

# Marine Science Review – 184

## Marine and coastal birds



### In this review:

- A. Recent articles – no abstract available
- B. Recent articles with abstracts

### A. Recent articles – no abstract available

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Gandini, P. and Frere, E. **Spatial and temporal patterns in the bycatch of seabirds in the Argentinian longline fishery.** *Fishery Bulletin* 104(3): 482-485, 2006.

Petersen, S.L., Branch, G.M., Ainley, D.G., Boersma, P.D., Cooper, J., and Woehler, E.J. **Is flipper banding of penguins a problem?** *Marine Ornithology* 33(2): 75-79, 2005.

Pitman, R.L., Ballance, L.T., and Bost, C. **Clipperton Island: pig sty, rat hole and booby prize.** *Marine Ornithology* 33(2): 193-194, 2005.

### B. Recent articles with abstracts

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Shaffer, S.A., Tremblay, Y., Weimerskirch, H., Scott, D., Thompson, D.R., Sagar, P.M., Moller, H., Taylor, G.A., Foley, D.G., Block, B.A., and Costa, D.P. **Migratory shearwaters integrate oceanic resources across the Pacific Ocean in an endless summer.** *Proceedings of the National Academy of Sciences [USA]* 103(34): 12799-12802, 2006.

**Notes:** Electronic tracking tags have revolutionized our understanding of broad-scale movements and habitat use of highly mobile marine animals, but a large gap in our knowledge still remains for a wide range of small species. Here, we report the extraordinary transequatorial postbreeding migrations of a small seabird, the sooty shearwater, obtained with miniature archival tags that log data for estimating position, dive depth, and ambient temperature. Tracks ( $262 \pm 23$  days) reveal that shearwaters fly across the entire Pacific Ocean in a figure-eight pattern while traveling  $64,037 \pm 9,779$  km roundtrip, the longest animal migration ever recorded electronically. Each shearwater made a prolonged stopover in one of three discrete regions off Japan, Alaska, or California before returning to New Zealand through a relatively narrow corridor in the central Pacific Ocean. Transit rates as high as  $910 \pm 186$  km day<sup>-1</sup> were recorded, and shearwaters accessed prey resources in both the Northern and Southern Hemisphere's most productive waters from the surface to 68.2 m depth. Our results indicate that sooty shearwaters integrate oceanic resources throughout the Pacific Basin on a yearly scale. Sooty shearwater populations today are declining, and because they operate on a global scale, they may serve as an important indicator of climate change and ocean health.

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Blanc, R., Guillemain, M., Mouronval, J.B., Desmonts, D., and Fritz, H. **Effects of non-consumptive leisure disturbance to wildlife.** *Revue D'Ecologie - La Terre et La Vie* 61(2): 117-133, 2006.

**Notes:** Human leisure activities are becoming more and more various and widespread, which may increase their potential consequences for wildlife in terms of disturbance. This paper summarizes existing knowledge on the effect of non-consumptive (i.e. not hunting nor fishing) leisure activities on wildlife. The aim is not to provide an exhaustive literature review but through the selection of relevant literature to examine the various aspects of the subject. First, we present the different definitions of disturbance, list the types of activities most likely to affect wildlife, and the species or taxonomic

groups generally considered as being the most susceptible. Then, we summarize the various means of measuring the effects of disturbance, highlighting the fact that, though generally most obvious, changes in animal behaviour are not necessarily the most appropriate index of disturbance. Then we present the various scales at which disturbance has been studied, from individual behaviour to population dynamics. Finally, we suggest further research priorities, especially the recognized need for more experimental studies and studies of long-term effects of disturbance on individual fitness, hence population dynamics, since it is at this scale that appropriate management measures of disturbance have to be taken in the future.

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Flint, P.L., Grand, J.B., Fondell, T.F., and Morse, J.A. **Population dynamics of greater scaup breeding on the Yukon-Kuskokwim Delta, Alaska.** *Wildlife Monographs* (162): 1-22, 2006.

