Seabirds

Table of Contents

Seabirds 2

Seabirds 2018 2

Seabirds 2017 2

Seabirds 2016 3

Seabirds 2015 6

Seabirds 2014 19

Seabirds 2013 28

Seabirds 2012 and earlier 36

Seabirds

Seabirds 2018

Kawakami, K., Eda, M., Isumi, H., Horikoshi, K., & Suzuki, H. 2018. Phylogenetic position of endangered Puffinus lherminieri bannermani. *Ornithological Science*, *17*(1), 11–18. https://doi.org/10.2326/osj.17.11

(Abstract)

Puffinus lherminieri bannermani is a small black-and-white shearwater, which is endemic to the Ogasawara Islands, Japan. The taxonomic position of this shearwater is contentious. It is treated as a subspecies of Audubon's Shearwater *P. lherminieri* or the Tropical Shearwater *P. bailloni* in some checklists, while it is as considered monotypic, as Bannerman's Shearwater *P. bannermani*, in others. We examined the mitochondrial cytochrome b region to determine the taxon's phylogenetic position. While on the one hand the results showed that it was not genetically related to either *P. lherminieri* or *P. bailloni*, but formed a clade with *P. myrtae, P. newelli*, and *P. auricularis*, on the other hand, *bannermani* has diverged substantially from the other three taxa in both genetic and morphological features. This shearwater was first described as Bannerman's Shearwater, and our results confirm that *P. lherminieri bannermani* should be split from Audubon's Shearwater, and the monotypic Bannerman's Shearwater is recommended to be restored as a distinct species.

Seabirds 2017

Liu D, Zhang G, Jiang H, Chen L, Meng D, Lu J. 2017. Seasonal dispersal and longitudinal migration in the Relict Gull *Larus relictus* across the Inner-Mongolian Plateau. PeerJ5:e3380https://doi.org/10.7717/peerj.3380

(Abstract)

The Relict Gull *Larus relictus* is a globally vulnerable species and one of the least known birds, so understanding its seasonal movements and migration will facilitate the development of effective conservation plans for its protection. We repeatedly satellite-tracked 11 adult Relict Gulls from the Ordos sub-population in Hongjian Nur, China, over 33 migration seasons and conducted extensive ground surveys. Relict Gulls traveled ~800 km between Hongjian Nur in northern China to the coast of eastern China in a predominantly longitudinal migration, following a clockwise loop migration pattern. The gulls migrated faster in spring (4 ± 2 d) than in autumn (15 ± 13 d) due to a time-minimization strategy for breeding, and they showed considerable between-individual variation in the timing of the autumn migration, probably due to differences in the timing of breeding. Gulls that made at least two round trips exhibited high flexibility in spring migration timing, suggesting a stronger influence of local environment conditions over endogenous controls. There was also high route flexibility among different

years, probably due to variations in meteorological or habitat conditions at stopover sites. Relict Gulls stayed for a remarkably long time (234 ± 17 d) on their major wintering grounds in Bohai Bay and Laizhou Bay, between which there were notable dispersals. Pre-breeding dispersals away from the breeding area were distinct, which seemed to be a strategy to cope with the degradation of breeding habitat at Hongjian Nur. Overwhelming lake shrinkage on the breeding ground and at stopover sites and loss of intertidal flats on the wintering grounds are regarded as the main threats to Relict Gulls. It is crucial to make protection administrations aware of the great significance of key sites along migration routes and to promote the establishment of protected areas in these regions.

Seabirds 2016

Sexson, M. G., M. R. Petersen, G. A. Breed, and A. N. Powell. 2016. Shifts in the distribution of molting Spectacled Eiders (*Somateria fischeri*) indicate ecosystem change in the Arctic. *The Condor* **118**:463–476.

(Abstract)

Shifts in the distribution of benthivorous predators provide an indication of underlying environmental changes in benthic-mediated ecosystems. Spectacled Eiders (*Somateria fischeri*) are benthivorous sea ducks that spend the nonbreeding portion of their annual cycle in the Bering, Chukchi, Beaufort, and East Siberian seas. Sea ducks generally molt in biologically productive areas with abundant prey. If the distribution of eiders at molting areas matches prey abundance, spatial shifts may indicate changes in environmental conditions in the Arctic. We used a randomization procedure to test for shifts in the distribution of satellite telemetry locations received from Spectacled Eiders in the 1990s and 2008–2011 within 4 late-summer, ice-free molting areas: Indigirka–Kolyma, northern Russia; Ledyard Bay, eastern Chukchi Sea; Norton Sound, northeastern Bering Sea; and Mechigmenskiy Gulf, northwestern Bering Sea. We lso tested for interannual and interdecadal changes in dive depth required to reach prey, which might affect the energetic costs of foraging during the molting period. Transmitter-marked birds used each molting area in each year, although the distribution of Spectacled Eiders shifted within each area. Interdecadal shifts in Ledyard Bay and Norton Sound decreased dive depth in recent years, although minor differences in depth were biologically negligible in relation to the energetic expense of feather growth. Shifts in Mechigmenskiy Gulf and Indigirka–Kolyma did not occur consistently within or among decades, which suggests greater interannual variability among environmental factors that influence distribution in these areas. Shifts in each molting area suggest dynamic ecosystem processes, with implications for Spectacled Eiders if changes result in novel competition or predation, or in shifting prey regimes.

McDuie, F., and B. C. Congdon. 2016. Trans-equatorial migration and non-breeding habitat of tropical shearwaters: implications for modelling pelagic Important Bird Areas. *Marine Ecology Progress Series* **550**:219–234.

(Abstract)

Declining prey availability drives many seabirds to migrate following breeding. While long-distance, latitudinal migrations are common in temperate-breeding species (including temperate-breeding Procellariiformes), regional dispersal or longitudinal migration is more common in tropical-breeding species. We used geolocators to track adult, tropical-breeding wedge-tailed shearwaters *Ardenna pacifica* from the Great Barrier Reef, Australia, through a ~6000 km migration to non-breeding grounds in Micronesia. This lengthy, trans-equatorial migration was similar to that undertaken by temperate-breeding Procellariiformes, but contrasted with patterns previously observed for tropical-breeding species. However, the oceanographic characteristics of tropical non-breeding habitats differed significantly from those of temperate sites. Core-use habitat had high sea-surface temperatures, very low wind speeds and low primary productivity, features normally associated with poor foraging habitat. However, activity was strongly linked to positive sea-level anomalies, indicating the presence of anti-cyclonic eddies at foraging sites. Such eddies are often associated with oceanic fronts and are known to aggregate micro-nekton and facilitate sub-surface predator feeding. Consequently, our results suggest that eddies, frontal activity and feeding associations with sub-surface predators enhance prey availability to non-breeding shearwaters beyond levels expected based on standard indices of primary production. This is the first tropical study to simultaneously assess the full set of oceanographic features considered important for modelling pelagic Important Bird Areas (IBA). Our findings demonstrate the need for IBA modelling in the tropics to go beyond standard indices of productivity by including measures of frontal activity and assessments of biological interactions. Consequently, this study provides a framework for better predicting candidate Marine IBAs throughout tropical regions.

Lescroël, A., R. Mathevet, C. Péron, M. Authier, P. Provost, A. Takahashi, and D. Grémillet. 2016. Seeing the ocean through the eyes of seabirds: A new path for marine conservation? *Marine Policy* **68**:212–220.

(Abstract)

Seeing the ocean through the eyes of seabirds could help meet the challenges of managing common-pool marine resources both in protected and unprotected areas. First, seabirds are top-predators, exposed to all threats affecting the oceans, and this makes them ideal sentinel organisms for monitoring changes within marine ecosystems. Second, seabirds cross both ecological and political boundaries, and following their movements should help making interdependencies within and between marine ecosystems more visible. Third, seabirds are conspicuous and often charismatic animals, which interact differently with different groups of stakeholders and provide the opportunity to acknowledge and discuss each other's values and

interests. In this paper, we present these research avenues using a seabirds' view, for tackling marine conservation and management issues, and we give operational examples of implementation based on our work in the English Channel.

Yamaguchi NM, Iida T, Nakamura Y, Okabe H, Oue K, Yamamoto T, Higuchi H. 2016. Seasonal Movements of Japanese Murrelets Revealed by Geolocators. *Ornithological Science* **15** (1):47-54.

(Abstract)

The Japanese Murrelet *Synthliboramphus wumizusume* is listed as a vulnerable species by IUCN, but little information is available on its movements during the non-breeding season. We tracked three murrelets during the non-breeding season using light-level geolocators in 2012–2014. Birds from Eboshijima in Kyushu and Koujima in Shikoku were each tracked for one year, and one bird from Birojima in Kyusyu was tracked for two years. All three moved northward in the Pacific Ocean off Shikoku and Honshu in the spring then to the Pacific and the Sea of Japan off Hokkaido and off Sakhalin. In the fall and early winter two movement patterns were observed: (1) southwestward along the coast of Primorskii, the People's Democratic Republic of Korea, and the Republic of Korea; (2) southwestward movement along the east and south coasts of Honshu and Shikoku. In winter, two stayed in the southwestern part of the Sea of Japan, while the third moved southward into the Pacific Ocean.

Öst, M., S. Ramula, A. Linden, P. Karell, and M. Kilpi. 2016. Small-scale spatial and temporal variation in the demographic processes underlying the large-scale decline of eiders in the Baltic Sea. *Population Ecology* **58**:121–133.

(Abstract)

The application of uniform conservation schemes often fails to account for small-scale spatial variation in the drivers of population decline. Demographic comparisons of imperilled populations across locations are therefore crucial for successful conservation, but progress is hampered by lack of long-term data from more than a single population. The recent large-scale decline of eider ducks (*Somateria mollissima*) in the Baltic Sea is ideal for determining to what extent mechanisms underlying population decline can be extrapolated over larger areas. We utilized stochastic demographic methods incorporating both environmental and sampling variation to assess small-scale spatial and temporal variation in the population dynamics of eiders at Söderskȁr (eastern range-margin) and Tvȁrminne (core breeding area), situated 130 km apart. The stochastic growth rate models accurately predicted the observed differences in the rate of decline between sites and time periods. At Söderskȁr, established breeder survival had by far the greatest elasticity, whereas elasticity was more evenly

distributed among vital rates at Tvärminne. Although the study sites showed the single largest difference in fecundity, stochastic life table response experiment analyses revealed that reduced adult female survival at Tvärminne mainly determined the observed difference in growth rates between sites. In contrast, reduced fecundity primarily differentiated the past population increase from the present population decline at Söderskär. Our results demonstrate that different mechanisms may be associated with population decline across adjacent geographic locations, and indicate that dispersal of first-time breeders may be important for population dynamics. Safeguarding adult female survival and/or fecundity should be prioritized in management efforts.

Seabirds 2015

Maftei, M., S. E. Davis, and M. L. Mallory. 2015. Assessing regional populations of ground-nesting marine birds in the Canadian High Arctic. *Polar Research* **34**:25055.

(Abstract)

The Queens Channel region of Nunavut is an ecologically distinct area within the Canadian High Arctic consisting of an extensive archipelago of small, low-lying gravel islands throughout which form several localized but highly productive polynyas. We used aerial survey and colony-monitoring data to assess regional- and colony-level fluctuations in the number of birds in this region between 2002 and 2013. Regional and colony-specific monitoring suggested that common eider (*Somateria mollissima*) numbers are increasing, while numbers of Arctic terns (*Sterna paradisaea*) may be in decline. Based on these data, we suggest that even infrequent comprehensive surveys are more useful than annual monitoring at specific sites in generating an accurate assessment of ground-nesting seabird populations at the regional level, and that dramatic fluctuations at individual colonies probably belie the overall stability of regional populations.

Solovyeva, D. V., and L. A. Zelenskaya. 2015. Changes in the species composition and number of gulls in tundra colonies on western Chukotka during the last 40 years. *Zoologičeskij žurnal***94**:68–75.

