained a higher percent of their initial body mass per day (GHAL: $5.42 \pm 0.91\%$ vs. CAAL: $2.78 \pm 0.87\%$; $p = 0.04$), but made fewer landings on the water per day (GHAL: 9.0 ± 1.2 vs. CAAL: 14.7 ± 1.1 ; $p < 0.001$), suggesting greater foraging efficiency if prey quality is comparable. Although these species utilize contrasting foraging strategies, both behavioral and physiological adaptations appear to offset energetic cost.

Talk



SEABIRD DIE-OFF DETECTED DURING A MAJOR COCCOLITHOPHORE BLOOM IN THE BERING SEA IN 2014

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In August 2014, we found evidence of a seabird die-off event in the southeastern Bering Sea, during a year with unusually warm ocean temperatures. Dead birds were encountered during U.S. Fish & Wildlife marine bird surveys in conjunction with National Oceanic and Atmospheric Administration's (NOAA) Bering-Aleutian Salmon International Survey (BASIS). Surveys were conducted from western Bristol Bay to St. Lawrence Island from 18 August – 3 October, 2014. The die-off was detected on 19 - 21 August, on 11 transects totaling 222 km, during which we recorded 31 dead birds, mainly murre (Uria spp) within 300 m of the vessel and an additional 20 birds off-transect. During the same period we recorded only 64 live murre. The main seabird die-off event covered an estimated area of 16,616 km². The average density of dead birds in this region was 0.47 birds km⁻². By extrapolation to the potentially affected area, approximately 7,800 dead birds could have been present. During the BASIS survey, corresponding oceanographic and fisheries data documented unusual conditions in the Bering Sea, including a shift in distribution of age-0 pollock similar to that observed during the last warm period (2002 – 2005). In addition, a major coccolithophore (Prymnesiophyceae spp) bloom was detected ~20 km northeast of the main seabird die-off area. Coccolithophores are nontoxic small (~ 5 µm) phytoplankton with calcium carbonate plates which give the water a cloudy/milky appearance. This taxa can flourish in the presence of nutrient poor waters, and has previously been associated with warm water, and seabird die-off event, possibly due to poor foraging conditions.

Talk



BROWN PELICAN FLEDGING SUCCESS AND DIET IN THE NORTHWESTERN GULF OF MEXICO: POTENTIAL DRIVERS OF CHANGING REGIONAL DISTRIBUTION

¹Juliet Lamb* and ²Patrick Jodice

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Following their extirpation from the northwestern Gulf of Mexico, Brown Pelicans (*Pelecanus occidentalis*) have gradually re-colonized the Texas coast. In recent years, nesting numbers of Brown Pelicans have grown exponentially in northern Texas colonies (Galveston Bay), while remaining stable or declining elsewhere in the state. Aside from annual breeding censuses, no demographic information has been reported for Brown Pelicans in this portion of their range. During summer 2014, we assessed fledging success and chick condition in subsets of the four largest Texas pelican colonies, which together contain over 90% of state's breeding pelicans. Since nesting colonies are predator-free and starvation is likely to be the principal cause of chick mortality, we also measured frequency, size, and content of chick meals as potential drivers of differences in demographic rates. Both chick condition and fledging success declined from north to south, with Galveston Bay breeders producing nearly twice as many fledgelings per nest (0.93 ± 0.43) as breeders in the southernmost colony, Corpus Christi Bay (0.47 ± 0.33). Similarly, provisioning rates and meal masses also declined from north to south. Nestlings at northern colonies received a higher proportion of menhaden, while the prevalence of ribbonfish, spot, and croaker was higher in southern colonies. However, energy density analysis suggests that energetic content of common prey species is similar across species and regions. We conclude that higher nest productivity at northern colonies may be contributing to their rapid growth, and that varying prey availability is a more likely driver than prey quality of observed demographic patterns.

Poster



SHOULD I STAY OR SHOULD I GO? PHYSIOLOGY AND GEOGRAPHY PREDICT INDIVIDUAL MIGRATORY STRATEGIES IN THE BROWN PELICAN

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Although Brown Pelicans (*Pelecanus occidentalis*) are resident throughout their range, some individuals regularly undertake postbreeding migrations of up to 3,000 km. Variation in migratory strategies could expose different subsets of the population to differing risk factors and play a substantial role in population dynamics of the species; however, little information exists on the prevalence or distribution of long-distance migrants. To address this information gap, we used GPS loggers to track postbreeding movements in 60 Brown Pelicans breeding across the northern Gulf of Mexico. For all individuals for which we obtained a complete migration cycle (n=43), we modeled migratory strategy (resident, medium-distance, or long-distance) as a function of sex, body condition, breeding location, and reproductive success during the most recent breeding season. We found that females were more likely to migrate long distances, while males were more likely to be resident. Neither body condition nor breeding success influenced migratory strategy, although failed breeders often dispersed away from breeding colonies immediately following nest failure. Long-distance migrants were also less likely than residents or medium-distance migrants to breed in the second season of data collection, which may indicate a biennial breeding strategy in a portion of the population.

Talk



CONSERVATION STATUS OF SHORT-TAILED ALBATROSS

¹Ellen Lance*

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A thorough review of the conservation status of the endangered short-tailed albatross (*Phoebastria albatrus*) is required every five years by section 4(c)(2) of the U.S. Endangered Species Act, and based on the findings in the review, the U.S. Fish and Wildlife Service (FWS) recommends changes if appropriate. The FWS evaluated whether the short-tailed albatross should be removed from the list of endangered and threatened species or be changed in status from endangered to threatened (FWS 2014). The world-wide population of short-tailed albatross is growing at an impressive rate; the FWS predicts with guarded optimism that by 2052, they will have fully recovered from the devastating market hunting that caused their endangerment. This poster provides highlights from the 2014, 5-Year Review Summary and Evaluation of the Short-tailed Albatross. The Review can be viewed in its entirety at: http://ecos.fws.gov/docs/five_year_review/doc4445.pdf.

Poster



IMPACTS OF DROUGHT ON CASPIAN TERN COLONY RESTORATION IN SEMI-ARID LANDSCAPES OF EASTERN OREGON AND NORTHERN CALIFORNIA

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As part of a regional Caspian tern (*Hydroprogne caspia*) management plan to reduce avian predation on salmonid smolts in the Columbia River estuary, the U.S. Army Corps of Engineers constructed 8 islands in interior Oregon and northeastern California as alternative nesting habitat. The first island was built in 2008 and, over the following 4 years, 7 additional islands were built to coincide with reductions in Caspian tern nesting habitat in the Columbia River estuary. Completion in 2012 of this interior network of nesting habitat coincided with the beginning of a region wide drought; by 2014, water shortages had reduced both the availability of foraging habitat and the insularity of restored nesting sites. Information from colony monitoring, identification of prey items in bill-loads, surveys of foraging activity, and GIS analysis of Landsat imagery were used to examine changes in colony site suitability, diet composition, foraging patterns, and foraging habitat availability during 2012-2014. Diet composition varied by geographic region and year based on local prey availability. Terns nesting in basins with highly managed water resources showed less between-year variability in diet composition, foraging site use, and foraging site availability than those nesting in areas with more natural hydrological regimes. We found colony sites to be less secure from mammalian predators as water levels declined; mammalian predators were detected at least once at all of the restored colony sites in 2014. Although the network of interior breeding sites has restored much-needed habitat for Caspian terns in the region, these sites are still susceptible to climate cycles that may periodically reduce their suitability for nesting.

Talk



USE OF DIGITAL AERIAL IMAGERY AND ONLINE GIS TO ESTIMATE COLONY SIZE AND AREA FOR GROUND-NESTING SEABIRDS: BETTER TOOLS FOR MONITORING SEABIRD POPULATIONS

¹Peter Loschl*, ²Daniel Roby, ³Aaron Turecek, ³Mike Hawbecker, ¹James Tennyson, ¹Donald Lyons

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An ability to accurately estimate seabird colony size using repeatable methods is important for detecting trends in colony size and overall population size. For large or difficult to access colonies, it is often not feasible to estimate colony size from observation blinds or other ground-based vantages. To address this problem, we developed methods of estimating ground-nesting seabird colony size from high-resolution aerial photography using Geographical Information System (GIS) tools. Our approach was effective for counting several species that nest in the open and are distinguishable on aerial images, including species of Pelecanidae, Phalacrocoracidae, Larinae, and Sterninae. We hired a professional photographic service to collect vertical aerial imagery of seabird colonies using large format digital or forward motion compensating film cameras. Digital images were georeferenced, resampled to a ≤ 2 -cm pixel size, and stitched into a single SID image. A custom colony-counting application was developed in ArcGIS to mark birds or nests on aerial imagery. Where estimates of variability in photo interpretation were desired, several counts were conducted independently. Estimated variation among counts in a GIS was typically low ($CV < 2.0$) enhancing the ability to detect changes in colony size between years. During 2011–2014, imagery was served to counters via an online application developed using Esri's ArcGIS API for Silverlight.. While estimation of colony size from aerial photography has been well established for seabird monitoring, our use of digital images and GIS tools served via a custom online application had the benefit of increased accuracy, repeatability, and simplified data archiving over traditional methods.

Poster



CASPIAN TERN RESPONSE TO NESTING HABITAT REDUCTIONS AT A MANAGED COLONY SITE IN EASTERN WASHINGTON, USA

¹Donald Lyons*, ¹James Tennyson, ¹Allison Patterson, ²Daniel Roby, ¹Yasuko Suzuki, ¹Peter Loschl

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In recent years, the availability of Caspian Tern (*Hydroprogne caspia*) nesting habitat in the U.S. Pacific Northwest has been managed with the intention of reducing predation on fish populations of conservation concern. In 2014, we evaluated the individual response of Caspian Terns to a reduction in nesting habitat at a colony on Goose Island in Potholes Reservoir in eastern Washington. We captured 28 terns at the former colony site in early April and fitted them with satellite telemetry tags. After capture was completed, the former colony site was made unavailable by covering the area with elevated ropes and flagging. A small amount of suitable habitat was left available on a rocky islet adjacent to Goose Island and 160 pairs of terns eventually nested there, down from 340 pairs that nested at the former colony in 2013. Initially, most tagged terns (n=28) were associated with the Goose Island site. By the end of the typical egg-laying period (late May), only a few tagged terns (n=3) were associated with Goose Island, with others (n=11) associated with nearby active colonies 70-125 km away. Half the tagged terns (n=14) were not consistently associated with any colony, however. Two of the nearby colonies failed in June and most tagged terns associated with those sites shifted their associations back to the Goose Island site until the breeding season concluded. These observations suggest three types of initial response to nesting habitat reduction: (1) stay at the site and compete for reduced available habitat, (2) move to a nearby colony and attempt to nest there, returning to the colony of origin if nesting fails, and (3) nomadic wandering throughout the region, without a sustained association with any colony.

Talk



PROJECTING THE POPULATION OF AUDUBON'S SHEARWATER IN THE CARIBBEAN USING SURVEY DATA AND AREA OF UNSURVEYED COLONIES

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Shearwaters and other seabirds that nest in cavities are notoriously difficult to survey, but they represent an important component of island ecosystems and many are of conservation concern. In the Caribbean, large human populations have severely limited the populations of seabirds including Audubon's Shearwater (*Puffinus lherminieri*), which have been extirpated from the majority of breeding islands and restricted to offshore cays. Audubon's Shearwater is known to nest or to have nested at 158 islands in the Caribbean and remains on at least 139 islands today. This paper projects the current and past populations of shearwaters with the best data available at each location. The area of each location was estimated using ArcGIS Explorer's satellite aerial basemap. To estimate detection rate, sixteen plots were searched on multiple nights in the same season and indicated a detection rate of 79.2% (57 of 72 defended nests). Of those nests, 54% (39 of 72) contained chicks and represented breeding pairs. After correcting for detection rate, shearwaters occur in a range of densities from 0.6 to 246 defended nests ha⁻¹ (n=21 colonies; median=31.5 * ha⁻¹; average=57.2 * ha⁻¹). A minimal estimate indicates at least 13,800 defended nests remain. If the best current estimate of density for each colony is multiplied by the area of the site, the current population is 22,800 defended nests. Pre-anthropogenic populations were conservatively 600,000 defended nests. The current populations represent a remnant of the former, and the ecological role of shearwaters in the Caribbean has not only decreased but changed in kind.

Talk



THE EVOLUTION OF EL NIÑO AND CRITERIA USED TO DEFINE EVENT TYPES

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In this talk I start with a review of the typical evolution of El Niño/Southern Oscillation (ENSO) in the tropical Pacific, and how events of different types have been defined in the academic literature and in agencies like NOAA. Two flavors of ENSO, the so-called Eastern Pacific and Central Pacific types, will be described, along with their respective definitions and associated teleconnections to climate and ocean conditions across the Pacific. I will end my presentation with a summary of the current state and seasonal forecasts for the tropical and Northeast Pacific Ocean.

Talk



CASSIN'S AUKLET DISTRIBUTION IN RELATION TO KRILL "HOTSPOTS" IN THE CENTRAL CALIFORNIA CURRENT SYSTEM

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Cassin's auklets (*Ptychoramphus aleuticus*) are highly dependent on zooplankton prey relative to other seabirds found in the California Current System (CCS). While most zooplankton exhibit diel vertical migration, tagging data suggests Cassin's dove up to a maximum of 39.5m (2008 – 2010) and successfully foraged on krill (predominantly *Euphausia pacifica* and *Thysanoessa spinifera*) during daylight hours. The frequency of occurrence of krill from daytime (0600 – 1800) surface hoop net sampling in the upper 50 meters shows widespread availability and presence of Cassin's preferred prey (adult krill) and non-preferred prey (immatures and juveniles) in high numbers (20% and 40%, respectively). We developed separate predictive models for Cassin's auklets and acoustic krill biomass at depths shallower than 30-meters (using a zero-inflated negative binomial regression and a two-part model combining logistic and negative binomial regressions respectively) from at-sea strip transect counts and hydroacoustics over a 10-year period (2004 – 2013), oceanographic variables collected underway with a thermosalinograph, remotely collected climate indices, and bathymetric and distance-related data. This work builds on a previous modeling exercise by adding several years of at-sea observations. Model predictions were applied to a 1-km² prediction matrix spanning the Gulf of the Farallones and Cordell Bank National Marine Sanctuaries for May, June, and July and we found several areas where both predator and prey consistently co-occur: the Farallones Escarpment and Cordell Bank. Both models of predicted abundance showed 2006 as an anomalous year based on the year effect (for Cassin's) and the interaction of year with temperature (for krill).

Talk



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

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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 the Channel Islands. In an effort to restore breeding habitat and improve reproductive success, extensive habitat restoration efforts have occurred over the last seven years at Scorpion Rock off Santa Cruz Island and Santa Barbara Island (SBI). On Scorpion Rock, the removal of 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%. These changes have improved nesting habitat for Cassin's Auklets (*Ptychoramphus aleuticus*) by providing accessible, protected habitat to excavate burrows. On SBI, efforts have focused on restoring nesting habitat for the State threatened Scripps's Murrelet (*Synthliboramphus scrippsi*) and Cassin's Auklet. More than 25,000 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 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



CHANGES IN SEABIRD BREEDING POPULATION SIZES IN THE NORTH CENTRAL COAST REGION OF CALIFORNIA, 1989 TO 2010-2012

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Seabird breeding colony surveys were conducted in the North Central Coast region of California between Point Arena and Pigeon Point in 2010-2012 to update population sizes and provide baseline data for monitoring newly established state marine protected areas. Numbers of breeding birds were estimated from counts of nests (or birds for certain species) from boats, mainland or island vantage points, or aerial photographs; in some cases, recent literature was substituted. In 2010-2012, over 500,000 breeding birds of 13 species were found at 68 active colonies. By far the largest breeding colony was at the South Farallon Islands within the Farallon National Wildlife Refuge, with about 328,500 breeding birds (over 80% of the regional total), including all 13 species. The most abundant species was the Common Murre (*Uria aalge*), with nearly 440,000 breeding birds. Since the last region-wide survey in 1989, regional populations of five species increased (Double-crested Cormorant [*Phalacrocorax auritus*], Black Oystercatcher [*Haematopus bachmani*], Common Murre, Pigeon Guillemot [*Cepphus columba*], and Rhinoceros Auklet [*Cerorhinca monocerata*]), one new breeding species was added to the region (California Gull [*Larus californicus*]), four species declined (Leach's Storm-Petrel [*Oceanodroma leucorhoa*], Pelagic Cormorant [*P. pelagicus*], Cassin's Auklet [*Ptychoramphus aleuticus*] and Tufted Puffin [*Fratercula cirrhata*]), and three species fluctuated or remained relatively stable (Ashy Storm-Petrel [*O. homochroa*], Brandt's Cormorant [*P. penicillatus*], and Western Gull [*L. occidentalis*]).