**Notes:** Populations of greater scaup (*Aythya marila*) remained relatively stable during a period when populations of lesser scaup (*A. affinis*) have declined from historic levels. To assist in describing these differences in population trends, from 1991 through 2000, we studied the survival, nesting ecology, and productivity of greater scaup on the Yukon-Kuskokwim Delta (Y-K Delta), Alaska, to develop a model of population dynamics. We located nests, radio-marked females for reneesting studies, estimated duckling survival, and leg-banded females to examine nest site fidelity and annual survival. Greater scaup initiated egg laying later than other species, and most clutches (> 80%) were initiated over 20 days each year. We located 1,056 nests; nest success ranged from 7 to 61% among years. Following loss of their first clutch, 51% of radio-tagged females attempted to reneest. Duckling survival to 30 days of age was 37.5%. Our best model suggested that annual survival did not vary among years and averaged 81%. Survival rate was positively related to structural body size. Only 8 of 214 banded individuals were reported as recovered (1 each in Maryland, Michigan, Minnesota, Washington, and Alaska and 3 in California). Using a stochastic model, we estimated that, on average, breeding females produced 0.57 young females/nesting season. We combined this estimate of productivity with our annual estimates of adult survival and an assumed population growth rate of 1.0, then solved for an estimate of first-year survival (0.40). Under these conditions the predicted stable age distribution of breeding females (i.e., the nesting population) was 15.1% 1-year-old, 4.1% 2-year-old first-time breeders, and 80.8% 2-year-old and older, experienced breeders. We subjected this stochastic model to perturbation analyses to examine the relative effects of demographic parameters on  $\lambda$ . The relative effects of productivity and adult survival on the population growth rate were 0.26 and 0.72, respectively. Thus, compared to productivity, proportionally equivalent changes in annual survival would have 2.8 times the effect on  $\lambda$ . However, when we examined annual variation in predicted population size using standardized regression coefficients, productivity explained twice as much variation as annual survival. Thus, management actions focused on changes in survival or productivity have the ability to influence population size; however, substantially larger changes in productivity are required to influence population trends.

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Thomas, G.H., Lanctot, R.B., and Szekely, T. **Can intrinsic factors explain population declines in North American breeding shorebirds? A comparative analysis.** *Animal Conservation* 9(3): 252-258, 2006.

**Notes:** Many shorebirds that breed in North America are declining. These trends reflect global patterns in shorebird populations. Here we ask what factors make some shorebird species more prone to decline than others. Specifically, we test the influence of migratory behaviour (route and distance), biogeography (population size and range), life history (body size, clutch size) and sexual selection (social mating system and testis size) on population trends in North American breeding shorebirds. Using phylogenetic comparative methods, we show that species that migrate across continental North America are more prone to decline than species that do not. Our finding that continental migrants are associated with population decline indicates that intrinsic factors may play an important role in predisposing a species to decline. Previous studies within the class Aves have failed to identify migration route as a correlate of decline or extinction risk. Two other intrinsic factors (oceanic migrants and threats on the non-breeding grounds) were also important in our overall models, although neither was significant alone. The moderate explanatory power of our variables indicates that other factors are also important for explaining shorebird declines. We suggest that contemporary threats, most notably habitat loss and degradation at migratory stopover sites, are likely to be important.

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Gonzalez-Zevallos, D. and Yorrio, P. **Seabird use of discards and incidental captures at the Argentine hake trawl fishery in the Golfo San Jorge, Argentina.** *Marine Ecology Progress Series* 316: 175-183, 2006.

**Notes:** We studied discard use and incidental mortality of seabirds attracted to high-sea trawl vessels operating in the Golfo San Jorge, Argentina, during the height of the fishing season in 2003 and 2004. Fourteen seabird species ate food made available by fishing operations. The most frequent and abundant seabirds (percent occurrence, mean number per haul) were the kelp gull *Larus dominicanus* (98.9%, 207.0), the black-browed albatross *Thalassarche melanophrys* (98.9%, 94.2) and the white-chinned petrel *Procellaria aequinoctialis* (91%, 8.4). Flock sizes for the 3 species varied from a few to a maximum of 1600 birds. Total seabird abundance varied significantly between stages of the fishing operation, being higher during discarding and haulback than during towing. Incidental capture of seabirds in nets was recorded in 37% of 89 hauls, with a mean capture rate of 1.2 birds per haul. Species incidentally caught were the great shearwater *Puffinus gravis*, the imperial cormorant *Phalacrocorax atriceps* and the Magellanic penguin *Spheniscus magellanicus*, with rates that varied between months and years. Considering the fishery's fishing effort, the estimated total numbers of birds killed during the study were 2254 great shearwaters (CV = 1.1), 1233 imperial cormorants (CV = 1.1) and 35 Magellanic penguins (CV = 2.4) in 2003, and 311 imperial cormorants (CV = 1.7) and 1516 Magellanic penguins (CV = 1.1) in 2004. Black-browed albatrosses and kelp gulls were also struck by the warp cable while feeding on discards from the surface, and drowned when they were dragged underwater. The results obtained in this study show that the hake trawl fishery operating in the Golfo San Jorge may have a significant effect on some seabird populations through the provision of fishing discards and incidental mortality.