(Abstract)

The long-term data on the number and species composition of gulls in large tundra colonies (more than 5 nests with a distance of less than 50 m between them) on Aiopechan Island (western Chukotka) are discussed. The comparative analysis of the information published for 1970–1984 and the author's results for 1989 and 2000–2013 have revealed significant

changes in the species composition and dynamics of the gull colonies during a 40-year period. A shift in the spring phenological characteristics to the earlier dates was found. The growth of the *Larus vegae* population and a decline in the number of *Xema sabini* were determined. The number of *Larus hyperboreus* seems to be stable. The changes in dominant species in the colonies, and the disappearance of some Sabine's gull colonies due to the expansion of Vega gull were observed. The increase in the number of *Larus vegae* occurred due to the formation of new colonies but not due to the growth of the previously known ones.

Hobday, A. J., L. E. Chambers, and J. P. Y. Arnould. 2015. Prioritizing climate change adaptation options for iconic marine species. *Biodiversity and Conservation* **24**:3449–3468.

(Abstract)

Adaptation options in response to climate impact scenarios for marine mammals and seabirds were developed based on the IPCC vulnerability framework. Under this framework, vulnerability to the physical effects of climate change can be reduced by adaptation options that reduce exposure of individuals, reduce the sensitivity of individuals, and increase the adaptive capacity of individual/species to cope with climate change. We evaluated options in each vulnerability category with three screening tools collectively forming an approach we term sequential adaptation prioritization for species. These tools were designed to evaluate (i) technical aspects (cost-benefit-risk, CBR), (ii) institutional barriers, and (iii) potential social acceptability. The CBR tool identified which adaptation options were high cost and low benefit, might be discarded, and which were high benefit and low cost, might be rapidly implemented (depending on risk). Low cost and low benefit options might not be pursued, while those that are high cost, but high benefit deserve further attention. Even with technical merit, adaptation options can fail because of institutional problems with implementation. The second evaluation tool, based on the conceptual framework on barriers to effective climate adaptation, identifies where barriers may exist, and leads to strategies for overcoming them. Finally, adaptation options may not be acceptable to society at large, or resisted by vocal opponents or groups. The social acceptability tool identifies potentially contested options, which may be useful to managers charged with implementing adaptation options. Social acceptability, as scored by experts, differed from acceptability scored by the public, indicating the need to involve the public in assessing this aspect. Scores from each tool for each scenario can be combined to rank.

Renner, H. M., M. D. Romano, M. Renner, S. Pyare, M. I. Goldstein, and Y. Artukhin. 2015. Assessing the breeding distribution and population trends of the Aleutian Tern *Onychoprion aleutica*. *Marine Ornithology* **43**:179–187.

(Abstract)

We compiled survey data on 202 Aleutian Tern colonies throughout Alaska and Russia to assess the current status and colony sizes and to evaluate whether there had been changes in recent decades. We fit a Poisson generalized linear mixed model to all available counts of Alaskan colonies since 1960, excluding colonies in which the temporal spread of counts was < 6 years. Russian data were not included in the trend model due to our inability to resolve dates on a number of counts. We estimate that numbers at known colonies in Alaska have declined 8.1% annually since 1960 or 92.9% over three generations (33 years; 95% CI = 83.3%–97%), with large colonies experiencing greater declines than small colonies. Trends at known colonies within discrete geographic regions of Alaska (Aleutian Islands, Bering Sea, Chukchi Sea, Gulf of Alaska and Kodiak Island) were consistently negative. The most recent counts of all known Alaskan colonies summed to 5 529 birds. This estimate should be considered a rough minimum because it does not account for colonies that have not been surveyed in recent years — the size of which may have changed — or for the fact that the surveys conducted were neither systematic nor inclusive of all potential habitats. In Russia, the sum of the most recent count of all colonies was 25 602 individuals, indicating that Russia may host approximately 80% of the world population. Numbers in some regions in Russia appear to have increased substantially in recent decades, especially on Sakhalin Island and the southern coast of the Koryak Highland. We have no data to identify any population-level stressor that could explain the apparent reduction in numbers in Alaska. However, predation, egging and other anthropogenic disturbances, and degraded habitat may cause population change at local levels. If this overall pattern cannot be explained by other possible but unlikely factors (e.g. establishment of large colonies in new locations within Alaska, or major shifts between Alaska and Russia), then the observed trends in Alaska are, indeed, alarming. Therefore, we urge close monitoring of known colonies within Alaska, studies of dispersal, establishment of management practices to insulate colonies from human disturbance, and more concerted efforts among Alaskan and Russian partners.

Wojczulanis-Jakuba, K., A. Kilikowska, J. Fort, M. Gavrilo, D. Jakubas, and V. L. Friesen. 2015. No evidence of divergence at neutral genetic markers between the two morphologically different subspecies of the most numerous Arctic seabird. *Ibis* **157**:787–797.

(Abstract)

Identifying natural populations that might be considered separate units using morphology, genotype or both is important in understanding the process of speciation and for conservation. We examined the relationships between the only two subspecies of the most numerous Arctic seabird, the Little Auk *Alle alle*, using both morphological (wing and head-bill lengths) and genetic data (482 base pairs of the mitochondrial control region and seven nuclear microsatellite loci). We found significant morphological differences between the subspecies, *A. a. polaris* being significantly larger than the nominate *A. a. alle*. However, we did not find the subspecies to be differentiated at either mitochondrial DNA or at microsatellite loci. Consequently, one evolutionary significant unit is proposed. The similarity of the two subspecies at neutral genetic markers may be due to contemporary gene flow between

populations, as well as large population sizes both in the present and in the past, combined with recent post-glacial colonization of the Artic.

Jang, J.-D., S.-G. Chun, K.-C. Kim, K.-Y. Jeong, D.-K. Kim, J. Y. Kim, G.-J. Joo, and K.-S. Jeong. 2015. Long-term adaptations of a migratory bird (Little Tern *Sternula albifrons*) to quasi-natural flooding disturbance. *Ecological Informatics* **29**:166–173.

(Abstract)

Population size of migratory birds responds to various types of environmental factors, which affect different stages of bird population. In the current study, we analyzed a long-term avifauna monitoring database to investigate population changes in the migratory bird Little Tern, *Sternula albifrons*, with respect to a quasi-natural disturbance, flooding, induced by a regional characteristic climate pattern, the Korean Monsoon (KM), in the Nakdong River Estuary of South Korea. We scrutinized the time-delayed influence by means of wavelet transformation and year-to-year comparison. Little Tern individuals started to grow in April, and reached its maximum generally in May or June, and an abrupt decrease of individual number was observed after KM occurred. Sequential time-series analysis based on wavelet transformation revealed that the changing pattern of the population size of Little Tern in the estuary was linked to the previous year's flooding (a 9- to 10-month delay), which is regarded as the time difference between Little Tern breeding season and previous KM period. Stronger flooding waters during KM season expelled comparably more individuals of Little Tern from the estuary ($r^2 = 0.595$; $p < 0.05$; $n = 9$), and the more the individuals left, the smaller the bird arrived at the estuary in the next year. Further examination revealed that earlier initiation and longer duration of KM in $year_{t-1}$ negatively affected the newly arriving Little Tern individuals in the current year (i.e., $year_t$; $r^2 = 0.809$ for impact of KM onset, $r^2 = 0.909$ for impact of KM duration; $n=10$, respectively; $p<0.005$). The Little Tern population gradually increased when summer flooding was not strong in the previous successive years, from which we concluded that the population of the migratory bird Little Tern tends to adapt to quasi-natural disturbance (flooding) to maintain their population size.

Gaston, A. J., Y. Hashimoto, and L. K. Wilson. 2015. First evidence of east-west migration across the North Pacific in a marine bird. *Ibis* **157**:877–882.

(Abstract)

Many marine birds undertake long migrations between breeding and wintering areas, including some species that undertake long-distance east–west or west–east movements across many degrees of longitude. To date, however, no east–west migrations have been described across the North Pacific. Geolocators were deployed on Ancient Murrelets *Synthliboramphus*

antiquus breeding in Haida Gwaii, British Columbia, in 2013 and four were retrieved the following year. Longitude positions showed that all four moved rapidly westwards after breeding, three of them reaching waters between Japan and China by November and this location was also supported by ringing data. Return migration was rapid, beginning in February and reaching Haida Gwaii in March, providing the first evidence for bird migration spanning the entire width of the North Pacific. This is the longest migration recorded in any of the Alcidae.

Petersen, M. R., G. V. Byrd, S. A. Sonsthagen, and M. G. Sexson. 2015. Re-colonization by common eiders *Somateria mollissima* in the Aleutian Archipelago following removal of introduced arctic foxes *Vulpes lagopus*. *Journal of Avian Biology* **46**:538–549.

(Abstract)

Islands provide refuges for populations of many species where they find safety from predators, but the introduction of predators frequently results in elimination or dramatic reductions in island-dwelling organisms. When predators are removed, re-colonization for some species occurs naturally, and inter-island phylogeographic relationships and current movement patterns can illuminate processes of colonization. We studied a case of re-colonization of common eiders *Somateria mollissima* following removal of introduced arctic foxes *Vulpes lagopus* in the Aleutian Archipelago, Alaska. We expected common eiders to resume nesting on islands cleared of foxes and to re-colonize from nearby islets, islands, and island groups. We thus expected common eiders to show limited genetic structure indicative of extensive mixing among island populations. Satellite telemetry was used to record current movement patterns of female common eiders from six islands across three island groups. We collected genetic data from these and other nesting common eiders at 14 microsatellite loci and the mitochondrial DNA control region to examine population genetic structure, historical fluctuations in population demography, and gene flow. Our results suggest recent interchange among islands. Analysis of microsatellite data supports satellite telemetry data of increased dispersal of common eiders to nearby areas and little between island groups. Although evidence from mtDNA is suggestive of female dispersal among island groups, gene flow is insufficient to account for recolonization and rapid population growth. Instead, near-by remnant populations of common eiders contributed substantially to population expansion, without which re-colonization would have likely occurred at a much lower rate. Genetic and morphometric data of common eiders within one island group two and three decades after re-colonization suggests reduced movement of eiders among islands and little movement between island groups after populations were re-established. We predict that re-colonization of an island group where all common eiders are extirpated could take decades.

Tirtaningtyas, F. N., and J. C. Hennicke. 2015. Threats to the critically endangered Christmas

Island Frigatebird *Fregata andrewsi* in Jakarta Bay, Indonesia, and implications for reconsidering conservation priorities. *Marine Ornithology* **43**:137-140.

(Abstract)

The Christmas Island Frigatebird *Fregata andrewsi* is one of the most endangered seabirds in the world. The reasons for its population decline are unknown, but recommended protection measures and management actions focus on the species' breeding site. Threats to the species away from Christmas Island have received little consideration. Here, we report on several previously undescribed anthropogenic threats to Christmas Island Frigatebirds based on observations in Jakarta Bay, Indonesia: accidental entanglement in fishing gear, as well as capture, poisoning and shooting. Based on these findings, we suggest that it is imperative to reconsider the present management strategies and conservation priorities for the species and to urgently include protection measures away from Christmas Island.

Linnebjerg, J. F., A. Reuleaux, K. N. Mouritsen, and M. Frederiksen. 2015. Foraging Ecology of Three Sympatric Breeding Alcids in a Declining Colony in Southwest Greenland. *Waterbirds***38**:143-152.

