

Marine Science Review - 171

Marine and coastal birds



In this review:

- A. Recent articles – no abstract available
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A. Recent articles – no abstract available

Skagen, S.K. **Migration stopovers and the conservation of arctic-breeding calidridine sandpipers.** *Auk* 123(2): 313-322, 2006.

B. Recent articles with abstracts

Walker, B.G., Boersma, P.D., and Wingfield, J.C. **Habituation of adult Magellanic penguins to human visitation as expressed through behavior and corticosterone secretion.** *Conservation Biology* 20(1): 146-154, 2006.

Notes: Ecotourism is increasing worldwide; hence, it is important to know how wildlife are affected behaviorally and physiologically by human visitation. We studied the effects of human visitation on the Magellanic Penguins (*Spheniscus magellanicus*) at Punta Tombo, Argentina, by monitoring changes in defensive head turns and plasma corticosterone (a hormone secreted in response to stress) for penguins with and without a history of tourist visitation. Habituation to human visitation was rapid. In penguins with no previous exposure to tourists, the number of defensive head turns and level of plasma corticosterone decreased significantly within 5 days of one 15-minute visit/day. Penguins living in tourist-visited and undisturbed areas secreted more corticosterone when captured and restrained than penguins visited by a person. Penguins in tourist areas, however, did not show as strong a corticosterone response to capture and restraint as did penguins in areas without tourists. This difference was due to a decreased capability of the adrenocortical tissue to secrete corticosterone in tourist-visited birds. Although our data show no direct negative effects of tourism on Magellanic Penguins at Punta Tombo, consequences of a modification of physiological capabilities (e.g., adrenocortical function) may not become apparent until much later in life. The physiological differences between tourist-visited and undisturbed groups of Magellanic Penguins emphasize the importance of monitoring the effects of anthropogenic disturbances on wildlife at multiple levels.

Jenouvrier, S., Barbraud, C., and Weimerskirch, H. **Sea ice affects the population dynamics of Adelie penguins in Terre Adelie.** *Polar Biology* 29(5): 413-423, 2006.

Notes: Overall Adelie penguin population size in Pointe Geologie Archipelago increased between 1984 and 2003 at a rate of 1.77% per year, and averaged 33,726 +/- 5,867 pairs. As predicted by the optimum model proposed by Smith et al. (*Bioscience* 49:393-404, 1999), Adelie penguin population size increased when sea ice extent and concentration (SIE and SIC) decreased six years earlier, indicating that the conditions around reproduction or first years at sea, were determinant. The breeding success averaged 85.2 +/- 35.45% and was not related to environmental variables. Adult survival probability varied between years from 0.64 to 0.82. Southern oscillation index (SOI) had a strong negative effect on adult annual survival. Adult survival of Adelie penguins increased during warmer events, especially during winter and spring at the beginning of reproduction. Therefore, we speculate that the rapid decreases in 1988-1991 and 1996 of the breeding population size were related to a decrease in adult mortality. However, adult survival varied little, and could not explain the strong increasing population trend. The sea ice conditions during breeding or during the first year at sea appeared determinant and influenced the population dynamics through cohort effects, probably related to the availability of productive feeding habitats.

Saino, N., Romano, M., Ferrari, R.P., Martinelli, R., and Moller, A.P. **Stressed mothers lay eggs with high corticosterone levels which produce low-quality offspring.** *Journal of Experimental Zoology Part A* 303A(11): 998-1006, 2005.

Notes: Organisms frequently encounter stressful ecological conditions. In vertebrates, a major mechanism of physiological response to stress is mediated by the hypothalamic-pituitary-adrenal axis and results in increased secretion of glucocorticosteroids, which can have adverse consequences on diverse phenotypic traits affecting fitness. Maternal stress may thus have carry-over effects on progeny if it influences pre-natal offspring environment in terms of glucocorticosteroid concentration, although this hypothesis has never been tested in any species under field conditions. We manipulated stress experienced by female barn swallows *Hirundo rustica*, by exposing them to a predator during laying and measured egg corticosterone concentration. Stressed females laid eggs with greater corticosterone concentration than controls exposed to a herbivore. In another experiment, we injected physiological doses of corticosterone in the egg albumen and compared the phenotype of offspring originating from these eggs with their control siblings originating from either sham-inoculated or unmanipulated eggs and reared in the same nest. Eggs injected with corticosterone had lower hatchability and produced fledglings with smaller body size and slower plumage development than did control eggs. Nestling body size in our study population predicts long-term survival. Thus, maternal stress impaired offspring phenotype and viability by increasing transmission of glucocorticosteroids to the eggs. This study identifies a novel mechanism mediating early maternal effects whereby maternal stress affects offspring quality. These results are relevant to biological conservation because they disclose a mechanism that can link environmental conditions to population productivity and viability.

Bustnes, J.O., Tveraa, T., Henden, J.A., Varpe, O., Janssen, K., and Skaare, J.U. **Organochlorines in Antarctic and Arctic avian top predators: A comparison between the south polar skua and two species of northern hemisphere gulls.** *Environmental Science and Technology* 40(8): 2826-2831, 2006.