Poster



DIVING DEEP INTO CASSIN'S AUKLETS DIVING BEHAVIOR

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The purpose of this study was to investigate the diving behavior of Cassin's auklets (*Ptychoramphus aleuticus*) using Time Depth Recorders and Python Computer Programming. We tested the hypothesis that in years when the birds made more frequent deep dives, they have lower reproductive success. Deeper dives could indicate that their zooplankton prey were distributed in a deeper layer and the birds would have to work harder to find food for their chicks. We studied Cassin's auklets nesting on the Farallones Islands from 2008 – 2013. We affixed TDRs to the body feathers of 73 adults raising chicks in nest boxes for around three days each. The TDRs recorded time, temperature, and pressure every 5 seconds and when the bird dove below 5 meters, every .5 seconds. Using Python coding language we calculated the maximum dive depth of 57,519 dives. We found significant interannual variation in maximum dive depth; mean maximum dive depth ranged from 4.4 (+/- 1.7 s.e.) in 2011 and 11.8 (+/- 1.5 s.e.) in 2010. In 2008, 54% of the dives were between 5 and 10 meters. In 2011 69% were between 15 and 30 meters and in 2013 65% were between 5 and 15 meters. Average maximum dive depths did not correspond to variations in reproductive success. In fact, in 2010, the year when the birds made the deepest dives, they had the highest reproductive success. This indicates that the density and distribution of zooplankton may be important in addition to depth distribution.

Poster



PREDATION BY ISLAND SPOTTED SKUNKS AND RAVENS ON ASHY STORM-PETRELS AT SANTA CRUZ ISLAND, CALIFORNIA

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At Santa Cruz Island, two sea cave colonies of Ashy Storm-Petrel (*Oceanodroma homochroa*) recently experienced major impacts due to predation by island spotted skunks (*Spilogale gracilis amphiala*) and Common Ravens (*Corvus corax*). These predators were not detected in sea caves during storm-petrel nest monitoring in 1995-2004. At Bat Cave in 2005, at least two skunks were trapped after killing at least 76 adults, associated with complete reproductive failure; this colony contained 64-97 nests per year in 1995-97. After 2005, numbers of active nests gradually recovered from 19 in 2006 to 95 nests in 2013 when limited raven predation was first noted. By 2014, the number of nests had been reduced to about half of 2013 numbers by raven predation. At Cavern Point Cove Caves in 2008, at least two skunks were trapped after killing at least 32 adults, associated with complete reproductive failure; this colony contained 11-17 nests per year in 1995-97. After 2008, little recovery has occurred, from 2 nests in 2009 to 6-7 nests in 2013-2014. After initial skunk removals, traps were placed within protective boxes each year but no skunks were noted. Skunk predation events in sea caves appeared to be unusual and related to temporary higher skunk population levels due to low numbers of the island fox (*Urocyon littoralis santacruzae*). Raven predation in sea caves appears to be a newly developed behavior, possibly related to a large public campground near Bat Cave that has developed since 1997.

Talk



USE OF ARTIFICIAL NEST STRUCTURES AND VOCALIZATION BROADCASTING TO RESTORE ASHY STORM-PETRELS AT ORIZABA ROCK, SANTA CRUZ ISLAND, CALIFORNIA, IN 2008-11

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In 2008-11, the Montrose Settlements Restoration Program funded deployment of artificial nest sites in caverns and vocalization broadcasting to restore the colony of Ashy Storm-Petrels (*Oceanodroma homochroa*) at Orizaba Rock, off Santa Cruz Island, California. This colony declined between 1996 and 2005, apparently due mainly to impacts from bright lights from squid-fishing boats. After 4 years of restoration actions, numbers of active nests almost doubled from 7-18 (2005-07) to 26 in 2011 (similar to 1995-97). Eggs were laid in 4-7 artificial nest sites per year in 2008-11. Numbers of active natural nests increased from 7-15 (2005-07) to 22-29 (2008-11). Eggs were laid in roof tile artificial sites in the first year of deployment (2008) and no problems were noted in 2008-09. Common Ravens (*Corvus corax*) dismantled 12 artificial nest sites in 2010. In early 2011, 13 roof tile nest sites were replaced with newly-designed ceramic chamber nest sites which mostly prevented raven impacts in 2011. In 2012, all artificial sites were removed and vocalization broadcasting was stopped due to additional raven impacts. Newly-designed ceramic nest sites were deployed in 2014 without vocalization broadcasting. Our work in 2008-11 demonstrated the effectiveness of these restoration actions under certain conditions and the need to make artificial sites raven-proof at Orizaba Rock.

Talk



PASSIVE ACOUSTIC MONITORING OF ASHY STORM-PETRELS AT BREEDING SITES - SUMMARY OF EXISTING RESEARCH AND NEXT STEPS

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Passive acoustic surveys can be an effective tool for monitoring rare or elusive seabird species. Automated sensors combined with automated post-processing of resulting data can: 1) detect vocalizations at potential breeding sites, 2) document patterns of vocal activity at survey sites, and 3) provide a metric of vocal activity rates for comparison among survey sites and through time. Here we present data from acoustic monitoring surveys for Ashy Storm-petrels (*Oceanodroma homochroa*) conducted on Southeast Farallon Island (2009-2012) and summarize findings from previous acoustic surveys on Anacapa Island (2011, 2012), and off Santa Cruz Island (2011). Our results confirm that automated sensors capture storm-petrel calls and that classifiers can be used to detect Ashy Storm-petrel vocalizations despite complicated soundscapes at breeding sites. Vocal activity rates show nightly and seasonal patterns consistent with the biology of the species, including low rates of activity on nights with moonlight. Call rates measured at 7 surveys points on Southeast Farallon Island are consistent with independent categorical assessments of storm-petrel breeding burrow densities. A more detailed comparison of call rates to nest counts could refine the efficacy of using call rates as an index of Ashy Storm-petrel relative abundance, and a comparison of call rates to catch per unit effort rates at mist netting sights could facilitate comparisons between these indices. Our results suggest that acoustic sensors deployed at breeding sites throughout the range of the species could contribute to long-term monitoring efforts.

Talk



LASER TECHNOLOGY FOR SEABIRD BYCATCH PREVENTION IN COMMERCIAL FISHERIES

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Lasers have been used in a variety of applications as non-lethal bird deterrents in terrestrial applications for over 40 years. Experience to date shows that the effectiveness of lasers at displacing birds is species specific and limited to low light conditions. A collaborative effort between Mustad Autoline and SaveWave led to the development a laser designed to exclude seabirds from the dangerous areas around fishing vessels. Preliminary results from the Iceland demersal longline fishery showed that that the laser beam (and its associated “dot”) effectively pushed seabirds away from the stern of the ship during dawn, dusk, cloudy, rainy or foggy conditions. These promising results and recent awards to the developers have spurred keen interest within the fishing industry in the US and globally to purchase, trial and apply the laser for seabird bycatch prevention. However, questions linger regarding safety, specifically potential retinal damage, to humans and birds exposed to this class 4 laser, a technology several times more powerful than the class 2 and 3b lasers used in terrestrial applications. We propose a three-step approach to test the laser for seabird bycatch control in US waters: 1) determine if the species bycaught in US North Pacific fisheries can be effectively displaced by the laser; 2) evaluate the risk of retinal damage to birds exposed to the laser using a sensory ecology approach; and 3) compare the effectiveness of lasers vs. streamer lines via formal field tests (assuming steps one and two produce acceptable results).

Talk



MODELING SEABIRD DISTRIBUTIONS FOR MARINE PLANNING BY WASHINGTON STATE

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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 by facilitating spatial planning. We developed seasonal distribution maps of seven seabird species off the Pacific Coast of Washington by integrating eight observation data sets and applying an ensemble machine-learning technique with component-wise boosting of hierarchical zero-inflated count models. The compilation of federal, state and academic observation data offers exceptional spatial and temporal resolution of patterns across seasons and years. The modeling technique allowed for complex non-linear relationships between response and predictor variables and interacting effects among spatial and temporal predictors. This technique solved key statistical challenges associated with heterogeneous survey platforms across multiple data sets, spatially and temporally biased effort, and the aggregated nature of sightings. Output maps provide a starting point for evaluating risk to marine bird populations in the region from human activities and identifying important offshore seabird conservation sites.

Talk



SOCIAL ATTRACTION TECHNIQUES FOR SEABIRDS RESTORATION ON TODOS SANTOS ISLAND, BAJA CALIFORNIA, MEXICO

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We present the results of the implementation of social attraction systems for the recolonization of seabirds on the Todos Santos Island, as part of the “Seabird Restoration in Baja California Pacific Islands Project”. The overall goal of this project is to restore seabird populations that have been affected by oil spills and DDT manufacturing. On Todos Santos we installed 10 social attraction systems; two artificial colonies (40 decoys each) of Double-crested Cormorant (*Phalacrocorax auritus*) were placed on highlands and steep slopes, four artificial colonies of Brandt's Cormorant (*Phalacrocorax penicillatus*) were distributed throughout the cliffs of the northern shore of Todos Santos, and four nest boxes (5 artificial burrows each) were installed to attract the Cassin's Auklet (*Ptychoramphus aleuticus*), each installed near potential nesting sites determined by observations during the previous season. A sound system was set near every nest box and colony. Monitoring consisted of daily observations during the breeding season of 2014 (April 21th to July 28th). Results show increased activity in colonies of Cormorant decoys, especially in the Double-crested colonies which had the highest number of interactions with conspecifics and active nests recorded inside the colony.

Talk



CLIMATE CHANGE IMPACT ON SEABIRD POPULATION – EVIDENCES FROM SOUTHERN AFRICAN REGION

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Seabirds breed on land, often at islands, and they obtain all or much of their food at sea. They may be good indicators of the health of the resources on which they feed. Population, demographic, diet and distribution parameters of several seabirds in southern Africa (including African Penguin, Cape Gannet, Bank Cormorant, Cape Cormorant and Swift Tern) have been related to trends in the abundance or availability of “commercially-exploited fish” on which they prey. This makes seabirds potentially useful indicators of the status of prey resources and, if the latter are influenced by climate, of climate change. However, seabirds and their prey are also affected by other factors, such as oil spills and fishing, so that changes in parameters need not result from climate change. In order to use seabirds as indicators of climate change, it will be necessary to distinguish between environmental and other factors that may be influencing populations and associated parameters. This paper aims to outline impact the climate change has on seabirds in the context of southern African region. In terms of methodology of the study, data (which are secondary in nature) that have been used to achieve this objective include assessment of the influence of environmental parameters. Analysis of data is basically descriptive in nature. The paper concludes that there are many examples for southern Africa seabirds where population, demographic, diet or distribution parameters have been related to, or conform with, trends in the abundance or availability of fish species on which they feed.

Talk



RINGED STORM PETREL PROJECT: BUILDING A LINK BETWEEN CONSERVATION AND CITIES

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The Ringed Storm Petrel project was created under the premise of giving special attention to the rescue, rehabilitation and release individuals of *Hydrobates hornbyi* that were found in urban areas of the coast of Peru. The project began in Lima, a city of nearly 9 million habitants, where the majority does not know the diversity of coastal marine fauna, much less the existence of pelagic birds. To develop the objective of rescuing the grounded birds, we reached public through social networking, developing talks and using print media. As a result, we were able to involve more than 300 citizens in rescue actions. Through talks we delivered the message to more than 270 people; managing to establish a volunteer network, and at the same time carrying out education. The use of social media was the best tool for direct communication between the project and the citizens. At present the Project has more than 2400 followers in Facebook who helped to rescue more than 250 birds in two years. The time between identifying the birds and to contact with the project were the main problems encountered. The people who had the opportunity to participate in rescue actions declared that they valued the opportunity to be involved in a conservation project in Lima. The Ringed Storm Petrel is the only seabird rescue network that exists in Peru and it gives the opportunity to create a bond of understanding, to link knowledge, respect and value to one species of wildlife and their habitat.

Talk



INDIVIDUAL CONSISTENCY OF MIGRATION ROUTE AND ACTIVITIES OF BLACK-TAILED GULL

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Much remains to be discovered about avian migration in terms of destination, route and behavioral strategies and recently researchers have begun to focus on individual consistency of migration. The aims of our study were to reveal migration route of Black-tailed Gulls *Larus crassirostris* (which is medium-scaled migration around Japan), and examine whether individuals are consistent in migratory behavior (migration route and foraging activities in the sea). We carried out our field study in Kabushima-Island (40° 32' N, 141° 33' E) in Japan, from 2011 to 2013. In total, we have tracked 15 migration journeys from six birds (four males, two females) in three years and two (two females) birds in the last two years. In eight birds followed in consecutive some years, migration routes of females were consistent but males were not. On the other hand, the foraging activities at sea were not consistent in all eight birds but the durations were shorter in 2010 than in 2011 and 2012. Repeating the same route to specific areas may lead to efficient foraging during the migration period. But food resources may not always exist every year in the same place. These results imply that gulls respond to spatial and temporal environmental change by changing their foraging activities.

Poster



SATELLITE-TRACKED SOOTY SHEARWATERS (*PUFFINUS GRISEUS*) RESPOND TO SPATIO-TEMPORAL WIND VARIABILITY IN THE CALIFORNIA CURRENT

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Marine predators forage in a heterogeneous landscape, where prey patches are unevenly distributed. Predators return to larger scale areas of consistent productivity such as the California Current, and search at finer temporal and spatial scales to locate prey patches. During the boreal spring-summer, Sooty Shearwaters (*Puffinus griseus*) are the most abundant seabird in the California Current. They migrate from southern hemisphere islands to the California Current waters at the completion of breeding. Shearwaters depend on the productive California Current waters to maintain body condition and undergo energetically demanding molt. Because shearwaters are adapted for efficient flight, with movements highly correlated with winds, we expected shearwaters to use winds opportunistically to move between foraging areas. Indeed shearwaters in this study responded by vacating foraging hotspots following a reversal in wind direction, often flying in the more economical downwind direction. Shearwaters also used headwind and tailwind flight much more frequently than expected, likely due to constraints of a north-south oriented coastline and availability of winds associated with this coastline orientation. Multiple tracked Sooty Shearwaters also travelled synchronously while moving within the California current between foraging areas, and again when departing on the autumn southern re-migration. We suggest the cue to depart on the southern migration involved a combination of seasonal phenology, local enhancement, and body condition.

Talk



MARbled MURRELET NEST SITE SELECTION AT THREE SPATIAL SCALES

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We implemented a unique tree-climbing effort examining nesting-habitat selection of Marbled Murrelets (*Brachyramphus marmoratus*) in Washington and Oregon. Data were collected from 1995 through 1999 in the North Cascades and Olympic Peninsula in Washington and the Coast Range of Oregon. Researchers searched for old and active murrelet nests using tree climbing in known occupied stands during the breeding season (May - Sep). Plot locations were randomly selected from grid points overlaid on each site. Over 3000 trees were climbed. Within known occupied stands, characteristics of murrelet nest sites and non-nest sites were measured at three spatial scales: nest limb or platform, nest tree, and nest-site or forest patch (0.5 ha). To determine nest-site selection, measurements of selected characteristics were taken for three randomly selected platforms in each of three randomly selected trees in each climbing plot. At the patch scale covariates included platform density (#/ha), variation in tree diameter, and canopy cover. At the tree scale covariates included tree diameter (cm), number of platforms, and moss depth (mm). At the platform scale covariates included horizontal cover (%), platform diameter (cm) and moss cover (%) on the nest limb. We report results of a Bayesian hierarchical logistic regression model highlighting characteristics that differentiate nest platforms from random platforms, nest trees from non-nest trees, and nest sites from non-nest sites, within our study area in the Pacific Northwest.

Poster



DEMOGRAPHIC IMPACTS OF CLIMATE VARIABILITY ON CASSIN'S AUKLETS: PROJECTING DYNAMICS OF THE FARALLON ISLANDS POPULATION IN AN UNPREDICTABLE ENVIRONMENT

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The Cassin's Auklet (*Ptychoramphus aleuticus*), a California Species of Special Concern, has exhibited long-term population decline on the Farallon Islands. The recently reported die-off of Cassin's Auklets is but the latest example of the species' marked sensitivity to climate variability. Here we quantify the impacts of the 2005-2006 oceanographic anomaly on auklet demographic parameters and compare its impacts to that of major ENSO events that occurred in the 1990s. Capture-recapture analyses of a known-age population reveal that breeding propensity declined by 50%, adult survival declined by 20%, and reproductive success among birds that attempted to breed declined by more than 90% in 2005 and/or 2006. We developed a stochastic population dynamic model to project future dynamics in the face of anticipated climate variation and assess management action that may ameliorate climate impacts. Our results suggest that the Cassin's Auklet population on the Farallon Islands will be able to maintain current population levels over the next 20 years assuming future El Niño events occur at moderate (i.e., long-term, historic) frequency and the 2005/2006 anomaly does not reoccur. However, the population is expected to decline by >62% over 20 years if anomaly of 2005 and 2006 were to re-occur and El Niño events continue at the elevated frequency that has recently been observed. Partial reduction of adult mortality due to predation has the potential to counteract expected population declines, turning declines into stable populations. There is substantial benefit to management action that reduces predation, even partially, given anticipated future climate variation.