(Abstract)

Sympatric nesting seabird species are often found to differ in one or more aspects of their foraging ecology. This is usually interpreted as resource partitioning, potentially due to current or past competition, but other explanations have been proposed. Three closely related species of alcids breeding together in subarctic southwest Greenland differed in several aspects of their foraging ecology during chick rearing. Thick-billed Murres (*Uria lomvia*) and Common Murres (*U. aalge*) did not differ in their diving behavior but both species differed markedly with Razorbills (*Alca torda*). Thick-billed Murres foraged mainly close to the colony, whereas Common Murres and Razorbills also made foraging trips to the mainland coast. Common Murres made significantly more bouts (series of dives) per trip than Thick-billed Murres, but significantly fewer dives per bout than Razorbills. Median dive depth of Thick-billed and Common murres was twice that of Razorbills. Thick-billed Murres nested on open ledges and spent most of their non-foraging time on the ledge attending the chick. Common Murres and Razorbills nested under boulders and in crevices and often left their chicks alone (particularly at night) and rested on the water. One interpretation of this pattern is that the risk of predation from Glaucous Gulls (*Larus hyperboreus*) was much higher on open ledges, and that Thick-billed Murres therefore had to guard their chicks at all times.

Lovvorn, J. R., A. R. Rocha, S. C. Jewett, D. Dasher, S. Oppel, and A. N. Powell. 2015. Limits to benthic feeding by eiders in a vital Arctic migration corridor due to localized prey and

changing sea ice. *Progress in Oceanography* **136**:162–174.

(Abstract)

Four species of threatened or declining eider ducks that nest in the Arctic migrate through the northeast Chukchi Sea, where anticipated industrial development may require prioritizing areas for conservation. In this nearshore corridor (10–40 m depth), the eiders' access to benthic prey during the spring is restricted to variable areas of open water within sea ice. For the most abundant species, the king eider (*Somateria spectabilis*), stable isotopes in blood cells, muscle, and potential prey indicate that these eiders ate mainly bivalves when traversing this corridor. Bivalves there were much smaller than the same taxa in deeper areas of the northern Bering Sea, possibly due to higher mortality rates caused by ice scour in shallow water; future decrease in seasonal duration of fast ice may increase this effect. Computer simulations suggested that if these eiders forage for >15 h/day, they can feed profitably at bivalve densities >200/m regardless of water depth or availability of ice for resting. Sampling in 2010–2012 showed that large areas of profitable prey densities occurred only in certain locations throughout the migration corridor. Satellite data in April–May over 13 years (2001–2013) indicated that access to major feeding areas through sea ice in different segments of the corridor can vary from 0% to 100% between months and years. In a warming and increasingly variable climate, unpredictability of access may be enhanced by greater effects of shifting winds on unconsolidated ice. Our results indicate the importance of having a range of potential feeding areas throughout the migration corridor to ensure prey availability in all years. Spatial planning of nearshore industrial development in the Arctic, including commercial shipping, pipeline construction, and the risk of released oil, should consider these effects of high environmental variability on the adequacy of habitats targeted for conservation.

Kuletz, K. J., M. C. Ferguson, B. Hurley, A. E. Gall, E. A. Labunski, and T. C. Morgan. 2015. Seasonal spatial patterns in seabird and marine mammal distribution in the eastern Chukchi and western Beaufort seas: Identifying biologically important pelagic areas. *Progress in Oceanography* **136**:175–200.

(Abstract)

The Chukchi and Beaufort seas are undergoing rapid climate change and increased human activity. Conservation efforts for upper trophic level predators such as seabirds and marine mammals require information on species' distributions and identification of important marine areas. Here we describe broad-scale distributions of seabirds and marine mammals. We examined spatial patterns of relative abundance of seabirds and marine mammals in the eastern Chukchi and western Beaufort seas during summer (15 June–31 August) and fall (1 September–20 November) from 2007 to 2012. We summarized 49,206 km of shipboard surveys for seabirds and 183,157 km of aerial surveys for marine mammals into a grid of 40-km x 40-km cells. We used Getis-Ord Gi* hotspot analysis to test for cells with higher relative abundance than expected when compared to all cells within the study area. We identified cells representing single species and taxonomic group hotspots, cells representing hotspots for

multiple species, and cells representing hotspots for both seabirds and marine mammals. The locations of hotspots varied among species but often were located near underwater canyons or over continental shelf features and slopes. Hotspots for seabirds, walrus, and gray whales occurred primarily in the Chukchi Sea. Hotspots for bowhead whales and other pinnipeds (i.e., seals) occurred near Barrow Canyon and along the Beaufort Sea shelf and slope. Hotspots for belugas occurred in both the Chukchi and Beaufort seas. There were three hotspots shared by both seabirds and marine mammals in summer: off Wainwright in the eastern Chukchi Sea, south of Hanna Shoal, and at the mouth of Barrow Canyon. In fall, the only identified shared hotspot occurred at the mouth of Barrow Canyon. Shared hotspots are characterized by strong fronts caused by upwelling and currents, and these areas can have high densities of euphausiids in summer and fall. Due to the high relative abundance of animals and diversity of taxa, these sites are clearly important areas of congregation for seabirds and marine mammals that should be prioritized in the development of management and conservation plans.

Divoky, G. J., P. M. Lukacs, and M. L. Druckenmiller. 2015. Effects of recent decreases in arctic sea ice on an ice-associated marine bird. *Progress in Oceanography* **136**:151–161.

(Abstract)

Recent major reductions in summer arctic sea ice extent could be expected to be affecting the distributions and life histories of arctic marine biota adapted to living adjacent to sea ice. Of major concern are the effects of ice reductions, and associated increasing SST, on the most abundant forage fish in the Arctic, Arctic cod (*Boreogadus saida*), the primary prey for the region's upper trophic level marine predators. The black guillemot (*Cepphus grylle mandtii*) is an ice-obligate diving seabird specializing in feeding on Arctic cod and has been studied annually since 1975 at a breeding colony in the western Beaufort Sea. The data set is one of the few allowing assessment of the response of an upper trophic marine predator to recent decadal changes in the region's cryosphere. Analysis of oceanographic conditions north of the colony from 1975 to 2012 for the annual period when parents provision young (mid-July to early September), found no major regime shifts in ice extent or SST until the late 1990s with major decreases in ice and increases in SST in the first decade of the 21st Century. We examined decadal variation in late summer oceanographic conditions, nestling diet and success, and overwinter adult survival, comparing a historical period (1975–1984) with a recent (2003–2012) one. In the historical period sea ice retreated an average of 1.8 km per day from 15 July to 1 September to an average distance of 95.8 km from the colony, while in the recent period ice retreat averaged 9.8 km per day to an average distance of 506.9 km for the same time period. SST adjacent to the island increased an average of 2.9 oC between the two periods. While Arctic cod comprised over 95% of the prey provided to nestlings in the historical period, in the recent period 80% of the years had seasonal decreases, with Arctic cod decreasing to <5% of the nestling diet, and nearshore demersals, primarily sculpin (Cottidae), comprising the majority of the diet. A five-fold increase in the rate of nestling starvation and reductions in nestling growth and fledging mass were associated with the shift

from Arctic cod. Annual adult survival during the nonbreeding season (September–May), showed no significant difference between the two periods, indicating no major change in availability of Arctic cod or other prey in the wintering area in the Bering Sea. Our findings of a substantial decrease in Arctic cod availability in late summer in response to decreased ice extent and increasing SST have implications for the entire Arctic given the ongoing and predicted basin-wide reductions in sea ice.

Schmidt, A. E., K. E. Dybala, L. W. Botsford, J. M. Eadie, R. W. Bradley, and J. Jahncke. 2015. Shifting Effects of Ocean Conditions on Survival and Breeding Probability of a Long-Lived Seabird. *PLoS ONE* **10**:e0132372.

(Abstract)

With a rapidly changing climate, there is an increasing need to predict how species will respond to changes in the physical environment. One approach is to use historic data to estimate the past influence of environmental variation on important demographic parameters and then use these relationships to project the abundance of a population or species under future climate scenarios. However, as novel climate conditions emerge, novel species responses may also appear. In some systems, environmental conditions beyond the range of those observed during the course of most long-term ecological studies are already evident. Yet little attention has been given to how these novel conditions may be influencing previously established environment–species relationships. Here, we model the relationships between ocean conditions and the demography of a long-lived seabird, Brandt's cormorant (*Phalacrocorax penicillatus*), in central California and show that these relationships have changed in recent years. Beginning in 2007/2008, the response of Brandt's cormorant, an upper trophic level predator, to ocean conditions shifted, resulting in lower than predicted survival and breeding probability. Survival was generally less variable than breeding probability and was initially best predicted by the basin-scale forcing of the El Niño Southern Oscillation rather than local ocean conditions. The shifting response of Brandt's cormorant to ocean conditions may be just a proximate indication of altered dynamics in the food web and that important forage fish are not responding to the physical ocean environment as expected. These changing relationships have important implications for our ability to project the effects of future climate change for species and communities.

Szostek, K. L., and P. H. Becker. 2015. Survival and local recruitment are driven by environmental carry-over effects from the wintering area in a migratory seabird. *Oecologia***178**:643–657.

(Abstract)

We estimated annual apparent survival rates, as well as local recruitment rates in different age groups and for different breeding status in the common tern *Sterna hirundo* using mark–recapture analysis on a long-term individual-based dataset from a breeding colony in Germany. Strong inter-annual variability in survival rates became apparent, especially in prospectors. Local recruitment also varied strongly between years and age groups. To explain these fluctuations, we linked survival and recruitment estimates to several environmental covariates expected to be limiting during the wintering period and migration, including the global climate indices of North Atlantic Oscillation and Southern Oscillation, fish abundance indices, and marine primary productivity in the West African wintering area. Contrary to expectations, global indices did not seem to be linked strongly to vital rates. Results showed that primary productivity had the strongest effect on annual survival, especially in young and inexperienced individuals. Primary productivity in the wintering area was also strongly associated with the probability of recruitment in the following breeding season, indicating that conditions during winter can have carry-over effects on the life cycle of individuals.

Martin, P. D., D. C. Douglas, T. Obritschkewitsch, and S. Torrence. 2015. Distribution and movements of Alaska-breeding Steller's Eiders in the nonbreeding period. *The Condor* **117**:341-353.

(Abstract)

Steller's Eiders (*Polysticta stelleri*) that breed in Alaska, USA, are listed as threatened under the U.S. Endangered Species Act (ESA), yet the degree to which these individuals segregate during the nonbreeding period from conspecifics that nest in Russia is unknown. Likewise, very little is known about the timing of use and distribution of autumn migration routes, stopover sites, and molting and wintering areas by the Alaska-breeding population. To address this information need, we implanted 14 Steller's Eiders with satellite transmitters in 2000 and 2001 at their primary Alaskan breeding grounds near Barrow. We found no evidence for segregation of the Alaska-breeding population in midwinter because locations were well-distributed along the Alaska Peninsula, congruent with prevailing knowledge about the wintering distribution of Steller's Eiders that breed in Russia. During the wing molt, from late August to early October, 7 of 13 individuals used Kuskokwim Shoals, corroborating the importance of this area and its designation as critical habitat under the ESA. Steller's Eiders are generally described as preferring shallow waters <10 m deep, but our winter tracking data clearly documented occupancy of deeper offshore waters. Steller's Eiders frequently used up to 30-m deep water almost exclusively at night during winter. We speculate that nighttime occupancy of deeper water habitats may be for resting and/or for consumption of zooplankton species, such as euphausiids, that are abundant and well known for their nocturnal vertical migrations in the water column.

Paleczny, M., E. Hammill, V. Karpouzi, and D. Pauly. 2015. Population Trend of the World's Monitored Seabirds, 1950-2010. *PLoS ONE* **10**:e0129342.

(Abstract)

Seabird population changes are good indicators of long-term and large-scale change in marine ecosystems, and important because of their many impacts on marine ecosystems. We assessed the population trend of the world's monitored seabirds (1950–2010) by compiling a global database of seabird population size records and applying multivariate autoregressive state-space (MARSS) modeling to estimate the overall population trend of the portion of the population with sufficient data (i.e., at least five records). This monitored population represented approximately 19% of the global seabird population. We found the monitored portion of the global seabird population to have declined overall by 69.7% between 1950 and 2010. This declining trend may reflect the global seabird population trend, given the large and apparently representative sample. Furthermore, the largest declines were observed in families containing wide-ranging pelagic species, suggesting that pan-global populations may be more at risk than shorter-ranging coastal populations.