Notes: Different organochlorine compounds (M) were measured in the blood of breeding south polar skuas (*Catharacta maccormicki*) at Svarthamaren, Dronning Maud Land (Antarctica) and compared to those in two species of northern hemisphere gulls: the Arctic glaucous gull (*Larus hyperboreus*) and the subarctic great black-backed gull (*Larus marinus*). The skuas had 8% and 29% of the SOC levels (45 ng/g, wet weight) of glaucous gulls (591 ng/g) and great black-backed gulls (158 ng/g), respectively. Polychlorinated biphenyls (PCBs) and p,p'-dichlorodiphenyl-dichloroethylene (p,p'-DDE) were very low in skuas compared to northern gulls, but the mean hexachlorobenzene (HCB) level was 1.7 times higher than in great black-backed gulls and one-third of the glaucous gull level. Mirex levels in skuas were among the highest reported in birds, the mean level being 3 and 26 times higher than those in glaucous gull and great black-backed gulls, respectively. In skuas, the mean levels of HCB, oxychlorane, p,p'-DDE, and PCBs increased by about 30% during a 2-week period, and mirex increased by nearly 60%. In glaucous gulls, HCB, p,p'-DDE, and PCBs increased by 10-20%. For HCB, mirex, and oxychlorane, only a relatively small proportion of the increase in skuas could be explained by changes in lipid pools and the levels at first sampling, compared to glaucous gulls. Thus, skuas were probably accumulating these compounds when present in Antarctica. P,p'-DDE and PCB levels, in contrast, seemed much more stable in the skuas. Relatively high levels of mirex and HCB in south polar skuas are concerning with regard to potential adverse effects.

Both, C., Bouwhuis, S., Lessells, C.M., and Visser, M.E. **Climate change and population declines in a long-distance migratory bird.** *Nature* 441(7089): 81-83, 2006.

Notes: Phenological responses to climate change differ across trophic levels, which may lead to birds failing to breed at the time of maximal food abundance. Here we investigate the population consequences of such mistiming in the migratory pied flycatcher, *Ficedula hypoleuca*. In a comparison of nine Dutch populations, we find that populations have declined by about 90% over the past two decades in areas where the food for provisioning nestlings peaks early in the season and the birds are currently mistimed. In areas with a late food peak, early-breeding birds still breed at the right time, and there is, at most, a weak population decline. If food phenology advances further, we also predict population declines in areas with a late food peak, as in these areas adjustment to an advanced food peak is insufficient. Mistiming as a result of climate change is probably a widespread phenomenon, and here we provide evidence that it can lead to population declines.

Garcia-Borboroglu, P., Boersma, P.D., Ruoppolo, V., Reyes, L., Rebstock, G.A., Griot, K., Heredia, S.R., Adornes, A.C., and da Silva, R.P. **Chronic oil pollution harms Magellanic penguins in the Southwest Atlantic.** *Marine Pollution Bulletin* 52(2): 193-198, 2006.

Notes: Petroleum pollution is a problem for seabirds along the Southwest Atlantic coast. Twenty-five groups from Salvador, Brazil (12°58'S) to San Antonio Oeste, Argentina (40°43'S) survey or rehabilitate sick or oiled seabirds. Four groups, one each in Brazil and Uruguay, and two in Argentina, kept counts of birds found alive and in need of rehabilitation. An average of 63.7% of the seabirds found were Magellanic penguins (*Spheniscus magellanicus*), with 3869 reported since 1987. Mainly adult penguins were found in Argentina (1605 of 2102 penguins of known age class) and Uruguay (158 of 197). Juveniles were most common in Brazil (234 of 325). Oil fouling was the most frequent cause of injury or sickness. The number of oiled penguins reported in their wintering range has greatly increased since the early 1990s and is strongly correlated with petroleum exports from Argentina. Our results show that chronic petroleum pollution is a problem for wildlife from Southern Brazil through Northern Argentina, and regulations and enforcement are failing to protect living resources.

Arnold, J.M., Brault, S., and Croxall, J.P. **Albatross populations in peril: A population trajectory for black-browed albatrosses at South Georgia.** *Ecological Applications* 16(1): 419-432, 2006.

Notes: Simulation modeling was used to reconstruct Black-browed Albatross (*Diomedea melanophrys*) population trends. Close approximations to observed data were accomplished by annually varying survival rates, reproductive success, and probabilities of returning to breed given success in previous years. The temporal shift in annual values coincided with the start of longline fishing at South Georgia and potential changes in krill abundance. We used 23 years of demographic data from long-term studies of a breeding colony of this species at Bird Island, South Georgia, to validate our model. When we used annual parameter estimates for survival, reproductive success, and probabilities of returning to breed given success in previous years, our model trajectory closely followed the observed changes in breeding population size over time. Population growth rate was below replacement ($l < 1$) in most years and was most sensitive to changes in adult survival. This supports the recent IUCN uplisting of this species from "Vulnerable" to "Endangered." Comparison of pre-1988 and post-1988 demography (before and after the inception of a longline fishery in the breeding area) reveals a decrease in l from 0.963 to 0.910. A life table response experiment (LTRE) showed that this decline in l was caused mostly by declines in survival of adults. If 1988-1998 demographic rates are maintained, the model predicts a 98% chance of a population of fewer than 25 pairs within 78 years. For this population to recover to a status under which it could be "delisted," a 10% increase in survival of all age classes would be needed.

Terauds, A., Gales, R., Baker, G.B., and Alderman, R. **Foraging areas of black-browed and grey-headed albatrosses breeding on Macquarie Island in relation to marine protected areas.** *Aquatic Conservation: Marine and Freshwater Ecosystems* 16(2): 133-146, 2006.

Notes: 1. Although marine protected areas (MPAs) are often established to protect threatened top-order predators, there is a paucity of data that can be used to evaluate their efficacy in achieving this purpose. 2. We assessed the effectiveness of a network of MPAs around Macquarie Island in the Southern Ocean by examining the foraging areas of breeding black-browed *Thalassarche melanophrys* and grey-headed albatrosses *T. chrysostoma*. 3. During late incubation and brood periods over 90% of time spent foraging by black-browed albatrosses was contained within MPAs, principally the Economic Exclusion Zone (EEZ) around Macquarie Island. In contrast, grey-headed albatrosses spent only 34% of their time foraging in MPAs. 4. Black-browed and grey-headed albatrosses spent 30% and 15% of their respective foraging times in the Marine Park around Macquarie Island. 5. Both black-browed and grey-headed albatrosses foraged in Antarctic waters under the jurisdiction of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), accounting for 5% and 12% of the total foraging times respectively. 6. The spatial extent of MPAs around Macquarie Island appear to adequately cover much of the foraging distribution of breeding black-browed albatrosses from Macquarie Island. 7. Breeding grey-headed albatrosses spend significantly more time in waters outside the spatial extent of the surrounding MPAs and are at higher risk from fisheries activities and other threats. 8. Further information on the foraging movements both of albatrosses outside the breeding season and of juvenile albatrosses is required to more fully assess the efficacy of MPAs in protecting foraging habitats of these species.