Talk



SPATIALLY DEFINING FORAGING DISTRIBUTIONS FOR TRIANGLE ISLAND BREEDING CASSIN'S AUKLET TO ESTIMATE EXPOSURE TO SHIP-SOURCE OIL POLLUTION AND MICROPLASTICS

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Cassin's Auklet (*Ptychoramphus aleuticus*) has one of the most extensive breeding ranges for a Pacific alcid. Although the extent of the breeding range of Cassin's Auklet has not substantially changed since the 19th century, breeding colonies in British Columbia have become increasingly more important for the conservation of this species. In particular, it has been estimated that the Triangle Island colony hosts approximately 55 to 65% of the global breeding population. This concentration of individuals during breeding makes this species vulnerable to small-scale anthropogenic stressors such as ship-source operational (or chronic) oil pollution and oceanographic accumulations of microplastics at the mesoscale or smaller. In this talk, we define foraging distributions of breeding Cassin's Auklet using RandomForest based on at-sea survey data collected in the Canadian Pacific during the breeding period (May through July, 1990-2011); and, home ranges estimated from radio-telemetry locations of tagged adults breeding on Triangle Island (May through July, 1999-2001). We compared these distributions spatially with vessel traffic information as a proxy for exposure to ship-source operational oil discharges, and with microplastic concentrations derived from the cooling intake of research vessels during late summer 2012. Our Cassin's Auklet distributions are exposed to a relatively high risk of encountering ship-source oily discharges, but are found in areas with relatively low densities of microplastic. Cassin's Auklet is currently under review for conservation status in Canada, and we believe this approach for estimating spatially explicit risk exposure while foraging at-sea could be useful for informing this review process.

Talk



BODY SIZE PREDICTS INDIVIDUAL WINTER FORAGING STRATEGIES OF THICK-BILLED MURRES (*URIA LOMVIA*) IN THE BERING SEA

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For marine birds that fly and dive, body size constraints may be important for migratory decisions as smaller bodies reduce flight costs whereas larger bodies are advantageous for diving deeper. This study tests the hypothesis that body size influences migratory strategies in Thick-billed Murres (*Uria lomvia*) from St. Paul, St. George, and Bogoslof islands in the southeastern Bering Sea. We used geolocation time-depth recorders and stable isotopes to examine individual migratory behavior during three non-breeding periods, 2008-11. Body size was quantified by a principle component analysis of wing, culmen, head+bill, and tarsus length. Body size, the first principle component, differed by colony and sex. Larger bodied birds dove to deeper depths, spent more time in the Bering Sea, and had higher $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values in feathers grown during late winter. A hierarchical cluster analysis identified three foraging strategies based on movement, diving, and stable isotope data. One strategy consisted of larger birds originating only from St Paul (31% of birds from this colony). These birds remained in the Bering Sea, foraged mainly during the day, and had elevated late winter $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values (throat feathers). In contrast, smaller birds from all colonies dove mainly at night in 2008/09 and 2009/10. High residency locations of birds using this strategy were largely in areas south of the Aleutian Islands. The third strategy occurred only during 2010/11 when birds dove more and deeper, suggesting limited prey resources. Foraging strategies were linked to body size and partitioned with respect to annual differences, presumably in response to shifts in the distribution of prey.

Talk



STATUS OF THE SOCORRO ISLAND BIRDS AFTER EXOTIC SPECIES CONTROL

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Socorro Island has a large number of endemic terrestrial species of Mexican islands. It is located on Revillagigedo Archipelago. Socorro host nine endemic bird species or subspecies level and a reptile, and several seabirds which nest on the island including the Critically Endangered Townsend's Shearwater (*Puffinus auricularis*). Decades ago, sheep and cats were introduced to the island, resulting in habitat destruction and declining native wildlife. The intensive work since 2012 until now has resulted in the removal of feral sheep, which has resulted in significant, visible recovery of the island's vegetation, and the removal to date of more than 200 feral cats (60% of advance). In 2012 we initiated the monitoring of endemic land birds and in 2014 the study of Townsend's Shearwater, one of the most threatened birds in America. Monitoring native birds include strip-transect visual surveys twice a year in three different habitat of island. In 2013 we started with night-vision, acoustic surveys, and/or visual surveys in daylight. As the habitat on island is recovered, and cat population decreases, preliminary results show about 80% increase in the population of terrestrial birds between 2012 and 2014 in the most impacted areas of the island. The most abundant species is the Tropical Parula (*Setophaga pitiayumi*), followed by Socorro Wren (*Troglodytes sissonii*) and Socorro Eastern Towhee (*Pipilo maculatus socorrensis*) all endemic to the island. With the use of radar in the highest part of the island, night vision equipment and equipment passive and active recording, we have recorded nesting sites, patterns of distribution and use of the Island. After complete eradication of cats, a recovery fauna on the island is expected.

Talk



RESTORING SEABIRD BREEDING COLONIES INVADED BY RATS AND OTHER INTRODUCED MAMMALS IN JAPAN AND KOREA

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Two meetings about eradication of introduced mammalian predators on islands with seabird breeding colonies were held in the Tokyo area in August 2014 to share data and exchange ideas on this issue in Japan and Korea. A roundtable discussion (RTD) was held at the International Ornithological Congress and a technical meeting was held at the Japan Wildlife Research Center. In total, more than 67 people participated, including scientists, naturalists, and members of the Japan Ministry of the Environment. In Japan, most (70%; n = 60) known seabird breeding island groups are protected within designations such as National Monument or wildlife protection area. However, introduced mammals (mainly rats and cats) have been reported as: (1) present on 20 groups; (2) suspected on 7 groups; (3) not present on 8 groups; and (4) status unknown on 25 groups. Much work is needed in both Japan and Korea to: (a) build a database of seabird islands that includes information on species presence and status; (b) conduct studies to demonstrate the effect of introduced animals on seabirds; (c) conduct appropriate baseline and post eradication monitoring to demonstrate the benefits of eradication to island biodiversity; (d) create a conservation bait matrix that is legal in both countries; and (e) determine methods to prevent future invasive species arriving on islands with seabird breeding colonies. Given the declining status of many seabirds in Japan and Korea, eradication of introduced mammalian predators is an important step in improving seabird health and restoring colony biodiversity.

Poster



TESTING THE SUN-COMPASS IN AN OCEAN WANDERING SEABIRD

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Seabirds are extraordinary navigators, but the mechanistic underpinnings of this ability remain unknown. In an environment devoid of visual landmarks, seabirds move over large distances with great accuracy both to find food and to locate nesting sites which are often on remote, inaccessible islands. In this study we tested a paradigm in terrestrial navigation – the time-compensated sun-compass - by clock-shifting a wild bird in situ for the first time. We displaced 49 clock-shifted Manx shearwaters *Puffinus puffinus* 40km from a colony on Skomer Island, Wales, where they were out of the sight of land and tracked their homing trajectories using GPS dataloggers. Using sophisticated analytical methods to evaluate homing tracks, we observed a significant effect of treatment on the orientation behaviour of the released birds but in the opposite direction to that which was expected, implying an alternative mechanism driving the use of the sun in pelagic navigation. We demonstrate that the Manx shearwater system is ideally suited for studying navigational mechanisms and discuss the potential implications of non compass-based sun-use in these ocean wanderers.

Talk



THE PRIBILOF ISLANDS SEABIRD YOUTH NETWORK

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The Seabird Youth Network (SYN) is a partnership between the Pribilof School District, the Aleut Community of St. Paul Island, the City of St. Paul, Tanadgusix Corporation, the St. George Traditional Council, the Alaska Maritime National Wildlife Refuge (AMNWR), and the wider scientific community. The network creates opportunities for youth to learn about seabirds with the aim of building local capacity for the collection of long-term seabird monitoring data on the Pribilof Islands. SYN has six main objectives: (1) Contribute to AMNWR's long-term data sets of breeding seabirds on the Pribilof Islands; (2) Promote scientific knowledge and inquiry among Native youth including creation of links with mentor scientists; (3) Build capacity in both field biology techniques and media skills; (4) Employ local people in research on traditional subsistence resources; (5) Increase youth awareness and appreciation of resident seabirds that will lead to future stewardship of the resources. The network uses a website as a platform for sharing seabird lessons with students and the wider teaching community, and learning about seabird monitoring, research, and conservation. Seabird Camps were held on both St. Paul and St. George Island in 2013, and on St. Paul in 2014. Camps are designed to provide hands-on scientific experience and new skills, encourage critical thinking, increase understanding about local resources, and.... be fun! We hope to continue with annual Seabird Camps on both Pribilof Islands, high-school internship positions with the Refuge, and the inclusion of a seabird curriculum in the Pribilof School District.

Talk



INITIAL RESPONSE AND DISPERSAL OF DOUBLE-CRESTED CORMORANTS FOLLOWING HABITAT REDUCTION AT THE LARGEST BREEDING COLONY IN NORTH AMERICA

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East Sand Island (ESI), in the Columbia River estuary, is home to the largest known breeding colony of double-crested cormorants (*Phalacrocorax auritus*; 12,300 pairs in 2012, ca. 40% of the Western North America population). Annual consumption of millions of out-migrating juvenile salmonids (*Oncorhynchus* spp.), including individuals from populations listed under the U.S. Endangered Species Act, has motivated managers to propose actions to reduce cormorant predation, including reducing colony size. In 2013, two visual barriers and limited hazing were used to reduce available nesting habitat to 1.6 ha, a 64% reduction in available habitat from 2012, but greater than the 1.1 ha occupied in 2012. The nesting habitat made available in 2013 also excluded 100% of nest sites used by cormorants in 2012; thus, all returning cormorants were forced to establish nests in a different location on the island, or prospect for nest sites elsewhere. To evaluate cormorant response and potential dispersal, satellite transmitters (Kiwisat 202 & 303 PTTs, Sirtrack Ltd.) were fitted on 83 cormorants during the pre-breeding or nest-initiation period, shortly after their arrival to the colony. Most tagged cormorants (n = 80 or 96%) initially dispersed away from ESI following tagging, a majority of which eventually returned to ESI and attempted to nest there (n = 73 or 96%). Dispersal was temporary, but may have provided information on where cormorants might prospect for alternative nest sites if habitat becomes limiting at ESI: tagged cormorants were detected at colonies and roost sites in the Columbia River estuary (n = 76), the lower Columbia River below Bonneville Dam (n = 27), the outer Washington coast (n = 21), and Puget Sound (n = 1).

Talk



SYNOPSIS OF SEABIRD RESEARCH PROGRAMS THAT CAN PROVIDE BASELINE AND MONITORING INFORMATION FOR OFFSHORE ENERGY ACTIVITIES IN THE PACIFIC

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Many people monitor seabirds using regular counts or other measures. Some monitoring programs do so out of an obligation, some out of a concern for specific species, and some as an indicator of change. If we are to detect changes in seabirds associated with climate or human disturbances, monitoring data are our only hope. However, coordination and sharing of mutual knowledge among seabird monitoring programs often are limited because of different histories and mandates of these research efforts. BOEM and USGS are partnering on a study (1) to identify ongoing or completed research programs that contain information on species and habitats sensitive to offshore energy activities, and (2) to review the capability of these programs to provide baseline and monitoring data to understand and guide mitigation to compensate for potential impacts caused by offshore energy development in the Pacific. The overall strategy is to summarize the main components of each research program, identify spatial and programmatic gaps, and to assess whether a research program could easily be enhanced to better address offshore energy information needs through additional support. Here, we ask some simple questions. Do you monitor seabirds? What seabirds do you monitor? What do you monitor about them? Why do you monitor them? How long have you been monitoring them? Are your data available to the public? Who does one contact to learn more about your program? Our intent is to catalog descriptions of seabird monitoring programs and to share them with the seabird community to foster greater visibility of seabird monitoring and opportunities for funding and collaboration.

Talk



NEST-SITE FIDELITY AT THE LARGEST BREEDING COLONY OF DOUBLE-CRESTED CORMORANTS (*PHALACROCORAX AURITUS*) IN NORTH AMERICA

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Colonial nesting waterbirds often display strong fidelity to natal, previously used, or historical colony sites. Benefits can include prior knowledge of suitable nesting habitat, adequate food supply, security from predators, and available mates. In addition to colony site fidelity, individuals may demonstrate fidelity to specific nest sites. Potential benefits of nest-site fidelity may include greater mate retention, familiar neighbors, and more favorable microhabitat. We investigated nest-site fidelity of double-crested cormorants (*Phalacrocorax auritus*) at East Sand Island (ESI) in the Columbia River estuary, the largest known breeding colony for this species (14,900 breeding pairs in 2013). Nest-sites were estimated for banded individuals in 2013 and 2014 by pinpointing locations on digital high-resolution georeferenced aerial photography while observing cormorants from blinds throughout the colony. Repeatability of mapped locations were within 4 m in 2013 and 5 m 2014. Nest coordinates were overlaid in ArcGIS 10.2 and inter-annual distance between nest-sites was calculated for individuals located on-colony in both years. Median inter-annual distance between an individual's nest-sites was 11 m (range = 0 - 480 m, n = 93). This was significantly less than distances between 2013 nest locations and randomly generated 2014 locations (median = 113 m, range = 8 – 590 m; Wilcoxon signed-rank test, $p < 0.001$), suggesting that nest-site selection in 2014 was not random. We conclude double-crested cormorants display a high degree of fidelity to specific nesting locations within this large colony. The relationship between cormorant nest-site fidelity and fidelity to the colony as a whole remains to be investigated.

Talk



VARIABILITY IN FORAGING BEHAVIOR OF MASKED BOOBIES (*SULA DACTYLATRA*) BREEDING AT ISLA MUERTOS, MEXICO

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Patterns in resource use may vary widely among individuals, leading to a wide array of foraging strategies that are challenging to describe at the population level. In marine environments, apex predators must efficiently process environmental cues derived from physical habitat features to locate prey, and variability and patchiness of the environment may be reflected in foraging behavior among individuals. We sought to examine foraging behavior and habitat use of 77 masked boobies tracked with GPS units during May and November 2013 at a regionally important breeding colony in the southern Gulf of Mexico. Birds exhibited individual variability in foraging behavior and searched for prey at nested hierarchical scales ranging from 60 m - 30 km. The oceanographic variables that were related to foraging behavior at small scales (at the prey patch level) varied widely between individuals, suggesting that individual masked boobies use different foraging strategies. Sea surface height and velocity of water corresponded to foraging most frequently (44% and 38% of birds respectively), a finding that is consistent with the characterization of the Gulf of Mexico as a highly dynamic system strongly influenced by currents and eddies. This study provides valuable information for creating models that explain population activity by integrating individual components and improving management plans by considering the range of behavior within a population. Furthermore, our data, when combined with other tracking efforts in the northern Gulf and Caribbean, provide valuable information for marine spatial planning efforts and serve as a baseline for anthropogenic based threats such as development, pollution, and commercial fisheries.

Talk



PATTERNS OF SEABIRD PRESENCE AT FUTURE WAVE ENERGY SITES ON THE CENTRAL OREGON COAST

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The central Oregon coast was selected for development of the Pacific Marine Energy Center, a facility where wave energy converters can be tested during development and prior to commercial deployment. The Center consists of two wave energy sites, one north (NETS) and the other south (SETS) of the Yaquina River. This area of the Oregon coast is lacking year-round data to assess potential impacts of wave energy to high use bird areas, migration corridors, and habitat alteration. We used vessel-based strip transect surveys to detect spatial and temporal patterns of seabirds during 19 surveys of NETS and SETS from 2013-present, and 24 surveys along the Newport Hydrographic (NH) Line (2006-2009, 2013-present), a cross-shelf oceanographic sampling line that extends 40 km west of NETS. Preliminary results indicate strong fine-scale temporal variation in species composition and abundance at all three sites. Changes in abundance were greatest for common murre (Uria lomvia) at NETS in spring, likely because of proximity to a large breeding colony. Species diversity was highest during the fall and relatively similar at all three sites, but appears to decrease further from shore. The abundance of procellariiformes increased with distance from shore, however, shearwaters (primarily Puffinus griseus) and small alcids (Cerorhinca monocerata and Ptychoramphus aleuticus) appeared to shift inshore seasonally. Marbled murrelets (Brachyramphus marmoratus) were sighted primarily at SETS. Diving planktivores were present at all three sites throughout the year. A better understanding of spatial and temporal shifts of seabird distribution is integral to marine energy planning, implementation, and impact monitoring.

Poster



THE EFFECT OF LOW TIDE TEMPERATURE ON LIMPET SUSCEPTIBILITY TO BLACK OYSTERCATCHER PREDATION

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While many studies have investigated the effects of temperature on ectothermic organisms on an individual level, we need more information about the effects of sublethal thermal stress on species interactions. This study addresses the ecological question: how does low tide temperature affect an ectotherm's susceptibility to predation? Our study organisms are a common rocky intertidal prey item (the owl limpet *Lottia gigantea*) and its low tide predator (the black oystercatcher *Haematopus bachmani*). We quantified the behaviors of a captive black oystercatcher feeding on limpets in order to understand how black oystercatchers prey on limpets. We used these observations and morphometric measurements of museum specimens of black oystercatchers to build a black oystercatcher mimic in the laboratory. To examine the effects of low tide temperature on limpet susceptibility to black oystercatcher predation, we will expose limpets to different low tide temperature treatments and quantify the proportion of individuals that are dislodged from the substratum this predator mimic. This study is particularly timely, as black oystercatchers have recently been observed in Orange County (CA) after being absent for many years. Global climate change has the potential to change species interactions and by better understanding the effects of temperature on the physiology of individuals we can best predict how future conditions may change species interactions.