Ramírez, F., C. Gutiérrez-Expósito, I. Afán, J. Giménez, R. de Stephanis, and M. G. Forero. 2015. Human influence on gull non-breeding distribution: potential consequences of changes in fishing practices. *Marine Ecology Progress Series* **527**:221–232.

(Abstract)

Interpopulation mixing of migratory species at particular stopover and wintering hotspots increases their vulnerability to anthropogenic impacts. Animal associations with human activities at this time of the annual cycle should, therefore, inform management policies. The Gulf of Cadiz, Spain is a key non-breeding area for the Near Threatened Audouin's gull *Ichthyaetus audouinii* and the over-abundant lesser black-backed gull *Larus fuscus*, both of which heavily depend on human fisheries. Here, we used long-term (1990−2013) data on coastal censuses, along with spatially-explicit information on fish landings (2000−2014) and on-board surveys of fishing vessels (2012−2013), to unravel the association of these gulls with human fisheries and evaluate its role in shaping their distribution at this important non-breeding hotspot. Fishing discards from trawlers were extensively used by lesser black-backed gulls, whereas Audouin's gulls apparently benefited from fish aggregations that occurred where purse seines were retrieved. Fishing influence was identified as an important driver of the non-breeding distribution of these gulls, particularly for the lesser black-backed gull, which congregated near main fishing ports. Within this scenario, we speculate that changes in fishing practices, such as those proposed by the upcoming EU Reform of the Common Fisheries Policy that includes a ban on fishing discards, will almost certainly impact the lesser black-backed gull. In contrast, the impact on the Audouin's gull remains unclear and will likely depend on how the proposed ban is implemented.

Szostek, K. L., S. Bouwhuis, and P. H. Becker. 2015. Are arrival date and body mass after spring migration influenced by large-scale environmental factors in a migratory seabird? *Frontiers in Ecology and Evolution* **3**:42.

(Abstract)

Changes in the timing of migratory events have been observed recently in many migratory species, most likely in response to climatic change. In the common tern *Sterna hirundo* we examined such changes in spring arrival date and body mass based on an individual-based longitudinal dataset from a transponder marked colony from 1994 to 2012. Although no long-term trend was observed in either trait, strong inter-annual and age-specific variation in arrival date and mass was evident. We investigated whether environmental factors such as (i)global climate phenomena, i.e., North Atlantic and Southern Oscillation Indices, NAOI and SOI, and/or (ii) local factors, i.e., food abundance in the wintering and breeding area represented by fish stock or marine primary productivity, could explain this variation. We found that 2-year-old birds on their first spring migration advanced arrival in relation to spring NAOI and delayed arrival in relation to sprat *Sprattus sprattus* abundance. The arrival date of 3-year-olds also advanced in relation to NAOI and delayed in relation to winter SOI. In contrast, adults delayed arrival with NAOI and advanced in relation to SOI. Within age groups, earlier annual arrival coincided with higher mass, indicating that a fast and/or early migration did not come at a cost to body condition. Changes in arrival mass relative to environmental covariates were found only in 2-year-olds on their first spring migration: in these birds arrival mass was positively related to herring *Clupea harengus* and sprat abundance in the breeding area as well as spring NAOI and negatively related to SOI. In conclusion, traits related to migration of common terns were linked with environmental conditions, but showed no long-term trends over the past two decades. Age-related differences were marked, suggesting that common terns might be subject to differing environmental constraints or respond differently to conditions during their annual cycle depending on their age.

Carlile, N., and D. Priddel. 2015. Establishment and growth of the White Tern *Gygis alba*population on Lord Howe Island, Australia. *Marine Ornithology* **43**:113-118.

(Abstract)

The White Tern *Gygis alba* is self-introduced to Lord Howe Island, Australia. It was first recorded there in 1943, but breeding was not confirmed until 1968. Breeding is confined to the central lowlands, with most breeding sites (White Terns do not make nests) located close to shore within the area of human settlement. All sites are in trees, predominantly large mature Norfolk Island Pine *Araucaria heterophylla*. In 2005/06, the White Tern population on Lord Howe Island was estimated to be ~500 breeding pairs, having increased at a mean rate of 12% per annum since 1971. In 2013/14, the population was ~600 pairs, having increased 2.7% per

annum between 2006 and 2013. When breeding was monitored in 2005, many pairs re-laid if the first or second breeding attempt failed, with a clutch mean (± SD) of 1.5 ± 0.6 attempts per pair. Hatching success was 37%, fledging success 47% and breeding success 17%. Reproductive output (mean number of fledglings produced per breeding pair) was 0.25, lower than that recorded for most other populations for which data are available. The endemic Lord Howe Pied Currawong *Strepera graculina crissalis* was a major predator of White Tern eggs and chicks, and the introduced Masked Owl *Tyto novaehollandiae* a predator of adults.

Haney, J. C., and D. S. Lee. 2015. Evaluating survey duration with community attributes of marine birds in the South Atlantic Bight. *Marine Ornithology* **43**:53-64.

(Abstract)

The expense of conducting dedicated marine bird surveys creates incentives to optimize sampling effort. We appraised spatiotemporal effort in two shipboard surveys off the southeastern coast of the United States using analyses of seabird community structure. By applying randomization routines from both data-analytic (curve-fitting) and sampling-theoretic methods (bootstrap, jackknife, coverage), we assessed sampling adequacy for estimating numerical and biomass dominance, species accumulation rates and species richness. Maximum-likelihood estimators indicated that each survey had been carried out long enough for cumulative species richness (Sobs) to reach an apparent asymptote. Data stratification by season did not reduce the asymptotic-based estimates of minimum survey effort overall. Three estimators of total species richness (Sˆ max) were equal to or less than values actually observed (Sobs = 53 species in each survey). Five other estimators of Sˆmax exceeded Sobs by 5%–18%, suggesting few species remained undetected by the time our surveys ended. Indeed, after >600 additional observation days, only six more offshore species were detected (all extralimitally rare), a tally that fell within error terms for estimators noted above. The two avifaunal surveys examined here were two to six times longer than required (36–65 days) to detect community dominants (species comprising ≥95% of numerical abundance and biomass). We conclude that sampling effort as appraised by community attributes was minimally adequate in both surveys. Measures of saturation in community structure can be applied while inventories are in progress to complement analyses of sample size based on statistical power, and may help minimize costs associated with over-sampling in dedicated surveys for marine birds.

Cervencl, A., K. Troost, E. Dijkman, M. de Jong, C. J. Smit, M. F. Leopold, and B. J. Ens. 2015. Distribution of wintering Common Eider *Somateria mollissima* in the Dutch Wadden Sea in relation to available food stocks. *Marine Biology* **162**:153-168.

(Abstract)

The number of Eiders *Somateria mollissima* wintering in the Dutch Wadden Sea has declined rapidly during the last two decades. Changes in the available food stocks are assumed to be an important cause of this trend. In order to extend the knowledge of the importance of particular food sources to wintering Eiders, data on distribution of Eiders obtained from aerial counts were spatially related to routinely collected monitoring data of shellfish. Based on previous diet studies, we hypothesized that the distribution of Eiders in the Dutch Wadden Sea is related to the presence of *Mytilus edulis* stocks and that *M. edulis* from the sublittoral areas, especially the ones from mussel culture plots will have the strongest effect on Eider distribution. Boosted regression tree models were applied to quantify the relative importance of different potential prey items on the distribution of wintering Eiders. Indeed, Eiders were found to prefer sites with high densities of medium- and large-sized *M. edulis*, especially from mussel culture plots. Other bivalve species seemed to serve as alternative prey, since sites with a relatively high abundance of these species increased in importance, when less *M. edulis* was available on culture plots. The contribution of cultured *M. edulis* to the diet of Eiders decreased during the course of the winter seasons, indicating that harvesting of *M. edulis* from the culture plots might reduce this high-quality food source at the end of the winter, forcing the Eiders to switch to less profitable prey.

Seabirds 2014

Smith, M. A., N. J. Walker, C. M. Free, M. D. Kirchhoff, G. S. Drew, N. Warnock, and I. J. Stenhouse. 2014. Identifying marine Important Bird Areas using at-sea survey data. *Biological Conservation***172**:180–189.

(Abstract)

Effective marine bird conservation requires identification of at-sea locations used by populations for foraging, staging, and migration. Using an extensive database of at-sea survey data spanning over 30 years, we developed a standardized and data-driven spatial method for identifying globally significant marine Important Bird Areas in Alaska. To delineate these areas we developed a six-step process: binning data and accounting for unequal survey effort, filtering input data for persistence of species use, using a moving window analysis to produce maps representing a gradient from low to high abundance, drawing core area boundaries around major concentrations based on abundance thresholds, validating the results, and combining overlapping boundaries into important areas for multiple species. We identified 126 bird core areas which were merged into 59 pelagic sites important to 45 out of 57 species assessed. The final areas included approximately 34–38% of all marine birds in Alaska waters, within just 6% of the total area. We identified globally significant Important Bird Areas spanning 20 degrees of latitude and 56 degrees of longitude, in two different oceans, with climates ranging from temperate to polar. Although our maps did suffer from some data gaps, these gaps did not preclude us from identifying sites that incorporated 13% of the assessed continental waterbird population and 9% of the assessed global seabird population. The application of this technique over a large and productive region worked well for a wide range of birds, exhibiting a variety of foraging strategies and occupying a variety of ecosystem types.

Zelenskaya, L. A. 2014. Feeding Ecology of the Slaty-backed Gull (*Larus schistisagus*) on Kuril'skoe Lake (Southern Kamchatka Peninsula). *Biology Bulletin* **41**:773–787.

(Abstract)

Data on the feeding of the slaty-backed gull (*Larus schistisagus*) nesting at the largest Asian red salmon spawning site – Kuril'skoe Lake (southern Kamchatka) – are analyzed. The seasonal dynamics of the qualitative composition of the diet of nesting slaty-backed gulls was determined. The data on the diet obtained for the lake and coastal nesting populations are compared. Typical colonies of slaty-backed gulls are situated no farther than 3 km from the sea. The birds use the following foraging strategies: (1) foraging near the colony; (2) Pacific salmon (*Oncorhynchus*) preference; and (3) feeding in the littoral zone. Red salmon is the basic component of the gull trophic chain in the lake ecosystem. The seasonal changes in the typical foraging strategies of slaty-backed gulls observed on Kuril'skoe Lake depended on the state of food reserves. Foraging flights of gulls for the red salmon did not exceed 5 km, whereas the use of littoral food was minimal. In addition, red salmon gurry was also the mass food for gulls, which was collected at a distance of approximately 40 km from the colony.

Duerr, R. S., and K. C. Klasing. 2014. Tissue component and organ mass changes associated with declines in body mass in three seabird species received for rehabilitation in California. *Marine Ornithology* **43**:11-18.

(Abstract)

Critical care for aquatic birds undergoing rehabilitation as a result of oil spills currently proceeds with minimal information about the nutritional status and needs of the affected animals, and lack of such information may substantially affect the survival of birds through the rehabilitation process and after their release. To objectively evaluate the nutritional condition of aquatic birds undergoing rehabilitation, we performed proximate analyses on carcasses of adult Common Murres *Uria aalge* (COMU), Western Grebes *Aechmophorus occidentalis* (WEGR) and Surf Scoters *Melanitta perspicillata* (SUSC) that died or were euthanized during rehabilitation. Carcasses were selected to capture the widest available range of body conditions. A regression analysis of protein, fat, ash mass and liver and leg muscle mass against total carcass mass examined changes related to presumed loss of body mass. WEGR and COMU were found to have a nadir of fat that illustrates the boundary between phase II and III starvation, at which fat stores have been exhausted. The bird mass at this boundary was approximately 900 g for male WEGR and 675 g for both female WEGR and COMU, which corresponds to 63.0%, 56.3% and 66.0% of their wild mean masses, respectively. For comparison purposes, the mean body mass of WEGR and COMU received for care during the S.S. Jacob Luckenbach oil spill were 70.9% and 70.5% of the wild mean

mass, respectively. Protein mass showed a linear decline as carcass mass declined in all comparisons, and the slope of the relationship did not change at a critical point, as would be expected from species that conserve protein while mobilizing fat stores. This suggests the phases of starvation in these species, or in faunivorous birds in general, may vary from that in better-studied omnivorous species. This work shows that birds commonly affected by oil spills in California may not be healthy animals in need of washing, but a large proportion may be presented for care in extreme catabolic states. Rapid capture of oiled animals is advisable to initiate treatment before excessive tissue catabolism results in severe nutritional depletion.