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Miller, T.J. and Skalski, J.R. **Estimation of seabird bycatch for North Pacific longline vessels using design- and model-based methods.** *Canadian Journal of Fisheries and Aquatic Sciences* 63(8): 1878-1889, 2006.

**Notes:** Bycatch estimation for sensitive species is becoming increasingly important with the shift toward an ecosystem-based approach to fisheries management. Incidental mortalities for various seabird species occur on longline vessels throughout the world, including those in the North Pacific groundfish fleet. We present an approach to seabird bycatch estimation for North Pacific longline vessels using observer-collected data. Observers collect enormous amounts of data through a complex sampling design, but some information deficiencies preclude bycatch estimation using only probability sampling. Our approach combines probability sampling with model-dependent techniques to overcome these information deficiencies. The resulting bycatch estimator reflects the observer sampling design as closely as possible and minimizes reliance on untested model assumptions. We apply our estimator to black-footed albatross (*Phoebastria nigripes*) bycatch as an example and compare yearly estimates to those previously published. We also suggest changes in data collection that would further reduce dependence on model assumptions.

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Barrett, R.T., Chapdelaine, G., Anker-Nilssen, T., Mosbech, A., Montevecchi, W.A., Reid, J.B., and Veit, R.R. **Seabird numbers and prey consumption in the North Atlantic.** *ICES Journal of Marine Science* 63(6): 1145-1158, 2006.

**Notes:** We compared seasonal composition, abundance, and biomass of seabirds between the Northeast (ICES region) and Northwest (NAFO region) Atlantic fisheries regions to identify differences in community assemblage and prey consumption. Seabirds were more abundant in the Northwest Atlantic, but biomass was greater in the Northeast. This disparity resulted from enormous numbers of little auks *Alle alle* breeding in West Greenland and of Leach's storm-petrels *Oceanodroma leucorhoa* breeding in Newfoundland, plus large numbers of non-breeding shearwaters *Puffinus* spp. entering southern NAFO areas in summer. The Northeast Atlantic communities were dominated numerically by northern fulmars *Fulmarus glacialis*, large auks *Uria* spp., and the Atlantic puffin *Fratercula arctica*. Seabirds occupying the North Atlantic consume approximately  $11 \times 10^6$  t of food annually. Overall consumption rates peak during summer as a result of increased breeding activity and seasonal movements of birds into the North Atlantic. Because of the greater biomass of birds in the northeast, consumption (mainly by piscivores) in ICES areas was approximately 20% higher than that in NAFO areas, where planktivores dominate. NAFO areas had, however, a much greater consumption rate per unit area than ICES areas. Comparative studies such as these could prove informative in assessing large predator responses to the influence of fishing and ocean-scale climate change.

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Mallory, M.L. **The Northern Fulmar (*Fulmarus glacialis*) in Arctic Canada: ecology, threats, and what it tells us about marine environmental conditions.** *Environmental Reviews* 14(3): 187-216, 2006.

**Notes:** The northern fulmar *Fulmarus glacialis* is a ubiquitous seabird found across the North Atlantic Ocean and into the Canadian Arctic. However, we know little of its ecology in the Arctic, which is unfortunate, because it possesses many traits

that make it an excellent biomonitor of the condition of Arctic marine environments. Presently, Arctic fulmars face threats from harvest, bycatch in fisheries, and fouling in oil spills while the birds are in their winter range (the North Atlantic). However, during breeding, migration, and overwintering, they may also experience stress from ecotourism, contaminants, particulate garbage, and climate change. In this paper I review the effects of all of these threats on fulmars and I describe how the ecology of these birds makes them particularly suitable for tracking contaminants, garbage, and the effects of climate change in the Arctic marine ecosystem. I also highlight our key existing knowledge gaps on this species and how additional research will strengthen the utility of fulmars as biomonitors.