Moller, A.P., Flensted-Jensen, E., and Mardal, W. **Rapidly advancing laying date in a seabird and the changing advantage of early reproduction.** *Journal of Animal Ecology* 75(3): 657-665, 2006.

Notes: Bird ringing schemes have collected immense amounts of data on timing of breeding for over 100 years. These data provide an unexploited source of information on temporal change in breeding date. We investigated changes in breeding date of the Arctic tern *Sterna paradisaea* Pont. in Denmark during 1929-98, using information on ringing date of young. Mean ringing date advanced by over 18 days during 70 years, while there was no temporal change in variance in date. Advanced mean ringing date was explained by an increase in mean temperature during April and May and an increase in North Atlantic Oscillation (NAO) index for May. Variance in ringing date increased in years with high temperatures in April and high NAO index values in April. There was changing temporal patterns of selection for early breeding as reflected by analyses of the difference in mean ringing date for Arctic tern young that were subsequently recorded as survivors and mean ringing date for all young. The intensity of selection on breeding date changed from favouring late breeding in the 1930s to favouring early breeding during the 1990s. Analyses of bird ringing information for millions of offspring of hundreds of bird species deposited in national ringing schemes may provide unlimited access to long-term time series of reproductive variables.

Boertmann, D., Mosbech, A., and Merkel, F.R. **The importance of Southwest Greenland for wintering seabirds.** *British Birds* 99(6): 282-298, 2006.

Notes: The coastal and offshore waters of Southwest Greenland are internationally important winter quarters for seabirds. Estimates of the total number of wintering seabirds are in the region of 3.5-5.5 million individuals (not including an unknown but probably extremely large number of Little Auks *Aile aile*). These seabirds originate mainly from Arctic Canada, Greenland and Svalbard, but also, to a lesser extent, from Alaska, Iceland, mainland Norway and Russia. The most numerous species are Common Eider *Somateria mollissima*, King Eider *S. spectabilis*, Brunnich's Guillemot *Uria lomvia* and Little Auk. Some key areas have been designated as Important Bird Areas (I BAs) by BirdLife International, and recent data indicate that more areas qualify as IBAs. The most immediate threat to the seabirds in Southwest Greenland is hunting, and current harvest levels of the Greenland breeding populations of Brunnich's Guillemot and Common Eider are considered unsustainable. Bird hunting is prohibited in spring and summer; however, there are no sanctuary areas in Southwest Greenland, and a degree of spatial regulation of winter hunting is urgently required.

Lescroel, A. and Bost, C.A. **Recent decrease in gentoo penguin populations at Iles Kerguelen.** *Antarctic Science* 18(2): 171-174, 2006.

Notes: Several sub-Antarctic penguin populations have exhibited decreasing trends in the last 5-20 years. At Iles Kerguelen, the gentoo penguin (*Pygoscelis papua*) has decreased by approximately 30% over the last 15 years. This decrease is likely to be related to reduced food availability for this coastal species. We discuss this decrease with regard to the impact of overfishing and to the potential effects of climate changes on marine food webs.

Votier, S.C., Crane, J.E., Bearhop, S., deLeon, A., McSorley, C.A., Minguuez, E., Mitchell, I.P., Parsons, M., Phillips, R.A., and Furness, R.W. **Nocturnal foraging by great skuas *Stercorarius skua*: implications for conservation of storm-petrel populations.** *Journal of Ornithology* 147(3): 405-413, 2006.

Notes: At St Kilda, Outer Hebrides, a large colony of great skuas *Stercorarius skua* feed extensively on one of the largest colonies of Leach's storm-petrels *Oceanodroma leucorhoa* in Europe, but little is known about the dynamics of this predator-prey system. Recently published population estimates of storm-petrels make it possible to estimate the impact of skua predation for the first time. Although skuas in the southern hemisphere catch petrels attending breeding colonies at night, it is not known whether congeners in the northern hemisphere also forage during the hours of darkness. We found (using radio-transmitters) that skuas regularly forage at night and (using light intensifying equipment) observed them catching storm-petrels at night. However, skuas also foraged during daylight hours, and it is unknown whether they might also catch storm-petrels at sea. Data

on diet composition reveals that the proportion of storm-petrels in skua diet declined between 1996 and 1997, but remained constant thereafter. Although a large proportion of the storm-petrel prey is likely to consist of non-breeders, numbers consumed suggest that breeders and an unknown quantity of transients may also been eaten. The numbers of storm-petrels eaten are not sustainable and may result in substantial long-term population declines. Under current conditions, maintenance of large populations of both Leach's storm-petrels and great skuas at St Kilda appears to be mutually exclusive.

Higdon, J.W. and Romberg, S. **Observations of juvenile ivory gulls (*Pagophila eburnea*) in Resolute Bay, Nunavut, Canada, August 2005.** *Polar Record* 42(221): 170-172, 2006.