Poster



IS IT POSSIBLE TO REDUCE RAT PREDATION OF ENDANGERED SEABIRDS ON KAUA'I USING AVAILABLE CONTROL METHODS?

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Two species of introduced rats – Black *Rattus rattus* and Polynesian *Rattus exulans* – are found in the upper montane areas of Kaua'i. Both are predators of endangered seabirds on the island, with multiple documented predations of Newell's Shearwater *Puffinus newelli* and Hawaiian Petrel *Pterodroma sandwichensis* chicks by Black Rats in particular. Rat visitations at active seabird burrows are often very high and can number in the 100s over the course of a breeding season. In 2013 and 2014, attempts were made to reduce rat predation in four management areas on the island – Upper Limahuli Preserve and three sites in Hono o Na Pali Natural Area Reserve. As the existing label for rat poison precludes realistic deployment of poison bait in upper montane areas, A24 Good Nature automatic rat traps were used. Rat traps were deployed in different configurations between the four sites, using either (i) 100m x 50m grids, (ii) the deployment of traps 5m from all known active seabird burrows or (iii) a combination of the two. To assess the effectiveness of each configuration, changes in rat presence were calculated using tracking tunnels and changes in rat burrow visitations were assessed using remote cameras. Finally all known seabird burrows were monitored over the study period and fledging success rates calculated at the end of each season and compared between sites and years. The results are discussed in the context of on-going management efforts to conserve endangered seabirds on Kaua'i.

Talk



A COMPREHENSIVE ISLAND RESTORATION STORY: FROM DETECTION OF AN UNUSUAL MOUSE INVASION AND ITS EXPLOSION, TO ITS ERADICATION AND DERIVED BENEFITS

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We present a summary of our detailed research (2009-2014) on a mouse invasion and its consequences, and its eradication and derived benefits to island biota on San Benito Oeste Island (SBOI; 400 ha), México. SBOI is a key Important Bird Area (IBA) in the Eastern Pacific where >2 million seabirds breed annually. This is not just another case to add to the world's record of ca. 40 successful house mouse eradications but the first one targeting an unusual invader. The Cactus Mouse (*Peromyscus eremicus cedrosensis*) was accidentally introduced to mammal-free SBOI from nearby Cedros Island in late 2006. By the following summer (2007), mice already were abundant and widespread. We then launched a project involving long-term research and monitoring (ongoing up to 2016). Research on mouse ecology and population dynamics of several native species revealed serious negative impacts. This warranted the need for action, especially because mice impacts could have worsen and multiplied if they had reached the other two nearby mammal-free islands of the archipelago. Finally, after years of research, planning and fundraising, the eradication was successfully completed by early December 2013. Indicator species for ecosystem recovery include the Savannah Sparrow (*Passerculus sandwichensis sactorum*), the Side-blotched Lizard (*Uta stansburiana*), two Murrelet (*Synthliboramphus* spp.) and three Storm-petrel species (*Oceanodroma* spp.). In addition to the findings from our ecological research, there also are lessons and experiences to be shared regarding community involvement on this type of conservation projects.

Talk



PREDATOR DISTURBANCE DURING COURTSHIP DRIVES COLONY DYNAMICS OF ELEGANT TERNS, *THALASSEUS ELEGANS*, IN THE SOUTHERN CALIFORNIA BIGHT

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Coastal seabirds are prey generalists known to be influenced by food availability, oceanographic conditions related to productivity, and predator disturbance. Elegant Terns (*Thalasseus elegans*) nest at three sites in southern California: south San Diego Bay, Bolsa Chica Ecological Reserve, and Los Angeles Harbor. Numbers of nesting pairs fluctuate dramatically within and among years at these sites. We tested the hypothesis that from 1999 to 2013 nest numbers were related to prey abundance, chlorophyll a and SST, or predator disturbance. Abundances of four of the tern's key prey species—northern anchovy, Pacific sardine, jacksmelt and topsmelt—were obtained from data on fish entrapped in nearby power-plant intakes. Chlorophyll a and SST were measured by in-situ data from the California Cooperative Oceanic Fisheries Investigations program and satellite data from the MODIS instrument aboard the Terra satellite. Nest number was not related to prey abundance, chlorophyll a, or SST according to bootstrap regression analyses. We measured predator disturbance by the number of Peregrine Falcon, feral dog, and coyote observations at the San Diego site, which had the most detailed data. Disturbance was higher in crash years (<1,000 nests) than non-crash years during courtship ($U = 46$, $z = 2.28$, $p = 0.02$, $r = 0.59$) and before incubation ($U = 44$, $z = 2.04$, $p = 0.04$, $r = 0.53$). Our results suggest that the courtship stage, defined as March 1 to April 18, is a trial period in which Elegant Terns assess a site for suitability, as judged by the level of predator disturbance. However, we need standardized methods of collecting disturbance data and nest numbers to generalize findings across all Elegant Tern colonies in southern California.

Talk



DIETARY SPECIALISATION IN GENTOO PENGUINS SUGGEST A SEASONAL INCREASE IN INTRASPECIFIC COMPETITION

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We studied individual specialisation in the diet of gentoo penguins *Pygoscelis papua* at Bird Island, South Georgia, using stable isotopes. Simultaneously, we collected GPS and TDR tags from sampled birds to investigate whether dietary specialisation was associated with differences in foraging behaviour. Linear mixed effects models revealed that individual specialisation explained 54% of the variance in the nitrogen (N) ratios in blood plasma and cells. N ratios also tended to increase from incubation to chick rearing. Normal mixture models found bimodality in the frequency distribution of N ratios in blood plasma but not cells, which suggests that dietary specialisation increased as the season progressed. Isotope mixing models allowed these patterns to be expressed in terms of percentage diet composition, and showed birds that specialised in krill tended to maintain a krill diet through the season, whereas those that tended to eat more fish during incubation generally increased fish in their diet substantially during chick-rearing. Birds that specialised in fish dived deeper than those specialising in krill, but there were no differences in trip duration or proportion of time spent at sea. However, all of these variables increased during chick-rearing compared to incubation. Moreover, GPS tracks from a subset of birds found the same pattern for distances travelled, maximum distance from the colony and the area of sea used. We conclude that the higher food demands during chick rearing lead to elevated foraging effort and intra-specific competition: this provides the impetus for increased dietary specialisation, as predicted by niche partitioning theory.

Talk



TESTING SURROGATE SPECIES CONCEPTS ON SYMPATRIC KITTIWAKE SPECIES IN THE BERING SEA AND ALEUTIAN ISLANDS

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The U.S Fish and Wildlife Service is actively engaged in a conservation planning process to identify surrogate species for monitoring. These should represent other species or aspects of the species' environment, ideally at a landscape scale. We evaluated two sympatric species, red-legged kittiwake (*Rissa brevirostris*) and black-legged kittiwake (*R. tridactyla*) for potential surrogate species relationships using three and four decade-long datasets from two colonies. These species occur together on the breeding grounds but have disparate wintering ranges and foraging behavior. At St. George Island in the Bering Sea, we found strong positive correlations among both species for multiple demographic parameters (population trend, reproductive success, timing of breeding and overwinter survival). At Buldir Island in the western Aleutian Archipelago, reproductive success was strongly positively correlated, but population trend and timing of breeding were not. We also explored the potential for kittiwake species to provide "surrogate" information about forage fish abundance, which is not well surveyed in these regions. The two species forage quite differently, with red-legged kittiwakes relying heavily on lanternfish (Myctophidae) and black-legged kittiwake diets being more diverse and including a larger percentage of invertebrates. We compared abundance of several fish species in chick diets to abundance in the limited available regional trawl and acoustic fisheries surveys.

Talk



CALIFORNIA LEAST TERN REPRODUCTIVE SUCCESS AND CALIFORNIA GULL PREDATOR MANAGEMENT IN THE EAST BAY REGIONAL PARK DISTRICT

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Gull predation is known to be an important source of egg and chick mortality for many waterbirds and can impact recovery efforts for special status species. From 2005 to 2014, we studied nesting success of a newly established California least tern (*Sternula antillarum brownii*) colony at Hayward Regional Shoreline in San Francisco Bay and the effects of implementing a California Gull (*Larus californicus*) predator control program. No gull management was undertaken prior to 2007. We evaluated the effectiveness of gull management and removal by monitoring tern hatching and fledgling success annually. California Gulls were the most abundant aerial predator (96%). We recorded 4,788 predatory gull-tern interactions and the presumptive take of 47 tern eggs and 21 chicks. Although there was no statistically significant change in gull predatory behavior, gull management efforts resulted in significantly improved tern breeding success (Numbers of nests, eggs, chicks, and fledglings). From 2007 to 2014, this colony produced a total of 543 successful nests and 653 fledglings, an average nesting density of 196 nests per ha, and an average of 1.05 fledglings per breeding pair. We discuss the difficulties of lethal control and suggest the importance of human presence for reducing gull predation at the site.

Talk



WESTERN SNOWY PLOVER NEST SITE SELECTION AND OYSTER SHELL ENHANCEMENT

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The Western Snowy Plover (*Charadrius alexandrinus nivosus*) generally nests on bare ground or sparsely vegetated beaches and salt pans adjacent to tidal waters. The Pacific Coast population of Western Snowy Plovers is listed as a federally threatened species and as a California Species of Special Concern. Previous studies have suggested that Western Snowy Plovers may select nest sites based on the amount of oyster shell substrate, which provides camouflage for eggs and chicks and potentially protects them from blowing wind and sand. We measured the percentage of crushed oyster shells, shell dimensions, number of shells, and total shell surface area for 18 Western Snowy Plover nests that occurred at the Hayward California Least Tern Colony from 2008 to 2014. Using pairwise t-tests, we compared these measurements to those obtained from 18 randomly chosen non-nest sites. Results indicate that Western Snowy Plovers at this location select nest sites with a greater percentage of crushed oyster shell cover, more shells, and a greater total surface area of shells than random sites.

Poster



GEOLOCATORS REVEAL THE MIGRATORY PATTERNS AND WINTERING AREAS OF ALEUTIAN-BREEDING CRESTED AUKLETS (*AETHIA CRISTATELLA*)

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Climate change and development are altering our oceans at an alarming rate, especially in circumpolar regions. To gauge the impact of these changes on potentially vulnerable marine species, we must first understand basics about their ecology including oceanic distributions and marine habitat use. The Crested Auklet (*Aethia cristatella*) is one of the most abundant breeding seabirds in Alaska, yet little is known about its distribution outside the short breeding season. This study aims to examine 1) the spatial and temporal patterns in migration, 2) activity patterns at sea, and 3) overlap between wintering hotspots and sites of anthropogenic activities such as oil exploration and shipping routes. We used geolocators to track the movements of known-sex, adult Crested Auklets originating from two large breeding colonies in the Aleutian Islands; Buldir (n=23) and Gareloi (n=21) Islands. After the breeding season, all tracked Auklets showed a consistent pattern of northerly migration to their first core wintering area, followed by a southerly migration to a second core wintering area. Our preliminary results also show that the northern wintering areas of some tracked birds overlap with current drilling leases within Alaska's Chukchi Sea outer continental shelf planning area. Future work will concentrate on analyzing the marine habitat variables associated with these wintering hotspots. Our results will have profound implications for our understanding of the link between seabird distribution and oceanic processes while providing a major advance in the risk assessment of this species.

Talk



DETERMINING THE BREEDING STATUS OF ASHY STORM-PETRELS ON VANDENBERG AIR FORCE BASE IN CENTRAL CALIFORNIA

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The Ashy Storm-petrel (ASSP, *Oceanodroma homochroa*) is a small seabird that is endemic to the California Current System (CCS). While 97% of the breeding population occurs at two island groups (Southeast Farallon (37%) and the Channel Islands (60%)), several small populations have been discovered at offshore rocks and islets throughout the CCS. ASSP were first discovered at Vandenberg Air Force Base (VAFB) in 2000, but breeding activity has never been confirmed. In 2012, we tested the hypothesis that ASSP are breeding at VAFB and two alternative hypotheses: 1) ASSP are foraging adjacent to the VAFB coast and attracted to vocalizations played during our surveys, and 2) ASSP are attracted to lighted structures on VAFB and respond to vocalizations played during our surveys. We conducted vocalization and mist net surveys at eight sites: four with potential breeding habitat and four without. Two sites for each habitat category were adjacent to lighted facilities. Additionally, we deployed acoustic recording devices at each site to see if ASSP were present when we were not conducting surveys or if they only appeared in response to our vocalizations. We rejected both alternative hypotheses as ASSP were only detected at Point Pedernales, the site where ASSPs have historically been netted. However, the acoustic recording device placed at Point Pedernales only recorded ASSP calls during our vocalization surveys and crevice searches conducted at Point Pedernales found no evidence of ASSP breeding activity. We therefore suspect that ASSPs are breeding on Destroyer Rock, a small offshore rock found adjacent to Point Pedernales. Future studies should attempt to confirm breeding activity on Destroyer Rock.

Talk



VARIABLE RESPONSES OF BREEDING SEABIRDS TO FIREWORKS DISTURBANCE

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Understanding effects of human activities on wildlife such as colonial nesting seabirds can provide important information needed to manage and protect these populations. Breeding seabirds on Alcatraz Island in San Francisco Bay, California, USA, were monitored during three seasons, 2011-2013, to determine potential disturbance impacts of fireworks. Responses of Brandt's Cormorants were studied using a combination of real-time observations during Independence Day (July 4th) firework events to characterize severity of behavioral responses, and nest monitoring to track loss of offspring. Behavioral responses were most severe in 2012, with 95% of birds either running or flushing from nesting areas, whereas in 2013 only 33% of birds reacted in such a manner. Cormorants sustained the highest daily proportion of nests with chick losses in 2012 (2.3%), and losses were significantly higher directly following the fireworks display than both baseline losses prior to fireworks and in the two subsequent weeks. The strength of seabirds' reaction to disturbance and the impacts this can have on reproductive success is clearly variable and could depend on a number of biological and environmental factors. In 2012, the Alcatraz cormorant population exhibited a late mean hatch date, resulting in more small chicks on July 4th. They also experienced poor food availability, a high frequency of other anthropogenic disturbances, and wind conditions that may have blown exploding fireworks closer to the breeding colony. These factors likely contributed to heightened sensitivity to disturbance and increased chick loss.

Talk



PROPOSAL FOR A MAJOR CULL OF DOUBLE-CRESTED CORMORANTS IN THE COLUMBIA RIVER ESTUARY: SCIENCE-BASED OR POLITICS-DRIVEN?

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The Double-crested Cormorant (*Phalacrocorax auritus*) colony on East Sand Island (ESI) in the Columbia River estuary is the largest known colony for the species, and represents about 40% of the western North America population. Cormorants from this colony have consumed as many as 20 million salmonid (*Oncorhynchus* spp.) smolts per year, including significant percentages of populations listed under the U.S. Endangered Species Act. In its Biological Opinion for the Federal Columbia River Power System, NOAA Fisheries has stipulated that the ESI colony must be reduced to about 5,600 breeding pairs, or ca. 9,300 fewer breeding pairs than peak colony size, to avoid jeopardy to listed salmonids. In a Draft Environmental Impact Statement, the U.S. Army Corps of Engineers (USACE), which owns ESI, proposes to cull up to 16,000 cormorants (~ 25% of the western North America population) on ESI during 2015-18 to get to the target colony size. The USACE and its cooperators, including the U.S. Fish & Wildlife Service (USFWS), prefer the primarily lethal management option because they are concerned about risks to threatened fish stocks from dispersing such a large number of cormorants from the ESI colony without control over where they settle to breed. The USFWS must issue a depredation permit if up to 16,000 cormorants, protected under the Migratory Bird Treaty Act, are to be killed, and the agency has preliminarily ruled that reducing the western North America population to ca. 41,600 adults, the population size in 1990 and about 30,000 fewer than current population size, is sustainable. Under this draft plan, large scale culling of piscivorous seabirds would be extended from eastern North America to the Pacific Flyway.

Talk



THE KEYS TO SUCCESSFUL RESTORATION OF TERN COLONIES AND THEIR APPLICATION TO RECOVERY OF A CRITICALLY ENDANGERED SPECIES

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Many populations of colonial seabirds, especially terns (Sterninae), are limited by availability of suitable breeding sites. Human disturbance, introduced mammalian predators, and anthropogenic habitat change contribute to reductions in tern nesting habitat. We monitored attempts to restore breeding colonies of Caspian terns (*Hydroprogne caspia*) in western North America by providing suitable nesting habitat on islands and attracting terns to nest. We used a 4-step process pioneered by S.W. Kress to establish new breeding colonies of Caspian terns on specially constructed or managed islands: (1) provide suitable nesting substrate, (2) install social attraction (tern decoys and audio playback of vocalizations), (3) closely monitor the new colony site to identify impediments to colony formation, and (4) remove predators if they limit the new colony. Social attraction techniques resulted in Caspian terns attempting to nest on 13 of 14 newly created colony sites in the first breeding season. Mark-resighting studies indicated that Caspian terns from well-established colonies quickly found the new colony sites > 500 km distant, recruited as breeders, and moved among the new colony sites in response to changes in nesting and foraging conditions. This approach is now being tried in the East China Sea to restore tern populations, in particular that of the critically endangered Chinese Crested Tern (*Thalasseus bernsteini*). The overall goal of tern restoration projects should be to provide a network of suitable colony sites for terns to choose from in order to grow tern populations. But managing these sites as suitable and productive nesting habitat over the long-term is the greatest challenge for achieving restoration goals.