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Goudie, R.I. **Multivariate behavioural response of harlequin ducks to aircraft disturbance in Labrador.** *Environmental Conservation* 33(1): 28-35, 2006.

**Notes:** The effects of low-level aircraft over-flights on behaviour of harlequin ducks (*Histrionicus bistrionicus*) breeding in central Labrador were quantified during 2000-2002. The Canadian Department of National Defence supports a low-level training programme in the 130 000 km<sup>2</sup> Military Training Area of Labrador involving military jets. The Institute for Environmental Monitoring and Research (IEMR) undertakes scientific research into environmental impacts of low-level military jet over-flights. A suite of 17 behavioural categories of paired male and female harlequin ducks was modelled, and a canonical variable representing alert behaviour, inactivity on the water and decreased inactivity out of water in response to over-flights represented 73.1% of the variance in the data cluster and provided marked separation of disturbed and undisturbed groups. Behavioural responses of harlequin ducks to military jets were 23 times stronger than their responses to floatplanes, helicopters and military cargo planes, and the significant interaction of aircraft type and noise indicated that noise may be the primary stressor affecting behaviour. A quadratic response of the canonical variable to noise generated from aircraft during standardized 30-minute observation periods was defined. The multivariate analyses were more robust because they indicated covariance in behavioural categories associated with disturbance that was not originally detected in univariate analyses, suggesting the importance of integrating behaviours other than overt responses. The significant effects of military jet over-flights on harlequin duck behaviour emphasize the need to evaluate potential population consequences of aircraft disturbance.

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Major, H.L., Jones, I.L., Byrd, G.V., and Williams, J.C. **Assessing the effects of introduced Norway rats (*Rattus norvegicus*) on survival and productivity of least auklets (*Aethia pusilla*).** *Auk* 123(3): 681-694, 2006.

**Notes:** We assessed potential effects of introduced Norway rats (*Rattus norvegicus*) on Least Auklets (*Aethia pusilla*) breeding at Sirius Point on Kiska Island, the largest auklet colony in the Aleutian Islands, Alaska. We compared productivity, chick growth, and adult survival of Least Auklets during 2001-2003 at Kiska and two nearby, rat-free Least Auklet colonies on Buldir and Kasatochi islands. During 2001 and 2002 (when rats were abundant), productivity at Kiska was the lowest ever recorded for this species (0.09-0.16 chicks fledged per eggs laid), primarily because of high mortality of newly hatched chicks. Growth rates and mean fledging mass were both lower on Kiska than on rat-free islands, though there were some interannual differences in these patterns. Adult survival rates were highly variable among years but strongly concordant among colonies, and survival from 2001 to 2002 on Kiska (0.881 +/- 0.033) did not differ significantly from long-term averages on either Buldir (0.853 +/- 0.014, 1990-2003) or Kasatochi (0.893 +/- 0.027, 1996-2003) islands. Although we found little evidence at nesting crevices of predation on adults, eggs, or chicks, low productivity and slow chick growth were both consistent with disturbance caused by rats, particularly through disruption of adults attempting to brood or provision young chicks. Breeding failure may have been exacerbated by low prey availability for chick provisioning, but the lack of concordance in either productivity or chick growth rates between Kiska Island and nearby rat-free Buldir Island cast doubt on this possibility.

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Dugger, K.M., Ballard, G., Ainley, D.G., and Barton, K.J. **Effects of flipper bands on foraging behavior and survival of Adelle Penguins (*Pygoscelis adeliae*).** *Auk* 123(3): 858-869, 2006.