Notes: Canadian ivory gull (*Pagophila eburnea*) populations have declined ca. 80% since the early 1980s, and observations, especially of juveniles, are noteworthy. From 20 to 26 August 2005 adult and juvenile ivory gulls were observed and photographed at Resolute Bay, Nunavut, Canada. The numbers of gulls observed reached a peak on 23 August when 18 birds (13 adults and 5 juveniles) were present. A minimum of 7 juveniles and 13 adults were present on 21 and 23 August, respectively, for a total minimum estimate of 20 ivory gulls. The highest numbers were observed during the stormiest days, suggesting that the gulls were taking shelter in the protected bay. Ivory gulls were observed in close proximity to other seabirds, and one fish capture attempt was observed. These are the first reported juveniles for Resolute Bay since 2000, and the first reported for the Canadian High Arctic since 2002, suggesting that breeding success in 2005 may have been better than in previous years.

Lafferty, K.D., Goodman, D., and Sandoval, C.P. **Restoration of breeding by snowy plovers following protection from disturbance.** *Biodiversity and Conservation* 15(7): 2217-2230, 2006.

Notes: Promoting recreation and preserving wildlife are often dual missions for land managers, yet recreation may impact wildlife. Because individual disturbances are seemingly inconsequential, it is difficult to convince the public that there is a conservation value to restricting recreation to reduce disturbance. We studied threatened western snowy plovers (*Charadrius alexandrinus nivosus*) at a public beach (Sands Beach, Coal Oil Point Reserve) in Santa Barbara, California (USA) before and during a period when a barrier directed foot traffic away from a section of upper beach where snowy plovers roost. The barrier reduced disturbance rates by more than half. Snowy plovers increased in abundance (throughout the season) and their distribution contracted to within the protected area. Snowy plovers that were outside the protected area in the morning moved inside as people began using the beach. Experiments with quail eggs indicated an 8% daily risk of nest trampling outside the protected area. Before protection, plovers did not breed at Coal Oil Point. During protection, snowy plovers bred in increasing numbers each year and had high success at fledging young. These results demonstrate how recreational disturbance can degrade habitat for shorebirds and that protecting quality habitat may have large benefits for wildlife and small impacts to recreation.

Żydelis, R., Lorentsen, S.-H., Fox, A.D., Kuresoo, A., Krasnov, Y., Goryaev, Y., Bustnes, J.-O., Hario, M., Nilsson, L., and Stipniece, A. **Recent changes in the status of Steller's Eider *Polysticta stelleri* wintering in Europe: a decline or redistribution?** *Bird Conservation International* 16(3): 217-236, 2006.

Notes: Steller's Eider *Polysticta stelleri* has a restricted arctic breeding range. The world population declined to c. 220,000 individuals in the late 1990s from an estimated 400,000-500,000 in the 1960s. The species has a limited global wintering distribution, occurring in marine habitats in north-east Europe, islands close to Kamchatka in Russia, and the eastern Aleutian Islands and south-west Alaska. European wintering numbers were estimated at 30,000-50,000 in the early 1990s, when the population was considered of favourable conservation status. Recent census data from the most important European wintering sites show annual declines of 8% in Norway since 1984, 9% in Estonia since 1994 and 22% in Lithuania since 1995, suggesting an overall 65% reduction in Europe. Counts in 1994 suggested that 30-50% of the European population wintered in Russia at that time. Current census data from Russia show similar declines along monitored sections of the Kola Peninsula wintering grounds since 1994. Accounting for trends in Russia, the current European wintering population could possibly stand at 10,000-15,000 individuals (a more than a 50% decline in 10 years), qualifying this population as Endangered under IUCN criteria. The changes in Baltic/Norwegian wintering numbers did not correlate with changes in the extent of ice-free marine waters in the Kola Peninsula/White Sea areas, but changes in annual numbers in Norway were correlated with winter

North Atlantic Oscillation indices. Variation in annual numbers in the Baltic Sea correlated with projected number of juveniles among wintering birds. However, none of the possible causes discussed in this paper could fully explain the decline in Steller's Eider, confirming the need for comprehensive monitoring of the population throughout its winter range and for cohesive demographic monitoring to target effective conservation action.

Gaston, A.J., Mallory, M.L., Gilchrist, H.G., and O'Donovan, K. **Status, trends and attendance patterns of the northern fulmar *Fulmarus glacialis* in Nunavut, Canada.** *Arctic* 59(2): 165-178, 2006.

Notes: Nunavut supports ten breeding colonies of northern fulmars (*Fulmarus glacialis*), most of which have rarely been visited on the ground by biologists. During 2000-04, we surveyed six colonies previously thought to support more than 80% of the Canadian Arctic population, which was believed to number about 300 000 breeding pairs. Our counts suggested that the breeding populations of some colonies, especially those at the largest colonies, Cape Searle and Prince Leopold Island, were substantially smaller than previously estimated. Our estimate for the total population of Nunavut was approximately 200 000 occupied sites. However, counts made at fixed monitoring plots at Prince Leopold Island and total colony estimates at Cape Vera, Devon Island, suggested no change in numbers at those colonies since the 1970s. Numbers present at the colony peaked in late June-early July and fell sharply after the end of July. Cyclical attendance, identified in an earlier study, was irregular in period length and was not seen in all years. We concluded that counts of Apparently Occupied Sites (AOS) conducted daily for 10-15 days are the best monitoring protocol for northern fulmars at these Arctic colonies. The great day-to-day variability in counts may have contributed to the large differences between past and recent population estimates.

Hilton, G.M., Thompson, D.R., Sagar, P.M., Cuthbert, R.J., Cherel, Y., and Bury, S.J. **A stable isotopic investigation into the causes of decline in a sub-Antarctic predator, the rockhopper penguin *Eudyptes chrysocome*.** *Global Change Biology* 12(4): 611-625, 2006.