Shibaev, Y. V. 2014. Expansion of “Mongolian gull” *Larus (Smithsonianus) mongolicus* Sushkin, 1925 to the eastern periphery of the Asian Continent. *Far Eastern Journal of Ornithology* **4**:3-19.

(Abstract)

This paper describes the process of colonization of a small island (Furugelm Island) in Peter the Great Bay (Russian side of the Sea of Japan) by a gull species from the *Larus argentatus* superspecies complex, starting from a single nesting pair in 2004 to a stable population of 72 pairs in 2012. The taxonomic status of the colonist species remains debatable and is not the purpose of this paper. Rather, this is an analysis of the dynamics of regional colonization, characteristics of seasonal migration, and species biology that allow for the conclusion that these observations amount to a sequential colonization by *Larus* (*smithsonianus*) *mongolicus* of the eastern periphery of the Asian continent. The settlers colonized two habitat types from Lake Khanka to the lower reaches of the Amur River: large, freshwater lakes, and coastal islands. The birds that settled on Furugelm Island started as a group of seven differently-aged birds: two mature birds (that bred) and five younger birds of varying maturity. Successful colonization by this species was based on a series of factors, including the protected status of Furugelm Island where the birds fortuitously chose to nest, an abundance of available habitat and food resources, and a relatively low abundance of Slaty-backed gulls, which occupy the same niche.

Oro, D. 2014. Seabirds and climate: knowledge, pitfalls, and opportunities. *Frontiers in Ecology and Evolution* **2**:1-12.

(Abstract)

As a physical driver of ecosystem functioning, it is not surprising that climate influences seabird demography and population dynamics, generally by affecting food availability. However, if we zoom in ecologically, seabirds are in fact very heterogeneous, ranging in size from very small to very large species(with a difference of more than two orders of magnitude in body weight), from planktivorous forms to predators of large fish and squid, from benthic to pelagic, from species with small foraging ranges to species feeding throughout the whole

circumpolar region, and from resident species (at a spatial mesoscale) to trans-equatorial migrating seabirds that travel large distances across several oceanographic systems. Due to this high variability and the difficulty in obtaining direct reliable estimates of long-term food availability, global climatic indices have been extensively used in studying seabird demography and population dynamics. However, the use made by researchers of these indices has certain conceptual and methodological pitfalls, which I shall address in this review. Other factors, such as anthropogenic impacts (including oil-spills and interaction with fisheries), may further alter or confound the association between climate and seabird demography. These pitfalls and environmental noise, together with the inability to incorporate resilience, may bias our predictions regarding the future impact of global warming on seabirds, many of which have vulnerable populations.

Rizzolo, D. J., J. A. Schmutz, S. E. McCloskey, and T. F. Fondell. 2014. Factors influencing nest survival and productivity of Red-throated Loons (*Gavia stellata*) in Alaska. *The Condor* **116**:574-587.

(Abstract)

Red-throated Loon (*Gavia stellata*) numbers in Alaska have fluctuated dramatically over the past 3 decades; however, the demographic processes contributing to these population dynamics are poorly understood. To examine spatial and temporal variation in productivity, we estimated breeding parameters at 5 sites in Alaska: at Cape Espenberg and the Copper River Delta we estimated nest survival, and at 3 sites within the Yukon-Kuskokwim Delta we estimated nest survival and productivity. Nest survival varied broadly among sites and years; annual estimates (lower, upper 95% confidence interval) ranged from 0.09 (0.03, 0.29) at Cape Espenberg in 2001 to 0.93 (0.76, 0.99) at the Copper River Delta in 2002. Annual variation among sites was not concordant, suggesting that site-scale factors had a strong influence on nest survival. Models of nest survival indicated that visits to monitor nests had a negative effect on nest daily survival probability, which if not accounted for biased nest survival strongly downward. The sensitivity of breeding Red-throated Loons to nest monitoring suggests other sources of disturbance that cause incubating birds to flush from their nests may also reduce nest survival. Nest daily survival probability at the Yukon-Kuskokwim Delta was negatively associated with an annual index of fox occurrence. Survival through the incubation and chick-rearing periods on the Yukon-Kuskokwim Delta ranged from 0.09 (0.001, 0.493) to 0.50 (0.04, 0.77). Daily survival probability during the chick-rearing period was lower for chicks that had a sibling in 2 of 3 years, consistent with the hypothesis that food availability was limited. Estimates of annual productivity on the Yukon-Kuskokwim Delta ranged from 0.17 to 1.0 chicks per pair. Productivity was not sufficient to maintain population stability in 2 of 3 years, indicating that nest depredation by foxes and poor foraging conditions during chick rearing can have important effects on productivity.

Pakanen, V.-M., H. Hongell, S. Aikio, and K. Koivula. 2014. Little tern breeding success in artificial and natural habitats: modelling population growth under uncertain vital rates. *Population Ecology* **56**:581–591.

(Abstract)

As a consequence of habitat loss, breeding in man-made habitats has become increasingly common for many coastal breeding bird species. While artificial sites provide valuable substitutes, they may also be more attractive, and importantly, differ in quality from natural sites. Therefore, information on habitat specific breeding success and their potential for supporting stable populations are needed. We compared little tern (Sternula albifrons) breeding success (nest and hatching success) between natural habitat (sandy beaches) and artificial port habitat at Bothnian Bay, Finland from 2006 to 2011. We further reviewed published estimates on pre-fledging and adult survival for little terns and least terns (Sternula antillarum), and used these ranges to estimate plausible parameter spaces for population growth rates given our estimates of breeding success. Nest success was among the highest reported for little terns in the artificial habitat (82 %) while being lower in the natural habitat (58 %). This difference may have resulted from differences in colony sizes and levels of disturbance. Hatching success did not differ significantly, but the percentage of successful nests containing unhatched eggs was twice as high in the natural habitat. The parameter spaces for population growth rates indicated that the artificial habitat has good potential to sustain stable populations (66 % positive growth rate) while for the natural habitat this potential was lower (37 % positive growth rate). While our results suggest that artificial habitats can be very productive breeding sites for habitat deprived tern populations, management should concentrate on improving both habitats with emphasis on natural sites.

Tirtaningtyas FN. 2014. Kleptoparasitic behaviour of Christmas Island *Frigatebirds Fregata andrewsi* in Jakarta Bay, Indonesia. *Birding ASIA* **21**, 66-67.

(No abstract available)

Kim Y, Priddel D, Carlile N, Merrick JR, Harcourt R. 2014. Do tracking tags impede breeding performance in the threatened Gould's Petrel *Pterodroma leucoptera*? *Marine Ornithology* **42**, 63-68.

(Abstract)

Effects of tracking device deployment have been studied in large seabirds but less in small seabirds. Given the widespread use of tracking for distribution and foraging research,

understanding whether attachment of such devices impedes breeding performance is critical. We examined the effects of both short- and long-term deployment of geolocators on Gould's Petrel *Pterodroma leucoptera* at Cabbage Tree Island, Australia, during the 2010/11 breeding season. We monitored breeding adults and their chicks over the 3 month period they carried geolocators. No significant effect on hatching success, fledging success or chick fledging mass was found. Body mass of adults carrying geolocators declined during the breeding season, but this was similar to birds without geolocators. No detectable negative impact was found for long-term (8–9 month) deployment during the non-breeding season on body mass or subsequent breeding performance. These findings suggest the use of small (1.5–2.0 g) geolocators does not inhibit foraging success and chick provisioning in Gould's Petrel. Similar verification in other small migratory seabirds fitted with geolocators is recommended.

Lilleyman A, Hensen BJ. 2014. Gull-billed Tern (*Gelochelidon nilotica affinis*) in the Darwin region, Northern Territory. *Northern Territory Naturalist* **25**, 12-17.

(Abstract)

The Asian subspecies *Gelochelidon nilotica affinis* of Gull-billed Tern breeds in Asia and migrates to northern Australia during its non-breeding season, which is the Australian wet season/summer. A substantial non-breeding population of this tern occurs in northwestern Australia and it is also an uncommon but regular visitor to the northern coasts of Queensland. However, *G. nilotica affinis* remains infrequently reported in the Top End. This fact has prompted us formally to report its occurrence in the Darwin region. Interestingly, our own and other recent reports fall outside its normal wet season/summer visiting period in northern Australia. We comment on the importance of recognising and recording this migratory tern, which is separable from the Australian-breeding subspecies (*G. affinis macrotarsa*) with some care in the field, and include some guidelines to identification of these terns in the field.

Arizaga J, Aldalur A, Herrero A, Cuadrado JF, Díez E, Crespo A. 2014. Foraging distances of a resident yellow-legged gull (*Larus michahellis*) population in relation to refuse management on a local scale. *European Journal of Wildlife Research* **60**, 171–175.

(Abstract)

Seasonal fluctuations in marine prey availability around breeding colonies are one of the major factors affecting resident behaviour in seabirds. This is particularly applicable to large gulls (*Larus* spp.). The effect of refuse management on large gulls has been studied chiefly in relation to breeding dynamics, but it is less understood with regard to movement patterns. Our aim was to test whether the closure of one large dump and the use of falconry to deter gull access to two others, within the southeastern Bay of Biscay area, affected the foraging

distance of local yellow-legged gulls (*Larus michahellis*). During a period of seven consecutive winters between 2005 and 2011, the proportion of gulls that moved less than 50 km from their natal site was 70 %. However, during the winter of 2010, when they were deterred from accessing refuse tips within the region, gulls were found to travel longer distances. This result was explained neither by a decreasing survey effort near colonies nor by a decrease in apparent availability of marine prey, thus supporting the hypothesis that refuse management within the region influenced the movement patterns of local gulls.

Linnebjerg JF, Huffeldt NP, Falk K, Merkel FR, Mosbech A, Frederiksen M. 2014. Inferring seabird activity budgets from leg-mounted time–depth recorders. *Journal of Ornithology* **155**, 301–306.

(Abstract)

Leg-mounted loggers are increasingly used in seabird activity studies, but few studies have validated the information obtained about bird behaviour with independent data. Using Brunnich's Guillemot *Uria lomvia* as a study species, we show by comparing interpretations of time–depth recorder (TDR) data with visual observations that activity budgets inferred from leg-mounted TDRs provide reliable information on colony attendance, and validate information on flight time by comparing periods interpreted as flight based on TDR data with periods interpreted as flight based on GPS speed information. Yet, special attention is needed because auks resting at sea occasionally withdraw one leg and/or foot into the plumage (leg-in-plumage). During this behaviour, the TDR may be warm and dry, potentially leading to spurious identification of colony visits. In our case study, spurious identification of colony visits would have resulted in mean trip duration being underestimated by a factor of 4, and number of trips being correspondingly overestimated. We therefore urge great care when deriving activity budgets from leg-mounted TDRs, but nonetheless recommend using leg-mounted TDRs to infer activity budgets from diving seabirds, particularly for longer deployments.

Lieske DJ, Fifield DA, Gjerdrum C. 2014. Maps, models, and marine vulnerability: Assessing the community distribution of seabirds at-sea. *Biological Conservation* **172**, 15–28.

(Abstract)

Whether considering the cumulative impact of chronic, small-size oil discharges or accidents associated with marine traffic and offshore oil and gas development, seabirds face a variety of threats in the marine environment. Assessing the vulnerabilities of seabirds to maritime hazards requires an understanding of their species distribution, and a means for combining this information across groups. Using at-sea survey data gathered as part of a regional monitoring program, an efficient framework for integrating multispecies data was developed.