Talk



VULNERABILITY OF SEABIRDS TO AT-SEA ANTHROPOGENIC THREATS: VARIATION ACROSS TAXA IN THE NORTH PACIFIC

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Within the field of seabird conservation there exists a paradigm that certain human stressors such as fisheries bycatch are more important than others. Though these generally accepted patterns may be true in some locations and for some taxa, it is not clear how such vulnerability varies across space and taxonomic groupings. To address this question, we evaluated the scientific literature using a scoring system modified from Maxwell et al. (2012) to create vulnerability scores for three species of albatrosses, two species of shearwaters and petrels, one alcid, and one storm-petrel to 10 anthropogenic at-sea threats. The threats assessed were: bycatch, fisheries competition, ecosystem disturbance from fisheries, organic pollution, inorganic pollution, marine debris, operational oil spills, large oil spills, and climate change-driven changes in wind intensity and SST variability. We assessed differences in vulnerability scores between taxa at the species and family levels, finding both significant differences and similar score patterns occurred at both taxonomic levels, depending on the taxa compared. Using spatially explicit maps of 8 of the anthropogenic threats, we constructed cumulative risk maps for each taxon. Differences in vulnerability combined with variation in ranges are shown to lead to significantly different potential exposure as well as different priority locations for conservation and management efforts.

Talk



ALASKA MARITIME NATIONAL WILDLIFE REFUGE EFFORTS TO ARCHIVE 40 YEARS OF SEABIRD MONITORING DATA IN DATABASES

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An estimated 80% of Alaskan seabirds breed on land managed by the Alaska Maritime National Wildlife Refuge. Long-term monitoring studies were established at several annual sites throughout the refuge by various researchers in the 1970s and by the refuge in the 1980s to evaluate the status of seabird species and to obtain insights into the health of the marine ecosystem. Until recently, much of the raw data associated with data sets spanning 40 years have only been available in hard copy, living in multiple filing cabinets, or in various non-standardized electronic files. In the last several years, refuge-housed databases have been developed to archive field data in its rawest form, which has resulted in increased standardization of reporting across sites, reduction of field data entry errors, automated summaries for annual reports and data requests, and has enabled more detailed analyses to be conducted than previously possible. Currently a seabird productivity and phenology database houses all historical data for several species at multiple monitoring sites, and another houses all historical diet data. Databases for population counts and survival data are under construction. Enhancing our in-house data management will ensure easy upload into many regional databases supported by the Pacific Seabird Group.

Poster



STATUS AND TRENDS OF RED-LEGGED KITTIWAKES IN ALASKA

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The red-legged kittiwake *Rissa brevirostris* is a rare seabird confined to only four major nesting locations (Pribilof Islands, Commander Islands, Bogoslof Island and Buldir Island). The IUCN has listed the red-legged kittiwake as “Vulnerable” on their Red List of Threatened Species, largely because of the species’ declining population and limited breeding distribution. The Alaska Maritime National Wildlife Refuge conducts annual monitoring of red-legged kittiwakes in the Pribilof Islands (both St. Paul and St. George), and at Buldir Island, in the Aleutian Islands. Red-legged kittiwakes have been monitored regularly in the Pribilof Islands since 1976, and at Buldir since 1988. The population on St. George declined precipitously from 1976 through 1989, but has steadily increased since then. The much smaller population on St. Paul experienced a significant and steady decline between 1976 and 2008 but recently the decline appears to have leveled-off. In contrast, population counts on Buldir were largely stable for more than 20 years before a significant increase in 2011. None of the demographic parameters that we monitor on Buldir seem to explain the recent increase in counts, though birds on Buldir may be redistributing themselves in response to changing nesting conditions. Here we discuss the results from population monitoring at all three islands and compare demographic parameters between sites. We also consider the IUCN assessment of red-legged kittiwakes and address whether their listing of “Vulnerable” is still warranted.

Poster



KITTLITZ'S MURRELET POPULATION ASSESSMENT ON FRESHWATER LAKES IN THE BRISTOL BAY REGION OF SOUTHWEST ALASKA

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Kittlitz's murrelets (*Brachyramphus brevirostris*) are an elusive sea bird of Beringia, however their presence on freshwater glacial lakes in the Bristol Bay region of southwest Alaska precipitated an extensive survey effort in 2014. Surveys were carried out on lakes in the Wood River Lake System, in close proximity to Togiak National Wildlife Refuge, as well as Togiak Lake within the Refuge proper during the late nesting and early post-nesting periods. Murrelets were confirmed present on Lakes Aleknagik and Nerka, with a peak abundance of 66 birds on Lake Aleknagik 4 August. Distance sampling was employed on Lake Aleknagik during formal surveys using traditional distance estimation and an off-transect method. Maximum abundance with 95% confidence intervals was estimated at 253 birds (100-644) and 419 birds (84-2093), respectively. Though the presence of hatch-year birds could not be confirmed, the findings of this study warrant further research given the sensitivity of this species and its novel use of freshwater resources.

Talk



COORDINATING SEABIRD CONSERVATION ALONG THE EAST ASIAN – AUSTRALASIAN FLYWAY

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Over 150 seabird species inhabit the East Asian-Australasian Flyway (EAAF), some with long trans-equatorial migration routes while others move at shorter regional scales. Although some species have very large populations, such as Short-tailed Shearwater (23 million individuals), several others have fewer than 100 individuals (Chinese Crested Tern). Many species are declining or are facing a high risk of extinction due to several ongoing threats at their breeding and wintering sites. To achieve positive conservation outcomes, a collective responsibility for the conservation of seabirds is urgently required across the region. The East Asian – Australasian Flyway Partnership (EAAFP) was established in 2006 as an informal, voluntary international framework aimed at coordinating the conservation of migratory waterbirds and their habitat. In 2012, the EAAFP Seabird Working Group was formed to promote, facilitate, coordinate and harmonize seabird conservation, management, education, and research activities across the EAAF. The Working Group cooperates with all member countries, EAAF Partners, scientists and managers interested in seabirds. The initial work of the group was a Seabird Species Prioritization project, which included compiling known population data and the current conservation status of seabird species in the region. We present results from this project and identify some regional priorities and conservation activities that will be addressed by the Working Group over the next several years.

Poster



FISH ASSOCIATED WITH JELLYFISH AS A FOOD SOURCE FOR THICK-BILLED MURRES IN BERING SEA

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Predator-prey interactions are difficult to observe underwater due to technological limitations, especially for wide-ranging diving seabirds. Here, we present novel observations on seabird-jellyfish-fish associations from bird-borne video loggers. We obtained video footages of underwater feeding behaviour of 4 thick-billed murres (*Uria lomvia*) breeding at St. George Island, southeastern Bering Sea. For 1 of the 4 birds, we also obtained dive depth, acceleration, and water temperature records together with video footages, using an accelerometer. Video footage lasted 8.5 hours and covered 97 dives in total (max depth: approximately 50 - 90 m). Video footages were light enough to examine possible objects only for 37.4 % of dive duration on average, and only during descent and ascent phases. We did not observe any feeding events during descent phase. During ascent phase, we observed 196 feeding events on small pelagic fish in 80 dives from all 4 birds. Large jellyfish were also observed during ascent phase (mean: 3.7 ± 2.1 jellyfish per dive), and 17.3 % of all feeding events occurred near the tentacles of jellyfish. Birds were more likely to approach and feed on fish associated with jellyfish, when larger number of fish occurred among tentacles of jellyfish. Previous studies suggested that small pelagic fish avoid predators by associations with tentacles of large jellyfish. Our results suggest that thick-billed murres opportunistically feed on fish associated with large jellyfish as a food source supplementary to feeding at the dive bottom.

Talk



MARINE PLASTIC DEBRIS MAY ACT AS AN OLFACTORY TRAP FOR PROCELLARIIFORM SEABIRDS

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The ingestion of plastic debris is assumed to be a visual evolutionary trap for many marine organisms. Procellariiform seabirds use odor cues to locate biologically productive marine regions; however, an olfactory component to plastic ingestion is usually not considered. We demonstrate that procellariiform species attracted to dimethyl sulfide (DMS; a byproduct of grazed phytoplankton) are more likely to consume plastics ($\chi^2_{1,158} = 2.786$, $P < 0.01$). We tested the hypothesis that three common plastic types, polypropylene (PP), high, and low-density polyethylene (HDPE, LDPE), can develop an attractive odor signature after exposure to marine conditions. To do this, we contained small beads of each plastic type in Nitex mesh and left them to float attached to two buoys off the coast of the Bodega Marine Lab (BML), and the Hopkins Marine Station (HMS) for a three-week period during the early upwelling season 2014. Chromatographic headspace analysis (GC-SCD) detected an average DMS concentration per gram of plastic that varied by location and plastic type (BML: $\bar{x} \pm \text{SE}$ HDPE = $3.45 \pm 0.56 \mu\text{g/g}$, $\bar{x} \pm \text{SE}$ LDPE = $4.33 \pm 0.50 \mu\text{g/g}$, $\bar{x} \pm \text{SE}$ PP = $1.54 \pm 0.20 \mu\text{g/g}$; HMS: $\bar{x} \pm \text{SE}$ HDPE = $1.41 \pm 0.25 \mu\text{g/g}$, $\bar{x} \pm \text{SE}$ LDPE = $2.93 \pm 0.56 \mu\text{g/g}$, $\bar{x} \pm \text{SE}$ PP = $5.25 \pm 0.81 \mu\text{g/g}$; results reported \pm SE), but were all significantly higher than baseline tests of the plastic (all with a $P < 0.05$; paired t-tests). These results indicate that three common plastic types can concentrate an odor signature after ocean exposure that is attractive to certain seabirds and is likely within their detection range, supporting the hypothesis that marine plastic debris may serve as an olfactory trap for procellariiform seabirds.

Talk



ARE WHISKERED AUKLETS REALLY SEABIRDS? WHAT WE'VE LEARNED FROM TAGGING STUDIES

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There are many ways to define what it means to be a seabird, but what most of them have in common, is the idea that seabirds use land only to breed, and once released from that constraint they spend the rest of the year foraging at sea. To understand and protect these species, it is important to determine where and how they spend their time during the winter. Logistical considerations have largely restricted seabird research to work at breeding colonies or expensive ship surveys. Developments in light-weight geolocation tracking tags now allow us a more cost-effective window into the migration, behaviour, and habitat use of small seabirds. Whiskered Auklets (*Aethia pygmaea*), unlike their more migratory congeners, remain close to home, spending the winter feeding in coastal waters around their breeding colonies in the Aleutian Islands. It has long been hypothesised that adults and fledglings return to the colony periodically after breeding, but winter surveys of Aleutian Islands are rare. Preliminary data from Whiskered Auklets breeding on Buldir Island (geolocation tags with immersion loggers; n=12), show that, not only do they remain near the colony, they also roost on land at night all winter. This is unique among auklets, and very unusual among seabirds. Overall they show significantly different behaviour patterns than the closely related Parakeet Auklet (*Aethia psittacula*) in all variables measured. The Whiskered Auklets' unusual wintering strategy, probably made possible by predictable concentrations of prey in coastal tide-rips and passes, makes them highly vulnerable to year-round predation on islands with introduced mammalian predators, and increased interaction with shipping traffic through Aleutian passes.

Talk



FORAGING AREAS OF MACARONI PENGUINS (*EUDYPTES CHRYSOLOPHUS*) IN THE SOUTH ATLANTIC AND SOUTH INDIAN OCEAN

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Macaroni penguins are the most important avian consumer of marine resources on the planet, but their population has declined substantially and consequently is regarded as Globally Endangered by BirdLife International and the IUCN. A better understanding of this decline and the implementation of effective protection is dependent on the identification of the bird's key foraging areas and the oceanographic features characterizing these areas. We analysed GPS, Argos and GLS tracking data of macaroni penguins breeding at South Georgia, Crozet and Kerguelen, where approximately 80% of their entire world population breed. We identified key foraging areas at sea, and recognized most important marine habitat features during different stages of the breeding cycle using Generalized Additive Models. The Antarctic Polar Front and Sea Surface Height appeared to play an important role for foraging macaroni penguins during incubation and pre-moult, whereas birds during the broodguard and crèche stage explored smaller-scale oceanographic features often related to bathymetry and regional circulation in proximity of the colony. Our maps of marine habitat use of these breeding sites will be used to delimit the boundaries of most important at-sea areas of macaroni penguins and list these as marine Important Bird Areas (IBAs) according to BirdLife International criteria.

Talk



THE IMPORTANCE OF AGE STRUCTURE AND LIFE HISTORY: INCREASING ENSO FREQUENCY LEADS TO DECREASED POPULATION VARIANCE IN BRANDT'S CORMORANT

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As the effects of global climate change begin to materialize, there is increasing interest in how changing the variance and frequency content of environmental process will affect populations and species. For example, El Niño events tend to occur every 3-7 years. However, some climate models predict that the frequency of El Niño events may increase in the future. Age structured populations can be viewed as a filter, responding preferentially to specific frequencies of environmental variability depending on their specific life history. Understanding the inherent sensitivity of a population to particular frequencies of variation is important as we consider the effects of changing environmental variance. We used a density dependent, age structured population model to assess how the Brandt's cormorant population on the Farallon Islands in California responds to variability at difference frequencies. Forcing the model with white noise initially showed that this population is most sensitive to low frequency variance. When the model was forced with actual environmental time series, those with the most variance at low frequency produced the highest variability in population abundance and recruitment. Importantly, increasing the frequency of El Niño events actually resulted in a lower variance in the population when compared to the historic El Niño frequency. These results highlight the need to consider a species' life history and age structure when assessing their response to potential changes in the frequency of environmental events.

Talk



LESSONS FROM A METAPOPOPULATION IN PERIL: THREE COLONIES' RESPONSES TO VARIATION IN ECOLOGICAL AND MANAGEMENT ENVIRONMENTS

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In the Gulf of Maine (GOM), five colonies comprise a metapopulation of Arctic Terns (*Sterna paradisaea*). These colonies are intensively managed, and represent a variety of colony sizes and management strategies. The largest of the colonies, Machias Seal Island (MSI), regularly supported at least half of the pairs of Arctic Terns in the GOM through the 1990s and early 2000s. In 2006, the MSI colony experienced complete breeding failure, which continued through 2013. The metapopulation has declined 42% since 2007; this crash has caused much speculation regarding Arctic Tern breeding success in the GOM, including concern over the sustainability of the metapopulation.

Why have other colonies succeeded while MSI failed? We analyzed trends in Arctic Tern nesting success and number of chicks fledged at three of these colonies in 1995-2014. We used logistic regression, focusing on predictors of food, weather, and predation. Predation and inclement weather best predicted nesting success and the number of chicks fledged. Nest success was not predicted by the amount of herring (a high-quality food) in the chick diet, but in successful nests the average mass per feeding predicted the number of chicks fledged. The high rate of predation at MSI is unique in this region, where selective lethal control is employed on large predatory gulls at the other four colonies in the metapopulation. These results illustrate the importance of predator management in the GOM tern colonies.

Talk



TRASH BIRDS? COMPARATIVE FORAGING ECOLOGY OF WESTERN GULLS FROM MULTIPLE COLONIES IN CENTRAL CALIFORNIA

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Western gulls (*Larus occidentalis*) are known to frequent landfills and garbage receptacles to scavenge food but the regularity of this activity by individual gulls is poorly studied. Here, we compared the habitat use and foraging behavior of western gulls breeding at Año Nuevo Island (ANI; N=12 birds) and Southeast Farallon Island (SEFI; N=28 birds) along central California. During incubation or early chick-rearing stages, gulls were equipped with 20 or 30 g GPS data loggers to record activity and distribution in relation to the exploitation of known landfills or at-sea foraging. A total of 40 tracked gulls (12 at ANI and 28 at SEFI) recorded 125 foraging excursions. We identified at least seven landfills, food recycling centers, or parks visited by gulls from SEFI but 90% of all foraging excursions were at sea. In contrast, gulls from ANI all targeted the same landfill (30 km southeast), and these trips comprised more than 40% of all foraging excursions. Overall, gulls from SEFI exploited a larger home range, traveled farther distances while foraging, and used more landfills compared to gulls from ANI but gulls from SEFI appear to use more marine resources. The close proximity of the landfill from ANI and the regularity of its use by tracked individuals suggest that gulls from ANI may be more reliant on garbage than gulls breeding further from the coast.