**Notes:** Since the 1950s, flipper bands have been used widely to mark penguins (Spheniscidae), but not without concerns regarding possible negative effects on survival and fitness. As part of a demographic study of Adelle Penguins (*Pygoscelis adeliae*) in the western Ross Sea, Antarctica, we investigated effects of flipper bands on foraging-trip duration and food loads, as well as apparent survival, during four breeding seasons (2000-2003), using mark-recapture and radio-frequency identification (RFID) technology. Foraging-trip durations were similar to 8% (3.5 h) longer, on average, for banded compared with

unbanded birds, but the effect varied among years. Food loads did not differ between banded and unbanded birds, but males carried heavier food loads than females. Flipper bands decreased apparent annual survival by 11-13% during 2000-2003, but over a longer time period (1996-2003) we observed high annual variability, including years of high survival for banded birds. Males had slightly higher survival than females in both banded and unbanded birds. Mechanisms resulting in band effects on foraging behavior and survival, the variable effect of bands by season, and the potential ameliorating effect of age or experience on the effects of bands need further investigation in Adelie and other penguin species. We recognize a need to understand and balance the negative consequences of flipper bands for penguins against the beneficial gains in information associated with their use.

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Suryan, R.M., Sato, F., Balogh, G.R., Hyrenbach, K.D., Sievert, P.R., and Ozaki, K. **Foraging destinations and marine habitat use of short-tailed albatrosses: A multi-scale approach using first-passage time analysis.** *Deep Sea Research Part II, Topical Studies in Oceanography* 53(3-4): 370-386, 2006.

**Notes:** We used satellite telemetry, remotely sensed data (bathymetry, chlorophyll *a* (chl *a*), sea-surface temperature (SST), wind speed) and first-passage time (FPT) analysis to determine the distribution, movement patterns, and habitat associations of short-tailed albatrosses (*Phoebastria albatrus*) during the non-breeding season, 2002 and 2003. Satellite transmitters were deployed on birds immediately prior to their departure from a breeding colony at Torishima, Japan (n = 11), or at-sea in the Aleutian Islands (n = 3). Tracking durations ranged from 51 to 138 days for a total of 6709 locations after filtering (131 - 808 per bird). FPT (time required to transit a circle of given radius) revealed the location and spatial scale of area-restricted search (ARS) patterns along flight paths. On average, ARS occurred within 70 km radii. Consequently, the fit of the habitat use models increased at spatial scales beyond a 40 km FPT radius ( $R^2 = 0.31$ ) and stabilized for scales of 70 km and larger ( $R^2 = 0.40-0.51$ ). At all scales, wind speed, depth or depth gradient, and chl *a* or chl *a* gradient had a significant effect on FPT (i.e., residence time). FPT increased within regions of higher gradients of depth and chl *a*. In contrast, FPT decreased within regions of greater depth and wind speed, with a significant interaction of wind speed and depth at some scales. Sea-surface temperature or its interactions were only significant at large spatial scales ( $\geq 160$  km FPT radius). Albatrosses engaged in ARS activities primarily over the shelf break and slope, including Kuroshio and Oyashio regions off the western subarctic gyre. Occasionally, birds transited the northern boundary of the Kuroshio Extension while in-route to the Aleutian Islands and Bering Sea, but overall spent little time in the western gyre. In the Aleutian Islands, ARS occurred within straits, particularly along the central and western part of the archipelago. In the Bering Sea, ARS occurred along the northern continental shelf break, the Kamchatka Current region, and east of the Commander Islands. Non-breeding short-tailed albatross concentrate foraging in oceanic areas characterized by gradients in topography and water column productivity. This study provides an understanding of the foraging ecology for a highly migratory, imperiled seabird, and confirms the importance of shelf break and slope regions as hot spots for a variety of top marine predators in the North Pacific.

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Piatt, J.F., Wetzel, J., Bell, K., DeGange, A.R., Balogh, G.R., Drew, G.S., Geernaert, T., Ladd, C., and Byrd, G.V. **Predictable hotspots and foraging habitat of the endangered short-tailed albatross (*Phoebastria albatrus*) in the North Pacific: Implications for conservation.** *Deep Sea Research Part II, Topical Studies in Oceanography* 53(3-4): 387-398, 2006.