Notes: The rockhopper penguin (*Eudyptes chrysocome*) is a conspicuous apex marine predator that has experienced marked population declines throughout most of its circumpolar breeding distribution. The cause(s) for the declines remain elusive, but the relatively large spatio-temporal scale over which population decreases have occurred implies that ecosystem-scale, at-sea factors are likely to be involved. We employ stable isotope analyses of carbon (C-13/C-12, expressed as $\delta^{13}C$) and nitrogen (N-15/N-14, $\delta^{15}N$) in time-series of rockhopper penguin feather samples, dating back to 1861, in order to reconstruct the species' ecological history. Specifically, we examine whether rockhopper penguin population decline has been associated with a shift towards lower primary productivity in the ecosystem in which they feed, or with a shift to a diet of lower trophic status and lower quality, and we use long-term temperature records to evaluate whether shifts in isotope ratios are associated with annual variations in sea surface temperature. Having controlled temporally for the Suess Effect and for increases in CO₂ concentrations in seawater, we found that overall, $\delta^{13}C$ signatures decreased significantly over time in rockhopper penguins from seven breeding sites, supporting the hypothesis that decreases in primary productivity, and hence, carrying capacity, for which $\delta^{13}C$ signature is a proxy, have been associated with the decline of penguin populations. There was some evidence of a long-term decline in $\delta^{15}N$ at some sites, and strong evidence that $\delta^{15}N$ signatures were negatively related to sea surface temperatures across sites, indicative of a shift in diet to prey of lower trophic status over time and in warm years. However, a site-by-site analysis revealed divergent isotopic trends among sites: five of seven sites exhibited significant temporal or temperature-related trends in isotope signatures. This study highlights the utility of stable isotope analyses when applied over relatively long timescales to apex predators.

Lehikoinen, A., Kilpi, M., and Ost, M. **Winter climate affects subsequent breeding success of common eiders.** *Global Change Biology* 12(7): 1355-1365, 2006.

Notes: The phenology of spring migration depends on the severity of the preceding winter and approaching spring. This severity can be quantified using the North Atlantic Oscillation (NAO) index; positive values indicate mild winters. Although milder winters are correlated with earlier migration in many birds in temperate regions, few studies have addressed how climate-induced variation in spring arrival relates to breeding success. In northern Europe, the NAO- index correlates with ice cover and timing of ice break-up of the Baltic Sea. Ice cover plays an important role for breeding waterfowl, since the timing

of ice break-up constrains both spring arrival and onset of breeding. We studied the effects of the winter-NAO-index and timing of ice break-up on spring migration, laying date, clutch size, female body condition at hatching and fledging success of a short-distance migrant common eider (*Somateria mollissima*) population from SW Finland, the Baltic Sea, 1991-2004 (migration data 1979-2004). We also examined the correlation between the NAO-index and the proportion of juvenile eiders in the Danish hunting bag, which reflects the breeding success on a larger spatial scale. The body condition of breeding females and proportion of juveniles in the hunting bag showed significant positive correlations with the NAO, whereas arrival dates showed positive correlations and clutch size and fledging success showed negative correlations with the timing of ice break-up. The results suggest that climate, which also affects ice conditions, has an important effect on the fledging success of eiders. Outbreaks of duckling disease epidemics may be the primary mechanism underlying this effect. Eider females are in poorer condition after severe winters and cannot allocate as much resources to breeding, which may impair the immune defense of ducklings. Global climate warming is expected to increase the future breeding success of eiders in our study population.

Barbraud, C. and Weimerskirch, H. **Antarctic birds breed later in response to climate change.** *Proceedings of the National Academy of Sciences [USA]* 103(16): 6248-6251, 2006.

Notes: In the northern hemisphere, there is compelling evidence for climate-related advances of spring events, but no such long-term biological time series exist for the southern hemisphere. We have studied a unique data set of dates of first arrival and laying of first eggs over a 55-year period for the entire community of Antarctic seabirds in East Antarctica. The records over this long period show a general unexpected tendency toward later arrival and laying, an inverse trend to those observed in the northern hemisphere. Overall, species now arrive at their colonies 9.1 days later, on average, and lay eggs an average of 2.1 days later than in the early 1950s. Furthermore, these delays are linked to a decrease in sea ice extent that has occurred in eastern Antarctica, which underlies the contrasted effects of global climate change on species in Antarctica.

Pimm, S., Raven, P., Peterson, A., Sekercioglu, C.H., and Ehrlich, P.R. **Human impacts on the rates of recent, present, and future bird extinctions.** *Proceedings of the National Academy of Sciences [USA]* 103(29): 10941-10946, 2006.

Notes: Unqualified, the statement that ~1.3% of the ~10,000 presently known bird species have become extinct since A.D. 1500 yields an estimate of ~26 extinctions per million species per year (or 26 E/MSY). This is higher than the benchmark rate of ~1 E/MSY before human impacts, but is a serious underestimate. First, Polynesian expansion across the Pacific also exterminated many species well before European explorations. Second, three factors increase the rate: (i) The number of known extinctions before 1800 is increasing as taxonomists describe new species from skeletal remains. (ii) One should calculate extinction rates over the years since taxonomists described the species. Most bird species were described only after 1850. (iii) Some species are probably extinct; there is reluctance to declare them so prematurely. Thus corrected, recent extinction rates are ~100 E/MSY. In the last decades, the rate is <50 E/MSY, but would be 150 E/MSY were it not for conservation efforts. Increasing numbers of extinctions are on continents, whereas previously most were on islands. We predict a 21st century rate of ~1,000 E/MSY. Extinction threatens 12% of bird species; another 12% have small geographical ranges and live where human actions rapidly destroy their habitats. If present forest losses continue, extinction rates will reach 1,500 E/MSY by the century's end. Invasive species, expanding human technologies, and global change will harm additional species. Birds are poor models for predicting extinction rates for other taxa. Human actions threaten higher fractions of other well known taxa than they do birds. Moreover, people take special efforts to protect birds.

Hedd, A., Bertram, D.F., Ryder, J.L., and Jones, I.L. **Effects of interdecadal climate variability on marine trophic interactions: rhinoceros auklets and their fish prey.** *Marine Ecology Progress Series* 309: 263-278, 2006.