Talk



IT TAKES TWO TO TANGO: AN INVESTIGATION OF PARENTAL CARE DISTRIBUTION IN A SCRIPPS' MURRELET NEST

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Using a video camera, we investigated the distribution of parental care for one breeding pair of Scripps's Murrelets (*Synthliboramphus scrippsi*) at Santa Barbara Island, California, in 2010. We hypothesized that the female invests less in incubation and housekeeping duties than the male, because females generally produce two energetically-costly eggs (~24% adult mass each) and need to spend more time at sea replenishing their energy reserves. To test this hypothesis, we watched approximately 574 hours of video of the pair inside the nest chamber. We categorized the different behaviors of the birds and distinguished male and female by differences in facial patterns noted when the female was laying one of the eggs. We recorded the number of egg-turnings, housekeeping behaviors, incubation bout lengths, periods of egg neglect and which parent(s) contributed to each behavior. We found that the pair laid 2 eggs and hatched 2 chicks. Both parents left the nest 7 hours after the first egg was laid and did not return until 7 days later, when they returned together just 22 minutes before the second egg was laid. The male performed 281 egg-turnings and 84 housekeeping behaviors and the female performed 299 egg-turnings and 101 housekeeping behaviors. We found no significant difference between mates in responsibility distribution or nest attendance. It is possible that duties are more unevenly divided up when there is low prey abundance or when the pair is young or inexperienced. More work is needed to examine a larger sample of nests under various environmental conditions and with adults of known age and experience.

Poster



THE RELATIONSHIP BETWEEN ENDANGERED HUTTON'S SHEARWATER (*PUFFINUS HUTTONI*) FALLOUTS AND LIGHT BULB TYPE

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In Kaikoura, New Zealand, hundreds of endangered Hutton's shearwater (*Puffinus huttoni*) fledglings crash into town on their first migratory flights out to sea. The Hutton's shearwater breeds in only three remaining colonies in the Seaward Range and Kaikoura Peninsula, and migrates to South Australia from March to April. We tested the hypothesis that visible long-wavelength light, such as red and yellow, might cause disorientation and collisions during migration, while blue-green spectrums do not. To investigate the effect streetlight bulb type may have on Procellariiform fallout frequencies with respect to wavelength emissions and intensity, we documented and mapped streetlight type, location, and Hutton's shearwater fallout location reports, the latter of which were mostly supplied by the local community. A total of 68 birds were collected, and the majority of fallouts were recorded on main streets along the coastline where streetlights were most prominent. Although there was a lack of provided data for LED wavelength emissions, no significance was found between the fallout rates at different bulb types. However, trends of fallout frequencies at certain bulb types were observed, so further study is needed. The results of this preliminary assessment indicate a need for 1) improved public outreach in order to create more initiative to help monitor the health of Hutton's shearwater populations, and 2) future data collection and potential street lighting improvements that are both practical for humans and safe for seabirds, which may be vital for the conservation of these marine animals.

Poster



WHO'S IN THE 'HOOD (AND HOW MANY ARE THERE)?

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A limited number of studies have multi-year datasets from which to compare seabird foraging distributions to their breeding aggregations. The Gulf of Alaska Integrated Ecosystem Research Project, wherein data were collected in 2011 and 2013, afforded us the opportunity to evaluate seabird distributions near St. Lazaria Island in southeast Alaska. We identified and counted seabirds along transects near St. Lazaria to assess their distributions and abundance. Concurrently, we collected data on population and productivity of nine species of seabirds breeding at St. Lazaria. Transects ran perpendicularly to the coast to sample across a full range of foraging conditions and extended beyond the continental shelf break (i.e., nearshore to oceanic biomes). As central-place foragers during the breeding season, we expected seabird sightings on transects to be consistent with generalized foraging ranges for each species. We present those findings in addition to identifying hotspots of seabird abundance.

Poster



SEYCHELLES: ON THE LEADING EDGE OF MARINE SPATIAL PLANNING

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The Seychelles is a rich, tropical marine ecosystem situated in the Western Indian Ocean. Encompassing 1.37 million km² and 115 islands, Seychelles is a recognized global biodiversity hotspot and home to two UNESCO World Heritage Sites. The islands are home to 18 seabird species and 20 BirdLife International Important Bird Areas (IBA); some colonies are the largest in the Indian Ocean and the world. Biodiversity is one of the country's most important assets and it supports two major economic sectors: tourism and fisheries. The sustainability of existing and future uses is very important to Seychelles, as is meeting their biodiversity protection goals and reducing their national debt. The Seychelles Marine Spatial Planning Initiative is focused on planning for, and management of, the sustainable and long-term use and health of the Seychelles Exclusive Economic Zone (EEZ). The Initiative is a government-led process, with planning and facilitation managed by a partnership between The Nature Conservancy and the UNDP-GEF-PCU. The Initiative takes an integrated, multi-sector approach with input from all major sectors including fishing, tourism, conservation, recreation, renewable energy, maritime safety, shipping and petroleum development. Ecological and socio-economic spatial data sets, stakeholder participatory mapping, and Marxan are being used to develop a zoning design for the entire EEZ. A UNDP biodiversity analysis to identify high priority conservation areas is being incorporated into the MSP. The implementation of the plan will be supported by a debt swap, an innovative financing mechanism to relieve some of the national debt and address climate change adaptation.

Talk



RICHNESS AND DISTRIBUTION OF SEABIRDS IN SEVEN MEXICAN NORTH PACIFIC ISLANDS

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The present work is a bird list of the monitoring results conducted during the nesting season of April to July 2014, as part of the restoration work with seabirds in seven Mexican North Pacific islands (Coronado, Todos Santos, San Martín, San Jerónimo, Natividad, San Roque and Asunción). A total of 118 bird species were recorded, of which 47.9% are aquatic or marine birds. Among the most important nesting birds in the islands are Brandt's Cormorant (*Phalacrocorax penicillatus*), Double-crested Cormorant (*P. auritus*), Brown Pelican (*Pelecanus occidentalis*), Black-vented Shearwater (*Puffinus opisthomelas*), American Oystercatcher (*Haematopus palliatus*), Black Oystercatcher (*H. bachmani*), Heermann's Gull (*Larus heermanni*), Western Gull (*L. occidentalis*), Elegant Tern (*Thalasseus elegans*), Cassin's Auklet (*Ptycoramphus aleuticus*) and Scripps' Murrelet (*Synthliboramphus scrippsi*). The island with the greatest diversity of aquatic and marine species was San Jerónimo with 34 species, while the one with the lowest diversity was Coronado Islands with 12. Most of islands shared both marine and terrestrial species, even though some of the records (35.9%) are particular to any of the islands. Moreover 18 species are listed under a conservation status by the Mexican Norm (NOM-059-SEMARNAT-2010) and two by IUCN Red List. The results show that the northern Mexican Pacific islands are an important home and shelter for both resident and migratory seabirds.

Poster



EXPOSURE OF THREATENED SEABIRD BREEDING ISLANDS TO CHANGING SEA LEVELS

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Seabirds are threatened globally, particularly on breeding islands. Most seabirds listed as threatened by the IUCN occur on islands that are not legally protected or contain invasive species. Fortunately, most of these islands are also relatively small and uninhabited, so proven conservation actions can usually protect seabirds. However, climate change-driven increased sea level and tidal surges on islands can exacerbate current threats to seabirds. We matched NASA's 90m resolution Shuttle Radar Topography Mission data with seabird breeding islands from the Threatened Island Biodiversity Database to determine island elevation and the proportion of islands that will be inundated under various climate scenarios. Of the 968 islands, 817 (84%) contained topographic information (avg elevation = 66.2m + 116.8; median = 14m; min = <1m, max = 4003m). Islands with a minimum height of 3m (195 (24%) islands) were considered at low risk of impacts from sea level rise and increased tidal surge; 63 islands (0.08%) were at least 10m high and were considered at zero risk. One hundred and forty-five islands (18%) had a maximum elevation of 3m and 109 islands (13%) were 1m high or less. These islands are considered at high and extreme risk of complete inundation. Eight species and 31 populations of threatened seabirds are currently breeding on these islands.

Talk



CALIFORNIA GULL (*LARUS CALIFORNICUS*) POPULATION GROWTH AND RESPONSE TO TIDAL MARSH RESTORATION IN SOUTH SAN FRANCISCO BAY

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Since 1980, the San Francisco Bay Bird Observatory has surveyed gull breeding colonies across the South Bay. This research has documented rapidly increasing numbers of California Gulls (*Larus californicus*) which are the most abundant gull species in the area during the breeding season. California Gull populations have increased from only 24 nesting birds in the early 1980s to over 50,000 in 2014. Simultaneously, there are documented declines in populations of many colonially-nesting waterbirds and also shorebirds such as the federally-threatened Western Snowy Plover (*Charadrius nivosus nivosus*). Scientists at SFBBO, the USFWS and the USGS have shown that California Gulls consume the eggs and chicks of other waterbird species. Therefore, the rapid growth of California Gulls has been identified as one of the most pressing concerns for management of the San Francisco Bay estuary by SFBBO, by federal and state agencies charged with managing this ecosystem, and by the South Bay Salt Pond Restoration Project. Information presented will include that which is used by land managers to predict gull response and manage adaptively to the future restoration of 15,000 acres of salt ponds in the San Francisco Bay. This includes how the California Gull population is changing, what factors may be responsible for these changes, and how gulls respond to restoration activities as determined by banding and re-sighting surveys which have tracked the movements of gulls, particularly the response to restoration of one salt pond that formerly housed the largest California Gull colony in the area.

Poster



HERE'S THE SCOOP ON SKUA POOP: THE REPRODUCTIVE SUCCESS AND DIETS OF SOUTH POLAR SKUAS BREEDING ON KING GEORGE ISLAND

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King George Island is located on the Antarctic Peninsula, an area that has recently experienced intense climate warming, large-scale changes in ice conditions, and declines in some krill-dependent predators, such as Adélie penguins. South Polar skuas (*Stercorarius maccormicki*) are piscivorous seabirds whose fledging success varied between 0.01 and 1.36 chicks per nest in the years 2004-2011. We hypothesized that, in years of low reproductive success, 1) average size of fish was smaller, 2) there were a greater frequency of small size classes of fish, and 3) skuas consumed a higher diversity of fish species. We tested whether these trends were more evident during courtship and incubation in years where hatching success was low. We collected guano samples of South Polar skua pairs during courtship, incubation, and chick rearing, from which we isolated and measured over 1000 otoliths. On the basis of these otoliths, we identified fish species and estimated fish sizes. We found that mean fish size varied significantly amongst years. Frequencies of size classes of fish also varied, and there appear to be identifiable cohorts within the fish populations. Fish diversity in skua diets was low; two species, *Electrona antarctica* and *Pleurogramma antarcticum*, dominated. We found no significant differences in diets among breeding phases.

Poster



NESTING SEABIRDS IN THE BAY AND THE SOUTH BAY SALT POND RESTORATION PROJECT

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Protected and isolated islands are prime property in the urban landscape of the south San Francisco Bay and provide important nesting habitat for Forster's terns, Caspian terns, and California gulls. Through an adaptive management approach, the South Bay Salt Pond Restoration Project has been experimenting with island creation in managed ponds in order to prevent the loss of nesting colonies as we move forward with tidal marsh restoration. Islands made from existing bay mud materials require a few years of weathering before they can be safely used by nesting birds; this process may be accelerated through soil amendments or discing and the cost of this type of amendment should be factored into the original construction cost of the islands. Placement of the islands in the landscape is important in terms of nearby foraging habitat and adjacent colonies of predatory gulls. We are using island toppings and social attraction to lure terns onto newly created islands in the South Bay. Gull hazing and alternative western snowy plover habitat (with social attraction) are important aspects of this project as well.

Talk



MODELING AND MAPPING HIGH-USE FORAGING HABITAT FOR MIGRANT AND VISITING SEABIRDS IN CENTRAL CALIFORNIA

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Seabirds can be biological monitors of marine ecosystem health and food web dynamics because they aggregate in areas of increased food availability. These aggregations result from trophic level interactions driven by oceanographic factors. Consequently, seabird foraging movements are relevant to ecosystem-based management. This research will inform marine spatial planning by identifying patterns of high-use foraging habitat of migrant and visiting seabirds that forage in central California's Gulf of the Farallones (GFNMS) and Cordell Bank (CBNMS) National Marine Sanctuaries. To identify high-use foraging habitat and to show how habitat use changes temporally, we used ten years of the Applied California Current Ecosystem Studies (ACCESS) seabird and oceanographic data to model and map distribution and abundance of four migrant and two visiting seabird species. We focused on the visiting Black-Footed Albatross (*Phoebastria nigripes*) and Northern Fulmar (*Fulmarus glacialis*) as well as the migrant Sooty Shearwater (*Puffinus griseus*), Pink-Footed Shearwater (*Puffinus creatopus*), Red Phalarope (*Phalaropus fulicaria*), and Red-Necked Phalarope (*Phalaropus lobatus*). Predicted *P. nigripes* distributions show the most foraging from May through July. *F. glacialis*, *P. griseus*, and *P. creatopus* forage primarily from June through September; and both *P. fulicaria* and *P. lobatus* largely from July through September. Predicted high-use foraging areas that are common to all six species closely follow the 200-meter isobath, which follows the continental shelf-break. The highest predictions of habitat use concentrate around Cordell Bank as well as the southernmost region of GFNMS along the shelf-break approaching Monterey Bay.

Talk



TESTING ACOUSTIC RECORDERS AND REMOTE CAMERAS TO MONITOR BREEDING POPULATIONS OF LEACH'S STORM-PETREL

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Populations of burrow-nesting seabirds, such as Leach's Storm-Petrel (*Oceanodroma leucorhoa*), are notoriously difficult to monitor because of limited access to remote offshore islands where they nest and concern for researcher impacts to colonies. Off the coast of Oregon, the abundance of nesting Leach's Storm-Petrels on some islands has changed by orders of magnitude over the past decades, increasing the need for effective, but low-impact population monitoring. We are developing and testing minimally invasive techniques to monitor nesting populations of Leach's Storm-Petrels by comparing remote recording devices to traditional manual burrow inspection methods of determining nesting density. In 2014, we established 3 study plots (10 m X 25 m) at a breeding colony on Goat Island off southern Oregon. We deployed remote cameras and acoustic recorders to generate indices of activity and abundance within plots, where we conducted concurrent but more invasive, traditional burrow inspection surveys. Each of the 3 plots had one acoustic recorder and three near-infrared cameras with self-contained, covert (No-Glow) illuminators, capable of taking single time lapse images or near video (2 frames/sec). We tested different camera sampling rates to determine which is best to compare with acoustic data. We collected over 2,000 hours of audio recordings and 1 million photos from which we will subsample to compare with results from manual burrow inspections of nesting density. We are also assessing methods of automated data processing to extract indices of storm-petrel activity, (e.g., diel visitation), nesting phenology (e.g., initiation and termination of breeding, chick hatch dates), and abundance.

Poster



COLONY SITE FIDELITY IN CASPIAN TERNS DESPITE LIMITED NESTING HABITAT: WHEN TO STAY AND WHEN TO GO

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We investigated factors influencing fidelity to breeding colony site by Caspian terns (*Hydroprogne caspia*) despite marked reduction in available nesting habitat. In order to reduce predation on ESA-listed salmonid smolts by Caspian terns nesting on Goose Island in eastern Washington, management of the tern colony was initiated in 2014. Passive dissuasion and active hazing during the first year of management prevented terns from nesting on the island. A small islet adjacent to the island was not managed, however, and Caspian terns nested on the islet for the first time. The area of suitable nesting habitat on the islet was less than one third of the former colony area on Goose Island. Of the color-banded Caspian terns seen on Goose Island during the 2013 breeding season and then resighted during the 2014 breeding season ($n = 198$), 27% were confirmed breeding on the islet. Of terns with longer resighting histories, the odds of individuals breeding on the islet in 2014 were 2.1 times greater for every year during 2011-2013 that they were resighted exclusively on Goose Island, indicating that a greater history of exclusive use of this site was associated with stronger site fidelity. The odds of those individuals breeding on the islet were 1.7 times greater for every year that they were seen rearing chicks on Goose Island, suggesting that history of successful nesting was also related to colony site fidelity. These results indicate that, despite the previously documented high vagility of Caspian terns, some individuals display consistent site fidelity across years, even when conditions worsen dramatically at their former breeding site.

Talk



SEABIRDS AT SEA AS PREDICTORS OF IMPENDING CLIMATE EVENTS

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Seabirds have long been proposed to be reliable indicators to shifts in ecosystem state and forage nekton availability, but rarely have they been examined in a predictive (leading) context relative to impending climate events, such as ENSO. In this study, we test the hypothesis that changes in seabird abundance (density) at sea reveals impending climate shifts before changes in physical oceanographic parameters are measured in situ. To test this hypothesis, we integrated seabird and hydrographic observations from the long-term data seasonal CalCOFI surveys off southern and central California. We examined a suite of seabird species for leading relationships using cross-correlation and wavelet analyses (i.e., seabird abundance changes preceding hydrographic changes). This study is important because seabirds may provide early warning indicators (EWI) to key climate-ecosystem shifts before they are recognized using other indicators. This may advance our abilities to respond and prepare for shifts in marine ecosystem productivity.