**Notes:** The short-tailed albatross (*Phoebastria albatrus*) is a rare and endangered seabird that ranges widely over the northern North Pacific. Populations are slowly recovering but birds face several threats at sea, in particular the incidental capture of birds in long-line fisheries. Conservation efforts are hampered by a lack of information about the at-sea distribution of this species, especially knowledge of where it may predictably co-occur with long-line fishing effort. During 18 years of transiting the Aleutian Islands Unit of the Alaska Maritime National Wildlife Refuge on a research vessel, we observed short-tailed albatross on 65 occasions. They were consistently observed near Ingenstrem Rocks (Buldir Pass) in the western Aleutians and near Seguam Pass in the central Aleutians. Based on the oceanographic characteristics of the locations where we saw most of the birds, we hypothesized that short-tailed albatross "hotspots" were located where tidal currents and steep bottom topography generate strong vertical mixing along the Aleutian Archipelago. As a test of this hypothesis, we analyzed a database containing 1432 opportunistic observations of 2463 short-tailed albatross at sea in the North Pacific. These data showed that short-tailed albatross were closely associated with shelf-edge habitats throughout the northern Gulf of Alaska and Bering Sea. In addition to Ingenstrem Rocks and Seguam Pass, important hotspots for short-tailed albatross in the Aleutians included Near Strait, Samalga Pass, and the shelf-edge south of Umnak/Unalaska islands. In the Bering Sea, hotspots were located along margins of Zhemchug, St. Matthews and Pervenets canyons. Because these short-tailed albatross hotspots are predictable, they are also protectable by regulation of threatening activities at local spatial scales.

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Yen, P.P.W., Sydeman, W.J., Bograd, S.J., and Hyrenbach, K.D. **Spring-time distributions of migratory marine birds in the southern California Current: Oceanic eddy associations and coastal habitat hotspots over 17 years.** *Deep Sea Research Part II, Topical Studies in Oceanography* 53(3-4): 399-418, 2006.

**Notes:** We used a 17-year time series of shipboard observations to address the hypothesis that marine birds associate with persistent hydrographic features in the southern California Current System (CCS). Overall, approximately 27,000 km of ocean habitat were surveyed, averaging 1600 km per cruise. We identified mesoscale features (eddy centers and the core of the California Current), based on dynamic height anomalies, and considered habitat associations for seven migratory seabird species: black-footed albatross (*Phoebastria nigripes*), Cook's petrel (*Pterodroma cookii*), Leach's storm-petrel (*Oceanodroma leucorhoa*), dark shearwaters (mainly sooty shearwater *Puffinus griseus*, with a few short-tailed shearwaters *Puffinus tenuirostris*), northern fulmar (*Fulmarus glacialis*), red phalarope (*Phalaropus fulicaria*), and red-necked phalarope (*Phalaropus lobatus*). We explored associations (presence/absence and density relationships) of marine birds with mesoscale features (eddies, current jet) and metrics of primary productivity (chlorophyll *a* and nitrate concentrations). Mesoscale eddies were consistently identified in the study region, but were spatially and temporally variable. The resolved eddies were large-scale features associated with meanders of the equatorward-flowing California Current. Cook's petrel was found offshore with no specific habitat affinities. Black-footed albatross, red phalarope, and Leach's storm petrel were found in association with offshore eddies and/or the core of the California Current, but the functional relationship for these species varied, possibly reflecting differences in flight capabilities. The more coastal species, including the shearwaters, fulmar, and red-necked phalarope, were positively associated with proxies of primary productivity. Of the hydrographic habitats considered, the upwelling region of Point Conception appears to be an important "hotspot" of sustained primary production and marine bird concentrations. Point Conception and other similar coastal locations (upwelling cells) may warrant protection as key foraging grounds for seabirds.

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Carter, H.R., Sealy, S.G., Burkett, E.E., and Piatt, J.F. **Biology and conservation of Xantus's Murrelet: discovery, taxonomy, and distribution.** *Marine Ornithology* 33(2): 81-87, 2005.