Notes: This paper presents time-series information on the diet composition and breeding performance of rhinoceros auklet *Cerorhinca monocerata* at Triangle Island, British Columbia, Canada, during 15 breeding seasons between 1976 and 2001. Three shifts in ocean climate occurred within British Columbia during this period (1976-77, 1989-90, 1998-99), allowing us to evaluate associations between marine environmental conditions and the reproduction of this piscivorous seabird. Lipid-rich Pacific sand lance *Ammodytes hexapterus* was the single most important prey delivered to chicks across years (15 yr avg. 38 %; annual range 4 to 86 %). Interannual variability was high, but in general breeding performance was strongest when 0+ sand lance predominated chick diets. Other annually important prey taxa included Pacific saury *Cololabis saira*, juvenile rockfishes *Sebastes*

spp., Pacific herring *Clupea pallasii* and juvenile salmonid *Oncorhynchus* spp. The dietary importance of these prey also varied seasonally. Marine environmental conditions (evaluated using sea surface temperatures, SSTs) were clearly associated with reproduction of rhinoceros auklet, as both occurrence of sand lance in the diet and the growth rates of chicks diminished as spring SSTs increased ($r = -0.680$, $p < 0.01$, and $r = -0.697$, $p < 0.01$, respectively). We hypothesized that recruitment to local sand lance populations was temperature dependent. The strong negative relationship between dietary occurrence of 0+ sand lance and spring SST ($r = -0.560$, $p < 0.05$), coupled with the lack of a similar relationship for 1+ sand lance ($p > 0.20$), was consistent with the temperature-dependent recruitment hypothesis. Our data suggest that SSTs could interact with population age structure to affect the recruitment dynamics of Pacific sand lance. We estimated the annual dietary importance of 0+ sand lance to rhinoceros auklets using spring SST and the importance of 0+ sand lance in the diet the previous year.

Beukema, J.J. and Dekker, R. **Annual cockle *Cerastoderma edule* production in the Wadden Sea usually fails to sustain both wintering birds and a commercial fishery.** *Marine Ecology Progress Series* 309: 189-204, 2006.

Notes: Low cockle *Cerastoderma edule* stocks in the Dutch Wadden Sea over the last ~ 15 yr have caused ecological problems, including declines in numbers of some specialized bird species and a sharpening conflict between nature conservationists and fishermen. To study why cockle production and resulting biomass of adult cockles failed, we analyzed long-term (1973 to 2003) data on annual and cohort production of cockles in the Balgzand tidal flat area in the westernmost part of the Wadden Sea. Somatic production was estimated from summed growth increments per half-year period and expressed in ash-free dry weight (AFDW). In adults, positive values in April to August regularly alternated with negative values in September to March, when up to 60% of individual weight gains in the preceding season were lost. Life-time production averaged 0.06 g AFDW for ~ 3 mo old recruits and 0.21 g for ~ 10 mo old recruits. The numerical recruit density of a cohort as observed after their first winter predicted subsequent life-time cohort production within narrow limits. The 31 yr mean of net somatic production amounted to 7.3 g AFDW m⁻² yr⁻¹. The period of largest production during the lifetime of a cohort occurred during their second growing season (when cockles grow from spat to adult size). Years with high production values occurred 1 yr after a highly successful reproductive season, and high biomasses were achieved 1 to 3 yr after a highly successful season. In contrast, low values were observed when a successful recruitment had been > 3 yr in the past, and also after severe winters (causing high cockle mortality). Local variation in mean annual production was primarily related to local variation in recruitment success; however, production per recruit was significantly higher at low than at high intertidal levels. The main cause of low biomass values observed in recent years was failing recruitment in off-shore areas. As a consequence, in nearly all of the last 15 years, cockles have been too scarce in the western Wadden Sea to sustain both wintering birds and a commercial fishery.

Smart, J., Gill, J.A., Sutherland, W.J., and Watkinson, A.R. **Grassland-breeding waders: identifying key habitat requirements for management.** *Journal of Applied Ecology* 43(3): 454-463, 2006.

Notes: 1. Habitat loss and degradation of wetland ecosystems, principally through large-scale drainage and conversion to arable farmland, have been implicated in the widespread, dramatic declines of breeding waders across Europe. Managing the remaining wetlands to reverse these declines will require a detailed understanding of their habitat requirements. 2. In the UK, grazing marshes are key components of the remaining wetlands in both coastal and inland sites, and the structure of grazing marsh habitat can differ between these locations. Redshank *Tringa totanus* is a declining wader species that breeds in both marsh types. We quantified the habitat features that influence redshank selection of breeding and nest site locations, across coastal and inland marshes, in eastern England. 3. On both marsh types, breeding location and breeding densities within fields were positively related to the lengths of pool edge and all wet features, respectively. Nest site location was principally influenced by vegetation characteristics, with soil penetrability also important on inland sites but proximity to wet features and vegetation type at the nest important on coastal sites. Hatching probability was higher when the surrounding soils were more penetrable. 4. *Synthesis and applications.* The wet features of critical importance for breeding redshank are common on coastal marshes and can be deliberately established on inland sites. Coastal marshes are often rare and frequently threatened by dynamic coastal processes, whereas inland marshes are more abundant but largely unsuitable for breeding waders at present. These analyses highlight the scope for improving the management of inland marshes for breeding redshank. As habitat suitable for breeding redshank frequently supports a range of other wader species, this information can also direct management efforts to improve breeding wader populations in the wider countryside.

Burton, N.H.K., Rehfish, M.M., Clark, N.A., and Dodd, S.G. **Impacts of sudden winter habitat loss on the body condition and survival of redshank *Tringa totanus*.** *Journal of Applied Ecology* 43(3): 464-473, 2006.