Talk



CALIFORNIA CURRENT PREDATOR DIET DATABASE: SEABIRDS AND FORAGE SPECIES

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The California Current Predator Diet Database (CCPDD) compiled diet data for upper trophic level predators from the past 100 years in the California Current region, including 37 species of seabirds from 77 references, as well as diet data for marine mammals, cartilaginous and bony fishes, and Humboldt squid. We characterized the role of forage species in seabird diet by determining the top 15 forage species consumed by the most seabird predators, including rockfish, anchovy, herring, sardine, and others. For each seabird species we considered the breadth of, as well as gaps in, the available published data to inform a general understanding of the role of forage species in seabird diet. Seabirds with abundant data (>1000 samples, >3 citations, >half the regions in a species range, >20 years of data) were Common Murre, Pigeon Guillemot, Rhinoceros Auklet, Cassin's Auklet, and Marbled Murrelet. Our analyses indicated the following information gaps: seasonal data were limited for winter, fewer than half the seabird species had % mass data (the preferred format because only mass-based diet data can be used to integrate marine predator needs to bioenergetics modeling and assessing impacts on fish stocks), few species had long-term data sets, and regional data outside of central California and Canada were limited to fewer than 10 species per region. This approach to information management leverages the power of relational databases to consolidate a diverse range of seabird diet data from broad temporal and spatial scales. This type of compiled information is critical to inform broad-scale conservation and management of marine species, including seabirds and their prey.

Talk



BEHAVIOR CHANGE: THE CORNERSTONE OF SEABIRD CONSERVATION

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The Seabird Protection Network is implementing community-based social marketing practices in order to reduce human disturbance at a seabird breeding and roosting site along the California coast. Community-based social marketing involves 5-steps: 1) selecting behaviors, 2) identifying barriers and benefits, 3) developing strategies, 4) conducting a pilot, and 5) broad-scale implementation. This presentation will highlight the 5-steps of community-based social marketing, and share preliminary results and outcomes of the Network's new tool being used for seabird conservation.

Since the Network began we have focused on a behavioral intensive approach, believing that if we can change attitudes we can change behaviors. Increased public awareness, coupled with coordinated management, enforcement and strategic partnerships has effectively minimized negative human interactions with seabirds. We have achieved many program successes; however, disturbance at one site continues to be a concern.

Disturbance rates at Devil's Slide Rock monitoring site have fluctuated between 0.451 and 0.068 disturbances per observation hour from 2005 to 2014. Compared with the average 0.002 disturbances per observation hour at other monitoring sites, Devil's Slide Rock continues to be an area of concern.

In November 2014, the Network began implementing community-based social marketing practices in an effort to reduce the overall rate of disturbance at Devil's Slide Rock and become more consistent with the other regional monitoring sites. Community-based social marketing strategies can be applied in numerous instances, and can produce behavior changes that support sustainability and conservation, world-wide.

Talk



OBSERVE A WILDLIFE DISTURBANCE? REPORT IT!

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Wildlife disturbance reports are a valuable tool for seabird conservation. In California, the Seabird Protection Network has developed an online system for reporting wildlife disturbance. By tracking wildlife disturbances, the Network is able to: 1) Assist natural resource managers with targeting outreach efforts; 2) Track repeat offenders; and 3) Target enforcement efforts.

With increasing coastal human populations, disturbance to wildlife will likely continue to proliferate and impact seabird colonies and other marine wildlife along the California coast. Low-flying aircraft, close-approaching watercraft and coastal visitors can disrupt breeding and roosting seabirds, which can lead to a reduction in the long-term population size and resiliency of the affected populations.

Any activity that disrupts the natural behaviors of marine wildlife is a disturbance. The severity of a disturbance varies widely. A disturbance can be as simple as a seabird showing signs of agitation by head-bobbing and beginning to move away from its nest or roost site. Conversely, a disturbance can be as extreme as the loss of eggs or death of chicks or pups from trampling as the birds or marine mammals scatter away from the disturbance source. Tracking observed disturbance sources, severity, locations and species affected is important to understand the scope of this conservation issue. Chronicling wildlife disturbances provides a means to use adaptive outreach and management strategies to address conservation issues. The Seabird Protection Network works to address human disturbance to seabirds through coordinated outreach, monitoring and enforcement in California through a multi-organization collaborative.

Poster



REPRODUCTIVE SUCCESS AND SUB-COLONY PERSISTENCE AT A CORMORANT COLONY ON THE OREGON COAST

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In the California Current, cormorants are sensitive to environmental changes during the breeding season with effects ranging from colony population decline to shifts in sub-colony persistence. Colonies are also highly dynamic, as cormorants exhibit lower site fidelity compared to other long-lived seabirds. In this study, we aimed to document productivity and sub-colony population size and persistence in a mixed species cormorant colony. From 2008 to 2014, we monitored reproductive success of Brandt's cormorants (*Phalacrocorax penicillatus*) and pelagic cormorants (*P. pelagicus*) at Yaquina Head near Newport, Oregon. Concurrently, counts of active Brant's and pelagic cormorant nests were collected annually for 13 sub-colonies in the Yaquina Head colony complex. Our preliminary results show moderate to high variability of reproductive success among years for both species, coupled with low to moderate rates of variability in nest site numbers among sub-colonies throughout the study period. Sub-colony dynamics that we observed seem congruent with similar studies conducted for these species. We also found some sub-colonies show higher rates of mixed species nesting, perhaps due to the size and heterogeneity of the rock structures being used. Understanding and monitoring these temporal and spatial variances at a colony level may lead to better development of management plans and reserve designs. Continued monitoring of this and other colonies also may serve to shed light on more complex processes responsible for the variability seen in reproductive success and sub-colony persistence.

Poster



MALE AND FEMALE AGE AND IDENTITY INFLUENCE BREEDING TRAITS IN THE NAZCA BOOBY
(*SULA GRANTI*)

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There is growing recognition that breeding traits, traditionally considered sex-limited characters expressed solely in females, can be considerably influenced by the identity and condition of both pair members. Males may directly influence the condition of their female partner through acquisition and defense of nest sites, and/or by sharing the costs of incubation, or may indirectly influence breeding traits through female response to male quality via differential investment in the breeding attempt. We constructed mixed-effects models using a long-term database of breeding records to evaluate the among-individual effects of both sexes on breeding date, clutch size, and egg volume in a tropical seabird, the Nazca booby (*Sula granti*). Explanatory variables included male and female age and age at recruitment, pair history, recent reproductive success, and measures of environmental quality. Preliminary results show individual females and males vary in their influence on breeding date and egg volume, but male identity does not influence clutch size. Middle-aged females achieved earlier laying dates and larger clutches and egg volumes, values associated with higher fitness in this species. Increasing male age was associated with earlier laying and increased egg volume, with evidence of performance declines in old age for breeding date only. Effects of pair history, recent reproductive success, environmental quality, and pairwise interactions of parameters were trait-specific. Recognition of the importance of males to breeding trait expression in females is increasing; our results support the need to consider breeding phenotype a function of both male and female identity and condition.

Talk



MONITORING THE NOCTURNAL MOVEMENTS OF SEABIRDS: A COMPARISON BETWEEN STANDARD MAGNETRON RADAR, OBSERVERS USING NIGHT VISION, AND A NEXT GENERATION SOLID STATE ORNITHOLOGICAL RADAR

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Many seabirds make inland flights to breeding sites under the cover of darkness, making it difficult to monitor their numbers, flight routes, and flight heights. The role of observers in monitoring seabird movement patterns is widely considered to be ineffective compared to radar. On Kaua'i, we conducted three years of side-by-side comparisons of observers and magnetron radar capabilities for nocturnal endangered seabirds. Observers were significantly better than radar at detecting seabirds when they had a low above-ground flight height (AGH), although observers also had a height detection bias. Both methods missed seabirds but at different times related to variation in AGH of seabirds when flying inland or seaward. We used two orthogonal methods to show that observer and radar detection capabilities are equivalent when birds have an AGH of approximately 50 m. Above this height radar has a higher detection rate than observers, while below this height observers outperform radar at detecting seabirds. When seabird mean flights were low, radar missed between 31% to 59% of the seabird passages, while observers missed between 66% and 75% of all seabird passages when seabird flight heights were high. We also report a comparison between a next generation ornithological radar (fully autonomous radar using simultaneous vertical/horizontal solid state technology) to that of standard magnetron radar and observers. We discuss the implications of these results and how they pertain to monitoring protocols for avian collisions with man-made obstacles like communication towers and power lines.

Talk



YOUR NIGHT TO COOK: COORDINATED FORAGING IN MANX SHEARWATERS (*PUFFINUS PUFFINUS*) DURING CHICK REARING

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The dual foraging strategy observed in several procellariiform species intuitively allows for parents to meet their own nutritional needs as well as that of their chick. Yet without coordination between parents, the chick would be likely to face routine starvation. Although such coordinated foraging has been reported, both the degree of coordination and how this behavior occurs remains unexplored.

As part of a long-term study of the Manx shearwater (*Puffinus puffinus*) colony on Skomer Island, Wales, radio frequency identification readers and passive integrated transponder tags were used to track the foraging behavior of 39 pairs across the breeding season. Using this substantial dataset, foraging coordination was examined by comparing consecutive foraging duration differences on nights when partners returned either together or alone.

On nights when both partners returned to the burrow, there was an average difference of 24 ± 4 hours between foraging trips, indicating that when partners returned together, their next foraging trip was either a day shorter or longer than their previous trip compared to when a partner returned alone. This change, however, was more pronounced in females, who altered foraging trip length by an average of 14 ± 4 hours more than males.

These results suggest that Manx shearwaters do coordinate foraging duration during the chick rearing period and, moreover, that this behavior is likely initiated by synchronous visits to the burrow by both partners. This finding has important implications for how cooperative, coordinated foraging may allow males and females to maximize long-term fitness.

Talk



MONITORING SEABIRDS ON REFUGES IN HAWAII AND THE PACIFIC A REVIEW: PAST, PRESENT, FUTURE

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National Wildlife Refuges in Hawaii and the Pacific have long been recognized as important breeding and roosting grounds for a number of seabird species. The number of species found on each refuge varies, but averages about 10-15 species. In this presentation we describe past, current, and future monitoring efforts for seabirds across 10 refuges. We present the history of monitoring on these refuges by reviewing the techniques used and results of analyses that have been conducted using these monitoring data. We also present the current state of the refuges seabird monitoring program by identifying monitoring locations, species monitored, methods, and challenges we face in monitoring seabirds on many of the refuges. Finally, we explore new methods for monitoring seabirds that we will be testing in the near future. These include acoustic and photographic remote survey methods.

Poster



LESSONS LEARNED FROM 15 YEARS OF MONITORING CONTAMINANTS IN SEABIRD EGGS

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The Seabird Tissue Archival and Monitoring Project (STAMP) has archived over 1900 seabird egg contents and shells since 1999. STAMP monitors long-term trends in environmental quality by (1) collecting seabird tissues (primarily eggs) at seabird colonies without inadvertently contaminating them, (2) processing and cryogenically banking the samples under conditions that ensure chemical stability during long-term (decadal) storage, and (3) analyzing subsamples of the stored contents for anthropogenic contaminants. Common and Thick-billed Murres (*Uria aalge* and *U. lomvia*) are suitable integrators of environmental conditions as they are abundant, circumpolar, essentially non-migrating, piscivores that lay only one egg. Archival of Glaucous and Glaucous-winged Gull (*Larus hyperboreus* and *L. glaucescens*) egg clutches began in 2004 at the request of subsistence harvesters and to complement other circumpolar studies. In 2010, STAMP was expanded to the Pacific Islands Region and began collections of Black-footed and Laysan Albatross (*Phoebastria nigripes* and *P. immutabilis*), Brown Booby (*Sula leucogaster*), and Sooty Tern (*Onychoprion fuscatus*) eggs. Differences in contaminant levels and patterns have been revealed for (1) species - can we use contaminants to identify species of unidentified conspecific seabird eggs?; (2) locations; and (3) temporal changes - including one long-term monitoring site that appears to correlate with the Pacific Decadal Oscillation [PDO]. These and other secrets from 15 years of monitoring contaminants in seabird egg contents will be presented.

Talk



STATUS AND DEMOGRAPHIC RATES OF THE CHRISTMAS SHEARWATER ON KURE ATOLL

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The Christmas Shearwater (*Puffinus nativitatis*) is a small (350 g) Procellariiform seabird that nests on remote islands in the tropical and subtropical Pacific Ocean. Little is known about its demography or conservation needs. We banded and recaptured 1120 Christmas Shearwaters on Kure Atoll, the northwestern-most of the Hawaiian Islands, on 60 occasions during a 20 year period from 1995-2014. To provide demographic information that is lacking for this species, we used robust design mark-recapture models to estimate annual survival, emigration, capture probabilities, and size of the study population. Annual survival of residents was 0.854 ± 0.034 , which is typical for seabird this size. The oldest known bird was at least 17 years and 1 month old. Of birds banded as chicks, the average age of first recapture was 3.9 years. 11% of birds sampled were transients. The annual emigration rate was 0.249 ± 0.096 . Thirteen shearwaters captured on Kure originally were banded on Midway Atoll, three of which were captured multiple times and presumably were breeding on Kure, indicating there is exchange between colonies on those two islands. The size of the study population averaged 358 birds, with an increasing trend and an estimate of 480 birds in the last two years. The primary reason for the population increase was eradication of black rats (*Rattus rattus*) in 1995, which has resulted in a 10-fold increase in population size since the 1980s. The high survival rate and increasing number of birds indicate the population is robust.

Talk



RECENT WARM LOCAL OCEAN ANOMALIES IN THE GULF OF CALIFORNIA DRIVE ELEGANT TERN NESTING NORTH INTO THE PACIFIC OCEAN.

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Measuring changes in marine environmental parameters and fish availability is difficult, but some seabird parameters have been shown to be useful predictors of such changes. In this century unique changes in the strength and periodicity of oceanographic anomalies such as ENSO have been observed, and to be related or preceded by local effects that had not been previously recorded. Seabirds have been shown to be sensitive to and to accurately reflect precursors of these changes. In this work we show how Elegant Terns (*Thalasseus elegans*) rapidly respond to slight variations in oceanographic and food conditions by changing their nesting site. This has been achieved through parallel studies in Mexico and the US. In the last 24 years Elegant Tern nesting colonies have grown and also expanded from the Gulf of California (GoC) into Southern California. This expansion has fluctuated from year to year. A strong inverse relationship between nesting pairs in Southern California and the GoC shows that terns migrate northwest when confronting potential nesting failure in the GoC. Migration between sites is triggered by local sea-surface temperature anomalies in the GoC, and secondarily, by collapses in sardine availability as a result of intensive fishing during the year previous to that nesting season. This behavior is new; before year 2000 the terns stayed in the GoC even when oceanographic conditions were adverse. Our results show that terns are responding dynamically to rapidly changing oceanographic conditions and fish availability by migrating 600 km northwest in search of more productive waters.

Talk



BEHAVIOUR OF PROSPECTING AND ADULT AUKLETS

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Pre-breeding seabirds ("prospectors") have been documented visiting multiple sites throughout the breeding season in order to gather information on colony productivity, identify suitable habitats, evaluate prey abundance, and locate potential partners; however, many aspects of their biology remain unknown. This project explores prospector behaviour that is vital for understanding post-natal seabird dispersal and colony attendance using auklets (*Aethia* spp.) breeding at Gareloi Island, AK as model species. Crested (*A. cristatella*) and Least (*A. pusilla*) Auklets are abundant species and often breed in mixed colonies with colony populations typically in the hundreds of thousands. In 2014, 195 auklets were colour-banded and a separate subset of 65 Crested Auklets were fit with coded radio tags. We recorded band combinations, length of time spent on the colony, individual behaviour (e.g., time spent preening, searching, resting, and calling), and interactions with conspecifics of auklets attending a study plot within the colony during multiple two-hour long watches through the course of the breeding season. In total, 28 Least and 102 Crested Auklets were observed and we compared behaviour of breeding adults and non-breeders in R using GLMMs. On average, adult auklets spent more time on the colony surface than prospectors ($1:17 \pm 2:07$ min and $0:57 \pm 2:32$ min, respectively); adult auklets spent a greater proportion of that time navigating the colony surface and preening while prospectors spent more time resting and socializing with conspecifics. Our preliminary results suggest pre-breeding auklets use a prospecting period to examine the quality of colonies and learn social behaviours from conspecifics.