Survey data was incorporated within a distance sampling framework to generate bias-corrected seabird densities for an area of over 730,000 km^2 size, which were used to construct multiple species distribution models (SDMs). The structural difficulties associated with sampling sparsely distributed individuals that also occur in large, localized concentrations led to the use of three modelling techniques potentially well suited for this type of data: negative binomial, ‘‘hurdle’’, and random forest methods. Predicted abundances were combined to produce an ensemble forecast, which met or exceeded the accuracy of predictions from the individual models. Multi-species potential sensitivity maps were developed to identify core areas, confirming the general importance of physiographic features such as the shelf break and bathymetry. Distribution was also seasonally influenced, with spring and winter standing out as periods of peak importance. When combined with an oil pollution layer derived from aerial surveillance, vulnerability was highest in the vicinity of major ports (e.g., Halifax and Sydney, Nova Scotia). However, the vulnerability map also indicated lower but widespread levels of oiling risk throughout the shelf, presumably associated with persistently high levels of shipping traffic and ongoing petroleum extraction and exploration. Outside of this region, migratory connectivity is expected to expose seabirds to a wider network of hazards and further underscores the need for the coordinated and routine collection of marine hazard data alongside at-sea distributional data.

De La Cruz SEW, Eadie JM, Miles AK, Yee J, Spragens KA, Palm EC, Takekawa JY. 2014. Resource selection and space use by sea ducks during the non-breeding season: Implications for habitat conservation planning in urbanized estuaries. *Biological Conservation* **169**, 68–78.

(Abstract)

Wide-ranging marine birds rely on multiple habitats for wintering, breeding, and migrating, and their conservation may be dependent on protecting networks of key areas. Urbanized estuaries are critical wintering and stopover areas for many declining sea ducks in North America; however, conservation measures within estuaries are difficult to establish given lack of knowledge about habitat use by these species and the variety of competing human interests. We applied hierarchical modeling to evaluate resource selection of sea ducks (surf scoters, *Melanitta perspicillata*) wintering in San Francisco Bay, California, USA, a large and highly urbanized estuary. We also examined their distribution, home range, and movements with respect to key habitat features and regions within the estuary. Herring roe was the strongest predictor of bird locations; however, eelgrass, water depth and salinity were also highly-ranked, with sea ducks using deeper areas of higher salinity associated with herring roe and eelgrass presence during mid-winter. Sea ducks were also strongly associated with ferry routes, suggesting these areas may contain resources that are too important to avoid and emphasizing the need to better understand water traffic effects. Movements and home range size differed between males and females in early winter but became more similar in late winter. Birds traveled farther and used several sub-bays in early winter compared to mid-winter when herring roe availability peaked in the Central Bay. Our findings identified key environmental variables, highlighted core use areas, and documented critical periods for

consideration when developing conservation plans for sea ducks in urbanized

Kirchhoff MD, Lindell JR, Hodges JI. 2014. From critically endangered to least concern? A revised population trend for the Kittlitz's Murrelet in Glacier Bay, Alaska. *The Condor* **116**, 24-34.

(Abstract)

The Kittlitz's Murrelet (*Brachyramphus brevirostris*) has been proposed for listing under the U.S. Endangered Species Act, and is classified as critically endangered by the International Union for the Conservation of Nature (IUCN). A significant portion of the global population occurs in Glacier Bay, Alaska, where steep population declines have been previously reported. To further examine Kittlitz's Murrelet population trends we replicated a 1993 survey in 2009 and 2010 using the same lead observer, the same transect lines, and similar methods. We found the number of Kittlitz's Murrelets unchanged since 1993. Other seabird surveys were conducted in Glacier Bay between 1991 and 2008 by federal agencies, using a variety of sampling designs. We added our surveys to previously published surveys, correcting for percentage of murrelets identified to species to enable comparison. When all surveys were analyzed collectively, the Kittlitz's Murrelet population showed no significant trend between 1991 and 2010 (P=0.51). A power analysis showed high power (>0.99) to detect a decline had the population truly been declining at a rate of -11% per year, allowing us to reject the prior published conclusion of decline rates of -10.7% to -14.4% per year in Glacier Bay. The prior result of murrelet population decline was driven by a high population estimate from an isolated, nonstandard survey in 1991. Our three surveys in 1993, 2009, and 2010 provide a direct long-term comparison of standardized surveys, and show a more comprehensive picture of the Kittlitz's Murrelet population trend in Glacier Bay. We suggest the previous conclusion of a declining trend was influenced by anchoring bias, which attached undue certainty to the initial observation. The revised population trend in Glacier Bay indicates Kittlitz's Murrelets are not at imminent risk of extinction.

Winiarski KJ, Miller DL, Paton PWC, McWilliams SR. 2014. A spatial conservation prioritization approach for protecting marine birds given proposed offshore wind energy development. *Biological Conservation* **169**, 79–88.

(Abstract)

There are currently no offshore wind energy developments (OWEDs) in North America, although numerous OWEDs have been proposed along the Atlantic Coast. Development pressure has been a catalyst for marine spatial planning (MSP) to identify suitable areas for OWED. However, integrating complex ecological information to guide OWED siting remains a

substantial challenge. We developed spatial distribution models of marine birds from aerial surveys that we conducted from 2010 to 2012 throughout a 3800 km^2area off the coast of Rhode Island. For seven groups of marine birds, we constructed either a density surface model or a presence–absence model that incorporated relevant environmental covariates. We integrated our spatial models, along with uncertainty, using spatial conservation prioritization (SCP) software. This identified sites with high marine bird conservation priority that aided evaluation of proposed OWED sites. We found that shallow nearshore waters had the highest conservation priority overall, but we also detected key offshore areas of high priority. Hypothetical OWEDs placed in conservation priority areas significantly reduced the overall distribution of focal species. Currently proposed OWED sites are located in areas of relatively low conservation priority and so would not substantially reduce the overall distribution of marine birds. This SCP approach when combined with quantitative models of bird distribution given relevant environmental covariates provides a robust framework that satisfies the principles of ecosystem-based MSP. Thus, this combined SCP-distribution modeling framework should be extremely helpful to decision makers as they evaluate proposed siting locations of OWEDs in the context of a dynamic marine system.

Seabirds 2013

Zelenskaya, L. A. 2013. Seabird colonies in the Tauysk Bay and on the Koni Peninsula (Sea of Okhotsk). *Вестник СВНЦ ДВО РАН* **3**:87–100.

(Abstract)

Breeding seabirds in colonies of the Tauysk Bay and on the coast of the Koni Peninsula were counted in 2005–2009. The most typical for this area are the monospecific colonies (46.1%) or colonies with two (32%) or three (13.3%) species. The total number of birds nesting in colonies of the Tauysk Bay and on the coast of the Koni Peninsula, is about of 825.7 thousand individuals. Most seabirds (93.5%) are located in the four following island colonies: Talan Island (83.6%); Umara Island (3.9%);

Three Brothers Isles (3.6%), and Shelikan Island (2.8%). On other small isles no more than 0.9% seabirds breed. The obtained data have been compared with materials of earlier countings in order to reveal changes in the species list, number of bird nesting colonies, and their distribution on the coast. Some sites show a substantial growth in number and the expansion of the seabird species list: on the islands of Shelikan, Three Brothers, Umara, isles in the Olsky lagoon, the coast of Gertner Bay, sites on the coast of the Koni Peninsula near Cape Skalisty, and from Cape Bligan to Cape Kornilov. At some of the other sites, reduction in number of seabirds can be observed. Colonies break into a number of smaller groups or disappear completely (sites of the coast of the Koni Peninsula from Cape Taran to Cape Bligan, coast of Zavyalov I., Nedorazumenia I., northern coast of the Odyan Bay).

Palm EC, Esler D, Anderson EM, Williams TD, Wilson MT. 2013. Variation in Physiology and Energy Management of Wintering White-Winged Scoters in Relation to Local Habitat Conditions. *The Condor* **115**, 750-761.

(Abstract)

Along the Pacific coast of North America, White-winged Scoters (*Melanitta fusca*) winter in sites that vary widely in habitat conditions. This habitat variation likely alters the relative costs and benefits of using specific sites in terms of factors such as foraging conditions, degree of predation danger, and thermoregulatory costs. To assess how White-winged Scoters adjust their physiology and energy management in response to variation in habitat conditions, we contrasted overwinter dynamics in several physiological indicators across five sites in British Columbia and Washington. We tested the relative support for various hypotheses that considered exposure to wind and waves, water depth, predation danger, diet composition, and collection period as possible underlying causes of variation in physiological indicators. Total body mass and lipid mass were highest at an exposed offshore site, which may reflect an adaptive response to buffer against unpredictable foraging conditions and increased thermoregulatory costs. At nearshore sites where exposure was lower, scoters maintained lower lipid masses throughout the winter. Total lipid mass declined through the winter in all sites, a result consistent with findings for many waterfowl species. However, levels of plasma metabolites (triglycerides, β-hydroxybutyrate) varied little by site, suggesting that, irrespective of body composition, birds at all sites maintained physiological homeostasis. Digestive morphology was strongly related to diet, with smaller gizzards and longer intestines associated with a greater fraction of soft-bodied foods in the diet. Our results suggest that the physiology and energy management of wintering White-winged Scoters is related to local habitat conditions.

Sha J. 2013. Next step for reducing seabird by catch. *Animal Conservation* **16**, 155–156.

Péron C, Grémillet D, Prudor A, Pettex E, Saraux C, Soriano-Redondo A, Authier M, Fort J. 2013. Importance of coastal Marine Protected Areas for the conservation of pelagic seabirds: The case of Vulnerable yelkouan shearwaters in the Mediterranean Sea. *Biological Conservation* **168**, 210–221.

(Abstract)

Marine Protected Areas (MPAs) are being established across all marine regions but their validity for the conservation of highly mobile marine vertebrates has been questioned. We

tested the hypothesis that French coastal MPAs primarily designed for coastal and benthic biota are also beneficial for the conservation of a pelagic seabird, the Vulnerable yelkouan shearwater (*Puffinus yelkouan*), an endemic species to the Mediterranean Sea. We used a vast spectrum of electronic devices (GPS, temperature-depth-recorders, satellite transmitters and geolocators) and stable isotopic analyses to study the year-round movements and the trophic status of yelkouan shearwaters from the Hyères archipelago (France). In addition we conducted large-scale ship and aircrafts observation surveys to investigate spatio-temporal density patterns of shearwaters (genus *Puffinus*) in the western Mediterranean Sea. This extensive investigation permitted the first comprehensive study of the at-sea ecology of yelkouan shearwaters showing strikingly coastal habits, partial migration, unsuspected diving capabilities (max dive depth of 30 m), and a broad diet ranging from zooplankton to small pelagic fish. Importantly, 31% of yelkouan shearwaters GPS positions associated with foraging, 38% of diving positions, and 27% of resting positions were within the three French MPAs during the breeding season. These high scores confirmed by year-round distribution derived from GLS, PTTs, at-sea and aerial observations, validated our hypothesis of the major importance of coastal MPAs for the conservation of yelkouan shearwater. Our case-study is therefore a major contribution to research efforts aiming at linking the spatial ecology of highly mobile marine vertebrates with effective conservation of marine biodiversity.

Bicknell AWJ, Oro D, Camphuysen K, Votier SC. 2013. Potential consequences of discard reform for seabird communities. *Journal of Applied Ecology* **50**, 649–658.

(Abstract)

1. Upcoming reform of the European Union (EU) Common Fisheries Policy will be the biggest change in European fisheries management for a generation. A central plank of this reform is a proposed ban on discards, to aid the creation of economically and environmentally sustainable fisheries. This, together with a global trend for declining discards, may have unforeseen knock-on consequences for the large number of scavenging seabirds that consume this plentiful subsidy.