Notes: 1. Recent theoretical modelling has provided important insights into how habitat loss may affect local populations through impacts on individual fitness (survival, body condition, fecundity). Despite this, attempts to provide empirical evidence of such impacts on displaced individuals have been limited. Using a before-after-control-impact (BACI) approach, we report how a sudden loss of wintering habitat impacted on the body condition and survival of redshank *Tringa totanus*. 2. The intertidal mudflats of Cardiff Bay, UK, were inundated with freshwater in November 1999 following impoundment by a barrage, resulting in the displacement of c. 300 redshank to adjacent habitat on the Severn Estuary. Movements and the survival of these birds were monitored through observations of colour-marked individuals. Comparative survival rates were calculated for marked populations at the main recipient site, Rhymney, and a control site. 3. Displaced redshank had difficulty maintaining their mass in the first winter post-barrage closure: adults previously only recorded at Cardiff Bay were significantly lighter than those previously recorded at Rhymney. 4. Survival rates of displaced redshank also declined. The estimated annual survival of adult Cardiff Bay redshank fell from 0.846 in the 2 years pre-barrage closure to 0.778 in the 3 following years because of a significant decline in winter survival ($P = 0.0006$). In comparison, there was no significant change in the survival of adult Rhymney redshank, and adult survival at the control site was actually greater post-barrage closure than beforehand. The lack of decline in these rates and the similarity between those of Cardiff Bay adults pre-barrage closure and Rhymney adults indicate that the increase in winter mortality of Cardiff Bay birds resulted from their displacement. 5. *Synthesis and applications.* This study provides the first conclusive empirical evidence that habitat loss can impact individual fitness in a bird population. Adult redshank displaced from Cardiff Bay experienced poor body condition and a 44% increase in mortality rate. Without an increase in the recruitment of first-winter birds, such a change is likely to reduce substantially local population size. The results reported here should help to inform governments, planners and non-governmental organizations (NGOs) seeking to understand how developments might impact on animal populations.

Brown, S.C., Schulte, S., Harrington, B., Winn, B., and Howe, M. **Population size and winter distribution of eastern American oystercatchers.** *Journal of Wildlife Management* 69(4): 1538-1545, 2005.

Notes: Conservation of the eastern subspecies of the American oystercatcher (*Haematopus palliatus palliatus*) is a high priority in the U.S. Shorebird Conservation Plan, but previous population estimates were unreliable, information on distribution and habitat associations during winter was incomplete, and methods for long-term monitoring had not been developed prior to this survey. We completed the aerial survey proposed in the U.S. Shorebird Conservation Plan to determine population size, winter distribution, and habitat associations. We conducted coastal aerial surveys from New Jersey to Texas during November 2002 to February 2003. This area comprised the entire wintering range of the eastern American oystercatcher within the United States. Surveys covered all suitable habitat in the United States for the subspecies, partitioned into 3 survey strata: known roost sites, high-use habitat, and intercoastal tidal habitat. We determined known roost sites from extensive consultation with biologists and local experts in each state. High-use habitat included sand islands, sand spits at inlets, shell rakes, and oyster reefs. Partner organizations conducted ground counts in most states. We used high resolution still photography to determine detection rates for estimates of the number of birds in particular flocks, and we used ground counts to determine detection rates of flocks. Using a combination of ground and aerial counts, we estimated the population of eastern American oystercatchers to be 10,971 +/- 298. Aerial surveys can serve an important management function for shorebirds and possibly other coastal waterbirds by providing population status and trend information across a wide geographic scale.

Peery, M.Z., Beissinger, S.R., Burkett, E., and Newman, S.H. **Local survival of marbled murrelets in Central California: Roles of oceanographic processes, sex, and radiotagging.** *Journal of Wildlife Management* 70(1): 78-88, 2006.

Notes: We estimated annual local survival rates for after-hatch-year (≥ 1 -yr old) marbled murrelets (*Brachyramphus marmoratus*) in central California using Cormack-Jolly-Seber mark-recapture models and radiotelemetry, and we modeled the effect of oceanographic conditions, sex, and radiotagging. We captured 331 after-hatch-year murrelets from 1997 to 2003, of which 117 were radiotagged. Recapture rates were best modeled using a term that reflected differences in capture effort among sampling occasions (P effort) and ranged from 0.068 to 0.166. The most highly ranked model (Φ PDO+radio, P effort) indicated that survival rates were positively related to the strength of the Pacific Decadal Oscillation (PDO) and were negatively affected by radiotransmitters in the year following tagging. Mortality was relatively low in warm-water years, perhaps because murrelets

flew inland to breed less frequently and were less exposed to avian predators. Two competing models indicated that survival in the year following tagging was affected by (1) only radiotagging (model $\Phi_{radio, P\ effort}$), and (2) radiotagging and sex (model $\Phi_{sex+radio, P\ effort}$). Model-averaged survival estimates were 0.868 (SE = 0.074) and 0.896 (SE = 0.067) for males and females, respectively, that were not radiotagged and 0.531 (SE = 0.175) and 0.572 (SE = 0.181) for males and females, respectively, that were radiotagged. Mortality of radiomarked individuals was greatest during a domoic acid (a neurotoxin in the marine environment) bloom in 1998 ($\Phi = 0.160-0.400$) and radiomarking impacts were much less pronounced during typical years ($\Phi = 0.724-0.810$). Additional causes of mortality included predation by peregrine falcons (*Falco peregrinus*) and oil spills. Survival for nonmarked individuals was similar or higher than what was estimated for murrelets in British Columbia and what was predicted for murrelets based on comparative analyses of other Alcid species, suggesting that mortality of after-hatch-year murrelets is not an immediate threat to population viability in the region.

Pearce, J.M., Talbot, S.L., Petersen, M.R., and Rearick, J.R. **Limited genetic differentiation among breeding, molting, and wintering groups of the threatened Steller's eider: the role of historic and contemporary factors.** *Conservation Genetics* 6(5): 743-757, 2005.