Poster



SEABIRD AND CETACEAN ASSOCIATIONS WITH PREY, BATHYMETRY, AND HYDROGRAPHIC FEATURES IN NORTHWEST ATLANTIC SUBMARINE CANYONS DURING SUMMER 2010

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The northwest Atlantic shelfbreak is incised by numerous canyons, but few studies have examined predator-prey associations in these little-sampled canyon systems. Here we report our results of a short cruise off of the U.S. east coast in July of 2010 to document conditions likely to influence the distribution and abundance of seabirds, cetaceans, and potential prey in two submarine canyons (Atlantis and Veatch) and two adjacent non-canyon regions. We used the strip-transect method to quantify seabird and whale abundance, while potential prey (zooplankton and fish) were sampled with multi-frequency acoustics and net tows. The core seabird community, composed of Wilson's Storm-Petrels, Cory's and Audubon's Shearwaters, fed along a frontal zone between a Gulf Stream warm-core ring and a cold water entrainment off the shelf and were not strongly associated with canyons. Shearwater density had a tendency to increase with increasing strength of fish-like backscattering, whereas odontocete whales tended to aggregate in canyon heads and shallower regions characterized by deep patches of euphausiid-like scattering. Storm petrels were broadly distributed yet were densely aggregated in Veatch. The distribution and abundance of top predators may reflect their disparate foraging strategies (e.g., surface feeding vs. diving) used to exploit profitable prey patches in both vertical and horizontal dimensions. Ephemeral frontal zones and retentive features that serve to aggregate prey in these dimensions may function as important mechanisms to facilitate trophic transfer at shelfbreak and submarine canyons systems.

Talk



POPULATION TRENDS OF RED-FACED CORMORANTS IN THE BERING SEA AND ALEUTIAN ISLANDS OF ALASKA

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Red-faced cormorants (*Phalacrocorax urile*) are a prominent, but little-studied, near-shore dwelling species for which we lack much basic breeding biology. Distributed from south central Alaska to the Kuril Islands, their center of abundance is found in the Aleutian and Pribilof islands of Alaska. There is often large annual variation in the number of individuals attending colonies and movement patterns between colonies are almost entirely unknown. The Alaska Maritime National Wildlife Refuge has conducted skiff-based marine bird surveys in the region over the last 11 years. Using whole island groups as our sample unit to account for possible movement, we compare historic counts from the 1970s and 80s with more recent counts to describe the current distribution and abundance of red-faced cormorants in the Bering Sea and Aleutian Islands. There have been large declines in numbers of red-faced cormorants within the range surveyed, including an order of magnitude decline in the Aleutian Islands. No system-wide causes are known to account for these observed declines.

Talk



EFFECTS OF HUMAN VISITATION ON SHOREBIRD ABUNDANCE AND FORAGING BEHAVIOR IN ROCKY INTERTIDAL HABITATS OF SOUTHERN CALIFORNIA

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Human visitation of rocky intertidal shores in urbanized areas, such as southern California, can have detrimental effects on marine invertebrates and algae. Often ignored are the effects of visitors on shorebirds that forage within rocky intertidal ecosystems. Visitors have the capacity to either drive birds away or affect shorebird foraging, such as increasing vigilance and reducing feeding time for birds that are naturally restricted to feeding during short low-tide periods. To examine visitation impacts on both resident and migratory shorebirds, surveys were conducted at 6 sites in southern California, a region where rocky shorelines are limited, during low-tide periods in winter and spring 2014. Bird counts and behavioral focal observations were used in combination with human presence or absence to assess the effects of visitors on bird abundances and foraging behavior. The abundance of obligate rocky intertidal foragers was driven by human presence, whereas non-obligate intertidal foraging bird abundances were driven by different factors. Foraging behavior varied among species, with the impact of visitation on feeding remaining unclear. Ongoing surveys through 2015 will provide a comprehensive look at visitation effects, with the potential for this information to be used by coastal managers to aid in the protection of shorebird species.

Poster



COMPARISON OF TREATY INDIAN AND NON-TREATY GILLNET FISHERY EFFORT AND MARBLED MURRELET (*BRACHYRAMPHUS MARMORATUS*) POPULATION TREND DATA IN THE SOUTHERN SALISH SEA

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In December 2011, a Geographic Information Systems (GIS) mapping project was initiated to determine a correlation between declining marbled murrelet population trends and increasing gillnet fishery landings in the southern Salish Sea within the boundaries of Washington State. In 2012, the GIS mapping project overlaid marbled murrelet population densities with Non-Treaty fisheries catch effort provided by the Washington State Department of Fish and Wildlife to examine seasonal variations in marbled murrelet foraging and fishing trends from 2001 to 2010. In 2013, Treaty-Indian fisheries catch effort was overlaid with marbled murrelet densities. Preliminary analysis showed catch effort for Treaty Indian Tribes has generally decreased or remained the same from 2001 to 2010 in areas with past high fishery catch effort corresponding with a high presence of marbled murrelets, with the exception of one catch area showing moderately high increases in fishing effort corresponding to high marbled murrelet presence. In marine catch areas with historically low fishery catch effort and low presence of marbled murrelet, fishery efforts have increased. When combined with Non-Treaty fisheries, results demonstrated that, overall, no correlation was found between declining population trends and increasing fishery landings. In areas of high marbled murrelet densities, lower fishing effort generally occurred; in areas of low marbled murrelet densities, higher fishing effort occurred. This information will assist Federal agencies in identifying areas of high risk for consideration in future Endangered Species Act Treaty-Indian and Non-Treaty fishery consultations to reduce the potential for future marbled murrelet fishery-related mortality.

Talk



MODELLING LONG-TERM AT-SEA DISTRIBUTIONS OF MARINE BIRDS IN THE MAIN HAWAIIAN ISLANDS TO INFORM SPATIAL PLANNING

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The State of Hawai'i is aiming to derive 40% of its energy from renewable sources by 2030. To inform spatial planning and risk assessment for marine renewable energy, the U.S. Bureau of Ocean Energy Management has funded a marine Biogeographic Assessment of the Main Hawaiian Islands. Here we report on efforts to characterize the long-term at-sea distributions of marine birds as part of that assessment. We analyzed visual sightings data from U.S. National Oceanic and Atmospheric Administration ship surveys conducted in the Hawaiian Exclusive Economic Zone between 1998 and 2010. An ensemble machine-learning technique was used to model counts of each species as a function of multiple spatial and temporal environmental predictor variables 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., frequency of occurrence, strength, and persistence of sea surface temperature and chlorophyll fronts) to explain spatial patterns of occurrence and abundance. Fitted models were used to predict the distributions of marine birds throughout the study area, and these maps provide essential information for marine spatial planning to minimize potential conflict between human activities such as renewable energy development and marine wildlife.

Talk



ASHY STORM PETREL RESEARCH AND CONSERVATION: PAST ACTIONS AND CURRENT NEEDS

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The Ashy storm-petrel (ASSP) is a globally rare and range-restricted seabird, with a breeding population estimated at 5000 to 10000 individuals with most breeding taking place at two population centers in central and southern California. The ASSP faces serious, ongoing threats from introduced and native predators, oil spills, habitat degradation, human disturbance, light pollution, and climate change. However, conservation efforts for this species have been hindered by the lack of rangewide information on status and trends at colonies and at sea, as well as by inconsistent coordination among scientists and conservation practitioners. We review rangewide research and conservation efforts to date, identifying gaps and priorities for future action. Past colony-based research activities have focused on two breeding islands, resulting in scattered information on reproductive success, colony size, and trends. Attempts to provide range-wide protection to the ASSP under the U.S. Endangered Species Act have failed. Other conservation actions have focused on reducing some threats at specific colonies, such as eradication efforts for introduced species, reduction of predation from native predators, and closures of breeding habitats to human activities, as well as restoring breeding habitat through the installation of artificial burrows and social attraction at specific sites. A Conservation Action Plan is needed to identify and prioritize research and conservation needs across the ASSP range in the US and Mexico. We also recommend establishing a collaborative working group of managers, biologists and conservationists committed to Plan creation, implementation and funding.

Talk



COMMUNITY-BASED SEABIRD CONSERVATION AND MANAGEMENT AT IMPORTANT BIRD AND BIODIVERSITY AREA (IBA)

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The Important Bird and Biodiversity Area (IBA) Program of BirdLife International has been used to identify and manage a network of sites of international importance for birds, using a set of standardized criteria. To date, around 3300 sites have been identified worldwide as IBAs that are triggered by seabirds. As seabirds are excellent indicators as to the state of the marine environment, these seabird IBAs can be key sites not only for seabird conservation but for wider marine biodiversity conservation as well. However, various onshore and offshore human pressures, such as invasive species, oil spills, bycatch in gill-net fisheries, and habitat destruction, threaten the coastal seabirds at these IBAs. BirdLife International considers involvement of local communities as a core component of the conservation and management of these IBA sites. In Japan, 167 IBAs have been identified by the Wild Bird Society of Japan, of which 40 are triggered by seabirds, including their breeding sites on land and foraging sites at sea. In 2014, we conducted a questionnaire survey at individual IBAs in Japan to gather information about community-based conservation/management actions, threats, and legal protection of the IBAs, with the intention to identify seabird conservation priorities and promote conservation for ecosystems. We present preliminary results from the analysis of questionnaires collected from WBSJ chapters and local governments located at seabird IBAs with a few examples of sites where community-based seabird conservation and management are already taking place. We also discuss conservation and management needs at these sites.

Poster



OVERWINTERING BEHAVIOUR OF CLOSELY RELATED SYMPATRIC DIVING SEABIRDS: THICK-BILLED AND COMMON MURRES

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Niche partitioning has been proposed as the major mechanism responsible for the coexistence of morphologically similar species. It includes segregations in relation to spatial and temporal distributions as well as diet. Thick-billed murres (*Uria lomvia*: TBMU) and Common murres (*U. aalge*: COMU) are pursuit diving seabirds, similar in size, and often breed sympatrically in Arctic and subarctic regions. Previous studies have examined the inter-specific differences in foraging and feeding behavior between these two sympatric species during breeding period, but evidences are limited during non-breeding period. Differences in the characteristic of foraging/feeding behavior are expected to relate to their habitat selection during non-breeding period. Thus, effects of environment-related change may differ between them, inducing a possible differential trend of population dynamics via a carry-over effect to the subsequent breeding performance. We examined behavior of COMU (n = 5) and TBMU (n = 5) during the non-breeding period of 2013–2014 using light-level geolocators on St. George Island (56°N, 169°W), located in the southeast Bering Sea. Non-breeding distributions of COMU and TBMU were ranged between southeastern Bering Sea and the Aleutian Island, and overlapped largely. Nonetheless, COMU remained over the shelf (<200 m) throughout, while TBMU utilized more southern area including continental slopes and oceanic waters. During this period, TBMU dove to relatively deeper depths than COMU, possibly owing to the difference in their body size, as TBMU is heavier than COMU at St. George Island. Our results revealed the three-dimensional differences in the non-breeding distribution of two sympatric diving seabird species.

Poster



BREEDING PERFORMANCE OF LAYSAN ALBATROSSES *PHOEBASTRIA IMMUTABILIS* IN A FOSTER PARENT PROGRAM

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Laysan Albatrosses, *Phoebastria immutabilis*, are large seabirds that breed primarily in the Northwestern Hawaiian Islands. In the 1960s, they began colonizing new sites across the Pacific, including the US Navy's Pacific Missile Range Facility (PMRF) on Kaua'i. Albatross were first recorded at PMRF in 1967, were breeding by 1977 and by 2012 had a colony of 84 nesting pairs. In 1988, a bird-aircraft strike hazard reduction program was begun in which adults were hazed and eggs were destroyed. In 2005, a foster parent program was initiated in which inviable eggs from Laysan Albatross pairs on Kaua'i's North Shore were replaced with viable eggs from PMRF. From 2009 to 2012, we placed 105 eggs from PMRF in foster nests. Hatching success of foster eggs (39%) was low because most foster eggs (71%) were placed with female-female pairs, which are known to have low hatching success compared with male-female pairs (32% vs. 63%). Fledging success of foster nests (93%) was high, but overall reproductive success of foster nests (36%) was lower than average for this species because of the low hatching rate. This project contributed to the conservation of Laysan Albatrosses by producing 37 additional young for the Kaua'i population and provided valuable insights into incubation, breeding performance and fostering methods. Due to a chronic shortage of available foster pairs on Kauai, a new colony of Laysan Albatrosses will attempt to be created at James Campbell National Wildlife Refuge (on Oahu) over the next several years by hand-rearing chicks that hatch from these eggs.

Talk



QUANTIFICATION OF THE PLASTIC LOADS INGESTED BY TRISTRAM'S STORM-PETREL NESTLINGS FROM TERN ISLAND, NORTHWESTERN HAWAIIAN ISLANDS: TOWARDS MEASURING IMPACTS IN THE FIELD

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The listing of the Tristram's storm-petrel (*Oceanodroma tristrami*, TRSP) as near-threatened due to ambiguous population trends and a limited breeding range, has stimulated research on their population status and threats. Despite limited evidence of historical plastic ingestion (1990s), it is not known whether plastic pollution impacts chick survivorship in this species.

This study provides the first documentation of marine plastic ingestion in TRSP in over 20 years. We found 100% plastic incidence in 57 nestlings collected over four breeding seasons (2007, 2010–2012), with the mass of ingested plastic ranging from 0.1 to 2.8 g (up to 2.8% of adult mass). Furthermore, plastic occurred in every stomach chamber (proventriculus, gizzard). Yet, when considering individual variability, we found a higher plastic mass, more fragments, and larger fragments in the proventriculus. Most (97.5%) of the ingested plastic consisted of hard 'fragments', with the 11,851 ingested items ranging in longest length from 0.4 to 10.0 mm. Digital color analysis of the fragments using the HSB color model documented a diverse color range, including shades of white, yellow, orange, red, blue, green, and black.

The impacts of this pervasive plastic ingestion on chick growth and survival are poorly understood. While TRSP do not produce a bolus prior to fledging, the fragments are broken down and passed into the intestine. Ongoing exploratory analyses are addressing the correlations between plastic loads and body condition, growth and survivorship of field-monitored chicks with the complexity of disentangling effects of plastic from oceanographic effects and in colony factors.

Talk



SEABIRD BYCATCH PATTERNS IN ALASKA: GOOD YEARS, BAD YEARS, AND PINK SALMON

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NOAA's Alaska Fisheries Science Center monitors seabird bycatch in federally-managed commercial fisheries in Alaska primarily to better understand the direct impacts of fishing on seabirds. Bycatch can occur when birds foraging at or near fishing vessels for bait or fishery discards get ensnared in fishing gear. Levels of bycatch have varied over the years due to changes in bird-detering fishing gear modifications and changes in fishing patterns. However there is evidence that the numbers of birds attending fishing vessels also varies due to broader scale environmental patterns of non-fishery related prey, i.e., "natural" prey. One underlying hypothesis is that when "natural" prey sources are scarce, birds are more likely to attend fishing boats in search for fishery-related, or "alternate" prey. Toge et al. (2011) found that bycaught short-tailed shearwaters (*Puffinus tenuirostris*) had lower body and liver mass in odd-numbered years when western Pacific pink salmon (*Oncorhynchus gorbuscha*) were super-abundant and concluded that pink salmon can negatively impact shearwater foraging through competition for shared prey. In this study, I describe annual and regional patterns of seabird bycatch estimates in the context of pink salmon abundance patterns throughout Alaska. Strongly biennial patterns in pink salmon abundance represent interannual changes in predation pressure on zooplankton, squid and small fish. I propose that positively correlated patterns in seabird bycatch may reflect ecosystem changes influenced by competition for shared "natural" prey.

Talk



FOOD WEB LINKS BETWEEN SEABIRDS AND PELAGIC SCHOOLING FISHES IN THE ESTUARY, PLUME, AND NEARSHORE MARINE HABITATS OF THE COLUMBIA RIVER

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Hundreds of thousands of seabirds aggregate in the Columbia River estuary and adjacent coastal regions during April to September. We synthesized existing studies to better understand marine food sources supporting seabirds near the Columbia River. Birds are numerically dominated by common murre (*Uria aalge*), sooty shearwaters (*Puffinus griseus*), double-crested cormorants (*Phalacrocorax auritus*), Brown pelicans (*Pelecanus occidentalis*), gulls (*Larus* spp.), and Caspian terns (*Hydroprogne caspia*), but also include loons, Western grebes, and less common cormorants, alcids, and procellariids. Large tidal exchanges between the Columbia River and nearshore ocean are accompanied by large but poorly understood changes in the distribution and biomass of marine schooling fishes. ESA-listed juvenile salmon (*Oncorhynchus* spp.) and eulachon (*Thaleichthys pacificus*) also occupy the same habitat. Data suggest that northern anchovy (*Engraulis mordax*), whitebait smelt (*Allosmerus elongatus*), Pacific herring (*Clupea pallasii*), and juvenile salmon are the key pelagic prey supporting seabirds in this region. Three fish species are common to both estuary and ocean: northern anchovy, surf smelt, and Pacific herring; juvenile salmon (primarily *O. tshawytscha*, *O. kisutch*, and *O. mykiss*) are also common in both locations. In contrast, juvenile American shad (*Alosa sapidissima*) are numerically dominant in the estuary only, whereas whitebait smelt, Pacific sardine (*Sardinops sagax*), and juvenile Pacific hake (*Merluccius productus*) are numerically common only in the ocean. Interactions among seabirds, pelagic fishes, and ESA-listed anadromous fishes have a number of implications for future management and conservation of marine resources.

Talk



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