2. Discards have shaped many aspects of seabird foraging, distribution and population dynamics. Here, we review these effects and consider the potential for both negative and positive impacts of discard reforms for seabirds, with particular focus on the EU, and propose recommendations for ongoing research and conservation.

3. EU seabird scavengers are dominated by a relatively small number of large generalist taxa. Many of these occur at globally significant numbers within the EU, but may be able to buffer a decline in discards by switching to feed on alternative foods.

4. A discard ban may have negative consequences by creating a food shortage for scavenging birds. Some species may offset this by feeding more on other birds, with potentially negative population-level impacts, or by moving into novel environments.

5. Benefits of a discard ban may be a reduction in seabird bycatch in fishing gears, as well as a reduction in populations of large generalist species that currently dominate some seabird communities.

6. Synthesis and applications. Reform of the Common Fisheries Policy and global discard declines are essential components towards creating sustainable fisheries, but may have both detrimental and beneficial effects on seabird communities. The nature of these impacts is still poorly understood, highlighting the need for detailed long-term seabird monitoring, as well as building resilience into populations through policy measures that incorporate remedial action on major seabird conservation priorities. Research should focus on understanding how seabird foraging, in terms of functional responses and searching behaviour, is influenced by both changing discards and natural fish prey availability, and how they impact upon fitness. It is also essential to link individual-level responses with population-, community- and ecosystem-level change. Understanding these links is fundamental to ongoing seabird management and conservation, and an ecosystem-based approach to fisheries management.

Agness AM, Marshall KN, Piatt JF, Ha JC, Vanblaricom GR. 2013. Energy cost of vessel disturbance to Kittlitz's Murrelets *Brachyramphus brevirostris*. *Marine Ornithology* **40,** 1-9.

(Abstract)

We evaluated the energy cost of vessel disturbance for individual Kittlitz's Murrelets *Brachyramphus brevirostris* in Glacier Bay National Park and Preserve in Alaska, USA. We used Monte Carlo simulations to model the daily energy expense associated with flight from vessels by both breeding and non-breeding birds and evaluated risk based on both the magnitude of costs incurred and the degree to which the costs may be chronic. We used two scenarios of vessel disturbance for average and peak vessel traffic. Because they are more likely to fly away from vessels, non-breeding birds had a greater increase in energy expenditure when disturbed (up to 30% increase under the average scenario and >50% increase under the peak scenario) than breeders (up to 10% and 30% increases under the average and peak scenarios, respectively). Likewise, non-breeding birds were more likely to experience chronic increases in energy expense (i.e. a greater percentage of days with an increase in energy expenditure) than breeding birds. Our modeling results indicated that breeding and non-breeding birds were both susceptible to fitness consequences (e.g. reduced reproductive success and survival) resulting from the energy cost.

Zydelis R, Small C, French G (2013) The incidental catch of seabirds in gillnet fisheries: A global review. *Biological Conservation* **162,** 76–88.

(Abstract)

Based on bird feeding ecology we identified 148 seabird species as susceptible to bycatch in gillnets, of which 81 have been recorded caught. The highest densities of susceptible species occur in temperate and sub-polar regions of both hemispheres, with lower densities in tropical regions. Gillnet fisheries are widespread and particularly prevalent in coastal areas. A review of reported bycatch estimates suggests that at least 400,000 birds die in gillnets each year. The highest bycatch has been reported in the Northwest Pacific, Iceland and the Baltic Sea. Species suffering potentially significant impacts of gillnet mortality include common guillemot (*Uria aalge*), thick-billed guillemot (*Uria lomvia*), red-throated loon (*Gavia stellata*), Humboldt penguin (*Spheniscus humboldti*), Magellanic penguin (*Spheniscus magellanicus*), yellow-eyed penguin (*Megadyptes antipodes*), little penguin (*Eudyptula minor*), greater scaup (*Aythya marila*) and long-tailed duck (*Clangula hyemalis*). Although reports of seabird bycatch in gillnets are relatively numerous, the magnitude of this phenomenon is poorly known for all regions. Further, population modelling to assess effects of gillnet bycatch mortality on seabird populations has rarely been feasible and there is a need for further data.

Bustnes JO, Moe B, Helberg M, Phillips RA (2013) Rapid long-distance migration in Norwegian Lesser Black-backed Gulls *Larus fuscus fuscus* along their eastern flyway. *Ibis* **155,** 402–406.

(Abstract)

We studied the long-distance migration of Lesser Black-backed Gulls *Larus fuscus fuscus*breeding in northern Norway along their eastern flyway using geolocators in 2009 and 2010. The majority of birds wintered in lakes in East Africa and the southeast Mediterranean was the most important stopover area. *Larus f. fuscus* along the eastern flyway travelled at a net travel speed of 399 and 177 km/day during the autumn and spring migration, respectively, higher than published travel speeds for Dutch *Larus fuscus* migrating along the western flyway. The results suggest that the long-distance migratory Norwegian *L. f. fuscus* seek to minimize time spent in transit, whereas lower travel speed during northerly spring migration may reflect differences in wind patterns or food conditions between spring and autumn.

Frederiksen M, Anker-Nilssen T, Beaugrand G, Wanless S. 2013. Climate, copepods and seabirds in the boreal Northeast Atlantic – current state and future outlook. *Global Change Biology* **19,**364–372.

(Abstract)

The boreal Northeast Atlantic is strongly affected by current climate change, and large shifts in abundance and distribution of many organisms have been observed, including the dominant copepod *Calanus finmarchicus*, which supports the grazing food web and thus many fish

populations. At the same time, large-scale declines have been observed in many piscivorous seabirds, which depend on abundant small pelagic fish. Here, we combine predictions from a niche model of C. finmarchicus with long-term data on seabird breeding success to link trophic levels. The niche model shows that environmental suitability for *C. finmarchicus* has declined in southern areas with large breeding seabird populations (e.g. the North Sea), and predicts that this decline is likely to spread northwards during the 21st century to affect populations in Iceland and the Faroes. In a North Sea colony, breeding success of three common piscivorous seabird species [black-legged kittiwake (*Rissa tridactyla*), common guillemot (*Uria aalge*) and Atlantic puffin (*Fratercula arctica*)] was strongly positively correlated with local environmental suitability for *C. finmarchicus*, whereas this was not the case at a more northerly colony in west Norway. Large seabird populations seem only to occur where *C. finmarchicus* is abundant, and northward distributional shifts of common boreal seabirds are therefore expected over the coming decades. Whether or not population size can be maintained depends on the dispersal ability and inclination of these colonial breeders, and on the carrying capacity of more northerly areas in a warmer climate.

Jonsson JE, Gardarsson A, Gill JA, Petursdottir UK, Petersen A, Gunnarsson TG. 2013. Relationships between Long-Term Demography and Weather in a Sub-Arctic Population of Common Eider. *PLoS ONE* **8,** e67093.

(Abstract)

Effects of local weather on individuals and populations are key drivers of wildlife responses to climatic changes. However, studies often do not last long enough to identify weather conditions that influence demographic processes, or to capture rare but extreme weather events at appropriate scales. In Iceland, farmers collect nest down of wild common eider *Somateria mollissima* and many farmers count nests within colonies annually, which reflects annual variation in the number of breeding females. We collated these data for 17 colonies. Synchrony in breeding numbers was generally low between colonies. We evaluated 1) demographic relationships with weather in nesting colonies of common eider across Iceland during 1900–2007; and 2) impacts of episodic weather events (aberrantly cold seasons or years) on subsequent breeding numbers. Except for episodic events, breeding numbers within a colony generally had no relationship to local weather conditions in the preceding year. However, common eider are sexually mature at 2–3 years of age and we found a 3-year time lag between summer weather and breeding numbers for three colonies, indicating a positive effect of higher pressure, drier summers for one colony, and a negative effect of warmer, calmer summers for two colonies. These findings may represent weather effects on duckling production and subsequent recruitment. Weather effects were mostly limited to a few aberrant years causing reductions in breeding numbers, i.e. declines in several colonies followed severe winters (1918) and some years with high NAO (1992, 1995). In terms of life history, adult survival generally is high and stable and probably only markedly affected by inclement weather or aberrantly bad years. Conversely, breeding propensity of adults and duckling production probably do respond more to annual weather variations; i.e. unfavorable winter

conditions for adults increase probability of death or skipped breeding, whereas favorable summers can promote boom years for recruitment.

Fort J, Steen H, Strøm H, Tremblay Y, Grønningsæter E, Pettex E, Porter WP, Grémillet D. 2013. Energetic consequences of contrasting winter migratory strategies in a sympatric Arctic seabird duet. *Journal of Avian Biology* **44,** 255–262.

(Abstract)

At the onset of winter, warm-blooded animals inhabiting seasonal environments may remain resident and face poorer climatic conditions, or migrate towards more favourable habitats. While the origins and evolution of migratory choices have been extensively studied, their consequences on avian energy balance and winter survival are poorly understood, especially in species difficult to observe such as seabirds. Using miniaturized geolocators, time-depth recorders and a mechanistic model, we investigated the migratory strategies, the activity levels and the energy expenditure of the closely related, sympatrically breeding Brünnich's guillemots *Uria lomvia* and common guillemots *Uria aalge* from Bjørnøya, Svalbard. The two guillemot species from this region present contrasting migratory strategies and wintering quarters: Brünnich's guillemots migrate across the North Atlantic to overwinter off southeast Greenland and Faroe Islands, while common guillemots remain resident in the Barents, the Norwegian and the White Seas. Results show that both species display a marked behavioural plasticity to respond to environmental constraint, notably modulating their foraging effort and diving behaviour. Nevertheless, we provide evidence that the migratory strategy adopted by guillemots can have important consequences for their energy balance. Overall energy expenditure estimated for the non-breeding season is relatively similar between both species, suggesting that both southward migration and high-arctic winter residency are energetically equivalent and suitable strategies. However, we also demonstrate that the migratory strategy adopted by Brünnich's guillemots allows them to have reduced daily energy expenditures during the challenging winter period. We therefore speculate that 'resident' common guillemots are more vulnerable than 'migrating' Brünnich's guillemots to harsh winter environmental conditions.

Kazama K, Hirata K, Yamamoto T, Hashimoto H, Takahashi A, Niizuma Y, Trathan PN, Watanuki Y. 2013. Movements and activities of male black-tailed gulls in breeding and sabbatical years. *Journal of Avian Biology* **44**, 603-608.

(Abstract)

Long-lived animals sometimes skip one or more breeding seasons; however, little is known about their movements and activities during such 'sabbatical' periods. Here we present novel

data on year-round movements and activities of two male black-tailed gulls *Larus crassirostris* during a sabbatical year. We compare the data with those in a year when they bred and with those of two other breeding males. The year-round migration routes of two sabbatical males were consistent with those of the breeding males: they returned to the breeding area but did not visit the colony in the sabbatical year. They landed more frequently on water (a potential index of foraging effort) during the non-breeding autumn and winter prior to the sabbatical year than before breeding. Sabbatical gulls may forage more intensively to recover body condition immediately after breeding.

Reid TA, Tuck GN, Hindell MA, Thalmann S, Phillips RA, Wilcox C. 2013. Nonbreeding distribution of flesh-footed shearwaters and the potential for overlap with north Pacific fisheries. *Biological Conservation* **166,** 3–10.

(Abstract)

Populations of flesh-footed shearwaters on Lord Howe Island, Tasman Sea, have declined recently, with mortality in longline fisheries likely to be one of the major causes. It is therefore imperative to increase our understanding of their distribution at sea, especially during winter. Although they are known to migrate to the north Pacific Ocean, until this study there was very little information available on timing of movements, distribution and habitat use of individuals. Ten to 16 flesh-footed shearwaters (37 in total) were tracked from Lord Howe Island in each of three winter seasons (2005, 2007 and 2008). All birds migrated to the north-west Pacific Ocean, with approximately 70% wintering to the east of Japan in the Kurashio and Oyashio currents, around the Bonin Islands in the north Philippine Sea, or in the eastern Sea of Japan. Others spent a varying amount of time in the Yellow and East China seas, or in the western Sea of Japan. These waters already support intensive fisheries and demand for seafood is likely to rise in tandem with the increasing human populations of East Asia. Consequently, results presented here show that members of the largest population of flesh-footed shearwaters winter exclusively in the north-west Pacific Ocean around Japan and East Asia, in areas they are likely to overlap extensively with a number of fisheries; it is therefore imperative to obtain more information on current and projected levels of bird bycatch and effort in these fisheries in order to developing management strategies for the conservation of the east Australian and New Zealand populations of the flesh-footed shearwater.