Notes: Due to declines in the Alaska breeding population, the Steller's eider (*Polysticta stelleri*) was listed as threatened in North America in 1997. Periodic non-breeding in Russia and Alaska has hampered field-based assessments of behavioral patterns critical to recovery plans, such as levels of breeding site fidelity and movements among three regional populations: Atlantic-Russia, Pacific-Russia and Alaska. Therefore, we analyzed samples from across the species range with seven nuclear microsatellite DNA loci and cytochrome b mitochondrial (mt)DNA sequence data to infer levels of interchange among sampling areas and patterns of site fidelity. Results demonstrated low levels of population differentiation within Atlantic and Pacific nesting areas, with higher levels observed between these regions, but only for mtDNA. Bayesian analysis of microsatellite data from wintering and molting birds showed no signs of sub-population structure, even though band-recovery data suggests multiple breeding areas are present. We observed higher estimates of F-statistics for female mtDNA data versus male data, suggesting female-biased natal site fidelity. Summary statistics for mtDNA were consistent with models of historic population expansion. Lack of spatial structure in Steller's eiders may result largely from insufficient time since historic population expansions for behaviors, such as natal site fidelity, to isolate breeding areas genetically. However, other behaviors such as the periodic non-breeding observed in Steller's eiders may also play a more contemporary role in genetic homogeneity, especially for microsatellite loci.

Boulet, M., Potvin, C., Shaffer, F., Breault, A., and Bernatchez, L. **Conservation genetics of the threatened horned grebe (*Podiceps auritus* L.) population of the Magdalen Islands, Quebec.** *Conservation Genetics* 6(4): 539-550, 2005.

Notes: The horned grebe (*Podiceps auritus*) population of the Magdalen Islands in the St. Lawrence Gulf (Quebec, Canada) has declined sharply over the last decades. It is the only breeding population of this species in eastern North America with nearest breeding populations being > 2500 km apart in western North America and Europe. We used three types of genetic markers: mitochondrial (mt) DNA ND2 sequence, alpha-enolase intron sequence, and 25 amplified fragment length polymorphism loci (AFLPs) to quantify the genetic diversity within the Magdalen Island population and to assess its genetic distinctiveness relative to populations from western Canada (five sites) and Iceland (one site). The Magdalen Island population retained a comparable amount of genetic diversity to the average diversity observed across all populations in all three markers. Horned grebe mtDNA sequences formed a monophyletic group and nearly all haplotypes present in Quebec were found elsewhere. In the ND2 fragment, populations partitioned into two groups corresponding to subspecies (Iceland versus North American sites) and more strongly in three groups according to geographic disjunctions (Iceland versus Quebec versus western Canada). In contrast, there was no evidence of structure between sites in the alpha-enolase intron. In the AFLPs, Iceland showed the greatest level of differentiation, followed by the Quebec and British Columbia populations. For conservation purposes, we suggest that the Magdalen Islands population should be recognized as a separate unit.

Yasue, M. **Environmental factors and spatial scale influence shorebirds' responses to human disturbance.** *Biological Conservation* 128(1): 47-54, 2006.

Notes: The extent of a shorebird's response to a human disturbance depends on the associated energetic or predation risk costs. These costs are influenced by a suite of environmental variables, operating at several temporal and spatial scales. Here, I measured prey availability, distance to forest cover, cloud cover, and wind speed, in addition to human and shorebird densities to examine how human presence affected habitat choice, relative to these environmental variables, at Pachena Beach, British Columbia. In a standardised experiment, I also approached feeding flocks to determine if environmental factors influenced the time taken for shorebirds to resume feeding. Binary logistic models suggested that people did not displace shorebirds. Instead, shorebirds were preferentially selecting areas further from forest cover that may have had lower predation risk. The time taken for shorebirds to resume feeding after a human disturbance was greater in the morning and in areas of low prey availability. This suggests that shorebirds respond more to a disturbance when the foraging cost is lower indicating that behavioural responses may not necessarily reflect the potential fitness costs of human disturbance.

Phillips, R.A., Silk, J.R.D., Croxall, J.P., and Afanasyev, V. **Year-round distribution of white-chinned petrels from South Georgia: Relationships with oceanography and fisheries.** *Biological Conservation* 129(3): 336-347, 2006.

Notes: The white-chinned petrel *Procellaria aequinoctialis* is a medium-sized procellariiform with a circumpolar subAntarctic breeding distribution. Feeding during both day and night, and often competing aggressively for bait, offal and discards, it has the highest incidental mortality rate of any seabird in Southern Ocean longline fisheries. Although still abundant, the limited census data suggest rapid population declines. Using geolocators, the movements of 10 white-chinned petrels from South Georgia were tracked for 226-664 days, which in combination with previous satellite-tracking provided the first comprehensive description of migration routes and year-round distribution of this species from any site. All birds migrated to Patagonian Shelf and shelf-break waters, concentrating in highly productive areas east of the River Plate estuary and to a lesser extent on the open shelf off central Argentina. Two birds traveled initially to the southern Patagonian Shelf but then moved in mid-winter to the Humboldt Current (Chile), before returning directly to South Georgia. One bird adopted this strategy in two winters, and was consistent in timing of return migration to South Georgia, but not of arrival off Chile. Despite the distance (> 2000 km), birds returned to feeding sites on the Patagonian Shelf for all pre-laying exodus, and most incubation, trips. In contrast, most chick-rearing trips were to the local shelf, central Scotia Sea or South Orkney Islands, on average only 610 km from the colony. The distribution of white-chinned petrels overlapped with several major fisheries, many of which are known or suspected to have high rates of seabird bycatch. Until this issue is addressed, the status of the white-chinned petrel population at South Georgia should be viewed with considerable concern.