Dias MP, Granadeiro JP, Catry P. 2013. Individual variability in the migratory path and stopovers of a long-distance pelagic migrant. *Animal Behaviour* **86,** 359-364.

(Abstract)

The analysis of repeated journeys of the same individuals is becoming an important tool in the

study of animal migration. This approach has been used to analyse the migratory consistency (in schedules, routes and stopovers) of various species, with implications for the understanding of navigation mechanisms, travel strategies and conservation. However, few studies have addressed the individual consistency in pelagic long-distance migrations, in particular in the routes followed in different years. By analysing 100 journeys from 35 individual Cory's shearwaters, *Calonectris diomedea*, that repeatedly migrated to the South African region we examined the fidelity to migratory paths and stopovers of a transequatorial seabird migrant. Cory's shearwaters showed an overall trend to be faithful to their routes in different years, which was particularly obvious in the first (southbound) part of the outward migration. Nevertheless, we did not detect any individual consistency in the final part of the outward migration, in the return migration or in the location of the stopovers. The fact that Cory's shearwaters can be either consistent or inconsistent in different parts of their routes is possibly related to the variability of the external factors (such as wind conditions and location of good foraging areas) found along the way.

Seabirds 2012 and earlier

2012

Zelenskaya, L. A. 2012. Glaucous gull (*Larus hyperboreus*) and vega gull (*Larus heuglini*) in western Chukotka: Biotopic distribution of nests and formation of colonies. *Zoologičeskij žurnal***91**:856–868.

(Abstract)

The data on the biotopic distribution of nests of glaucous gull and vega gull in the seaside boggy tundra of western Chukotka are analyzed. The process of formation of mixed colonies is described. The incubation success depends on the time of building nests relative to spring flood and on the gained experience (age) of breeding birds.

Lascelles BG, Langham GM, Ronconi RA, Reid JB. 2012. From hotspots to site protection: Identifying Marine Protected Areas for seabirds around the globe. *Biological Conservation* **156**, 5–14.

(Abstract)

Marine Protected Areas (MPAs) are recognised as a key component of an ecosystem-based approach to managing the marine environment more effectively and sustainably. Marine top predators, such as seabirds, may be used to identify and prioritize sites for marine

conservation. Here we highlight the important role that seabird scientists can play in identifying candidate sites for MPAs; areas identified using at-sea surveys, seabird tracking, and species-habitat modelling. Prioritization of species and sites needs knowledge of ecological and habitat dynamics, threats and important areas at key stages of annual and life-cycle. The results need to be interpreted within the context of relevant policy mechanisms and agreements. The size and shape of candidate MPAs should be: a realistic for the key species and systems involved; b easy to monitor and enforce; and c where feasible involve reasonably long-term data sets. Designation of MPAs by relevant authorities and organisations will require effective advocacy (at local, national and international levels) and must be based on robust and defensible science. Site boundaries should also be sufficient flexibility to be modified, if necessary, in the light of future experience and data collection. The effectiveness of MPAs at the scale required for seabird conservation will need to build on existing experience and develop innovative, as well as traditional, marine spatial planning, monitoring and management techniques. To achieve this within the target timeframes outlined in a number of policy mechanisms will require the rapid development of new approaches, resources and partnerships.

Ronconi RA, Lascelles BG, Langham GM, Reid JB, Oro D. 2012. The role of seabirds in Marine Protected Area identification, delineation, and monitoring: Introduction and synthesis. *Biological Conservation* **156**, 1–4.

(Abstract)

Currently less than 1% of the world's seas are under any form of protected area designation, thus, there is an important and immediate need for tools to identify and delineate a network of ecologically representative Marine Protected Areas (MPAs). Although the role of seabirds in MPA identification and the importance of MPAs to seabird conservation have been discussed for more than a decade, the actual designation of MPAs using seabird data has lagged far behind. To synthesize the current state of knowledge regarding seabirds and the designation of MPAs, this special issue presents 14 papers resulting from the 1st World Seabird Conference, held in Canada in 2010. These papers present examples from around the world that show the important role seabirds can play in the identification, design, implementation, and monitoring of MPAs. Approaches to seabird MPA site identification consider single- versus multiple-species approaches, mapping of marine biological ‘‘hotspots’’, and assessment of overlap with risks and threats. The delineation of MPA boundaries may further be refined with information on seabird foraging ranges, at-sea density estimates, and tools for ranking areas based on conservation priorities. Seabirds can also be used to evaluate the effectiveness of MPAs as conservation tools by monitoring changes in seabird foraging ranges, patterns of distribution and abundance, and population dynamics. To date, very few MPAs have been established specifically for the benefit of seabirds, however, many of the papers in this special issue suggest that this should become a growing trend in seabird conservation and marine spatial planning.

Thaxter CB, Lascelles B, Sugar K, Cook ASCP, Roos S, Bolton M, Langston RHW, Burton NHK. 2012. Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. *Biological Conservation* **156**, 53–61.

(Abstract)

There is a growing need to identify Marine Protected Areas (MPAs) for marine species. For seabirds, MPAs include those near breeding colonies, offshore foraging areas, inshore habitats for wintering species, and migratory bottlenecks. However, frequently there is a lack of readily available current and comprehensive data on foraging areas used by species from particular colonies. Therefore, representative breeding season foraging ranges for each species may be useful alongside other datasets for scoping candidate MPAs. We reviewed studies that estimated foraging range for 25 species of UK breeding seabirds. For representative foraging ranges, we prioritised studies, giving highest value to those based on direct tracking of birds (21%); then those involving indirect estimates using flight speeds and time activity (12%) followed by, boat, aerial, and land-based 'survey' observations (46%); and finally we gave lowest value to speculative estimates (21%). Highest confidence was placed in the foraging ranges of northern gannet (*Morus bassanus*), black-legged kittiwake (*Rissa tridactyla*), and common guillemot (*Uria aalge*), and lowest for common gull (*Larus canus*), common eider (*Somateria mollissima*), Leach's (*Oceanodroma leucorhoa*) and European storm petrels (*Hydrobates pelagicus*). Both annual and colony-specific variation was evident for some species. Manx shearwater (*Puffinus puffinus*), northern gannet, and northern fulmar (*Fulmarus glacialis*), had the largest foraging ranges (maximum ranges >330, 590 and 580 km, respectively), whereas red-throated diver (*Gavia stellata*) and little tern (*Sternula albifrons*) had the smallest (maximum ranges 9 and 11 km, respectively). Representative foraging ranges may be useful to suggest likely colony-specific foraging areas, prior to habitat-association modelling for defining candidate MPAs. The approach here has international applicability, and would help progress towards more comprehensive protection of seabird populations.

Stenhouse IJ, Egevang C, Phillips RA. 2012. Trans-equatorial migration, staging sites and wintering area of Sabine's Gulls *Larus sabini* in the Atlantic Ocean. *Ibis* **154,** 42–51.

(Abstract)

The migrations and winter distributions of most seabirds, particularly small pelagic species, remain poorly understood despite their potential as indicators of marine ecosystem health. Here we report the use of miniature archival light loggers (geolocators) to track the annual migration of Sabine's Gull *Larus sabini*, a small (c. 200 g) Arctic-breeding larid. We describe their migratory routes and identify previously unknown staging sites in the Atlantic Ocean, as well as their main Atlantic wintering area in the southern hemisphere. Sabine's Gulls breeding

in northeast Greenland displayed an average annual migration of almost 32 000 km (n = 6), with the longest return journey spanning close to 39 000 km (not including local movements at staging sites or within the wintering area). On their southern migration, they spent an average of 45 days in the Bay of Biscay and Iberian Sea, off the coasts of France, Spain and Portugal. They all wintered in close association with the cold waters of the Benguela Upwelling, spending an average of 152 days in that area. On their return north, Sabine's Gulls staged off the west African coast (Morocco, Mauritania, Senegal), spending on average 19 days at this site. This leg of migration was particularly rapid, birds travelling an average of 813 km⁄ day, assisted by the prevailing winds. Sabine's Gulls generally followed a similar path on their outbound and return migrations, and did not exhibit the broad figure-of-eight pattern (anti clockwise in the southern hemisphere and clockwise in the northern hemisphere) seen in other trans-equatorial seabirds in the Atlantic and Pacific oceans.

2011

Zelenskaya, L. A. 2011. Monitoring of the slaty-backed gull of urban population *in* Magadan city in Conservation of biodiversity of Kamchatka and coastal waters. Proceedings of XI International Scientific Conference Petropavlovsk-Kamchatsky, November 24–25 2010.

(Abstract)

Based on the annual observations (2004–2010) the dynamics of the occupation of a new nesting biotope – the roofs of the city of Magadan – by Slaty-backed Gulls was investigated. During this period the number of the nests constructed on buildings has grown from 112 to 794. Number of the gull settlements has increased from 7 colonies and 7 single birds in 2004 to 34 colonies and 58 singles in 2010. Ecological features of the urban population of gulls are discussed and methods of fighting with this phenomenon are offered.

Van Dijk, K., S. Kharitonov, H. Vonk, and B. Ebbinge. 2011. Taimyr Gulls: evidence for Pacific winter range, with notes on morphology and breeding. *Dutch Birding* **33**:9-21.

(No abstract available)

2010

Cao L, Zhao G, Tang S, Guo H. 2010. The First Reported Case of Cooperative Polyandry in

the Red-footed Booby: Trio Relationships and Benefits. *The Wilson Journal of Ornithology* **122**, 361-365.

(Abstract)

We report the first observations of cooperative polyandry in the Red-footed Booby (*Sula sula*), a trio that remained stable over at least 4 consecutive years. Both males were heterosexual; neither was dominant. One male was more sexually active, but mounting activity suggested shared paternity over the years. Trio males, compared to monogamous males, invested more in pair bond maintenance activity which possibly assisted in maintaining a stable breeding unit. Trio members, like monogamous adults, shared breeding duties evenly, reducing the total investment for each trio member relative to that of monogamous adults. The extra foraging effort of the trio enabled similar provisioning rates in good and bad years. We suggest trio formation improved female lifetime reproductive success due to enhanced nest, egg, and chick care; maintained stable food provisioning rates despite highly heterogeneous foraging conditions; and increased male survivorship due to sharing of breeding duties. Red-footed Booby trio formation is probably an “opportunistic deviation” from normal monogamy which is favored by differential costs and benefits to males and females.

2005

Cao L, Pang YL, Liu NF. 2005. Status of the Red-Footed Booby on the Xisha Archipelago, South China Sea. *Waterbirds* **28,** 411-419.

(Abstract)

Visits were made to the Xisha Archipelago, northern South China Sea, from 13 March to 9 April 2003 and 2 April to 7 September 2004, to determine the status of the Red-footed Booby (*Sula sula*). The Red-footed Booby was found to breed only on Dong Island, (area of 1.55 km2). Random sampling indicated that the island supported approximately 35,500 breeding pairs. The colony is the largest in the west Pacific and comprises more than 10% of the estimated world population. It is suggested that the island may hold more than 100,000 individuals, including fledged birds of the year, and immature and non-breeding birds. The Red-footed Booby nests only in *Pisonia grandis* trees on the island, and the most serious threat to the breeding colony is from a herd of introduced cows which are consuming the new *P. grandis* growth that otherwise would develop into potential nesting habitat. Recommendations are made for improved protection of birds on the Archipelago.