**Notes:** The biology of Xantus's Murrelets *Synthliboramphus hypoleucus* is similar in many respects to better-studied Ancient Murrelets *S. antiquus*, especially regarding morphology and the species' precocial mode of post-hatching development. It nests mainly in rock crevices but also under shrubs on islands in southern California, United States, and northwestern Baja California, Mexico (27°N to 34°N). The species was discovered in 1859 by János Xántus. Two subspecies (*S. b. hypoleucus* and *S. b. scrippsii*) are recognized that show limited evidence of interbreeding. At sea, closely related Craveri's Murrelets *S. craveri* co-occur with Xantus's Murrelets off California and western Baja California during half the year, but the former species has a discrete breeding range in the Gulf of California, Mexico. Breeding was documented at 13 island groups between 1863 and 1976. Post-breeding dispersal as far north as central British Columbia, Canada (c. 52°N) was observed in the 1940s to 1960s. A few Xantus's Murrelets disperse south of breeding colonies to Magdalena Bay, Baja California (c. 24°N). The southernmost record is the type specimen collected by Xántus near Cabo San Lucas, Baja California (c. 23°N). Chief threats to this species include introduced mammalian predators on breeding islands, heightened predation by natural predators in human-modified island habitats, and oil pollution. In January 2005, a Pacific Seabird Group special symposium, "Biology and conservation of the Xantus's Murrelet," highlighted conservation concerns and promoted publication of recent studies of this little-known alcid, with nine symposium papers published in this issue of *Marine Ornithology*. Much of what we know about Xantus's Murrelets has been learned in recent years, and many aspects of biology remain to be described.

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Karnovsky, N.J., Spear, L.B., Carter, H.R., Ainley, D.G., Amey, K.D., Ballance, L.T., Briggs, K.T., Ford, R.G., Hunt, G.L., Keiper, C., Mason, J.W., Morgan, K.H., Pitman, R.L., and Tynan, C.T. **At-sea distribution, abundance and habitat affinities of Xantus's Murrelets.** *Marine Ornithology* 33(2): 89-104, 2005.

**Notes:** We used shipboard and aerial surveys at sea to study distribution, abundance and habitat affinities of Xantus's Murrelets *Synthliboramphus hypoleucus* within their range, including waters from British Columbia to southern Baja California, and to 500 km offshore. We recorded 1628 murrelets during strip-transects conducted in most years from 1975 to 2003. Densities were highest over the continental slope (depths 200-1000 m) at distances 25-150 km offshore. Murrelets were most numerous in warmer waters of lower salinity, a pattern consistent each year regardless of El Niño-Southern Oscillation or

Pacific Decadal Oscillation anomaly fluctuations. During the breeding season, murrelets concentrated in the Southern California Bight (SCB), with lower densities off Baja California and from Point Conception to Bodega Bay, California. During the nonbreeding period, they dispersed north as far as northern Vancouver Island, British Columbia, although densities were highest from central Baja California to central Oregon. We used generalized additive models to estimate the abundance of this species at sea. We observed no trends in abundances across years, 1975-2001 (SCB), and 1985-2003 (central California). After adjustment for biases in survey data, our estimate for the total number of Xantus's Murrelets in North America during the nonbreeding season (1975-2003) is 39 700 birds, consisting of an estimated 17 900 breeding birds (95% confidence interval = 13 900 to 21 000) and 21 800 subadults/nonbreeders.

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Keitt, B.S. **Status of Xantus's Murrelet and its nesting habitat in Baja California, Mexico.** *Marine Ornithology* 33(2): 105-114, 2005.

**Notes:** A preliminary survey was conducted in 1999 to establish the status of the Xantus's Murrelet *Synthliboramphus hypoleucus* in Baja California, Mexico. Seven island groups with prior evidence of breeding (Coronado, Todos Santos, San Martín, San Jerónimo, San Benito, Asunción and San Roque) and two potential breeding islands without prior evidence of nesting (Natividad and Adelaida) were examined. In 2004, additional work was conducted at Afuera Islet off Guadalupe Island. Presence of murrelets was detected through nest searches and by rough estimation of birds in nocturnal at-sea congregations using boat-based and land-based vocalization counts. Vocalizations were heard at six island groups (Coronado, Todos Santos, San Martín, San Jerónimo, San Benito and Guadalupe) and nests were found at four island groups (Coronado, San Jerónimo, San Benito and Guadalupe). Land-based and boat-based vocalization surveys both detected presence or apparent absence of murrelets at potential nesting islands, although boat-based vocalization rates were higher on average. Vocalization surveys cannot readily be converted to breeding population estimates, but overall population size of murrelets in Baja California appears to about 2300 pairs (range: 1000-4000 pairs), similar to previous estimates. Historically, nonindigenous mammals were introduced to most islands in Baja California; recent progress in removing introduced mammals should benefit Xantus's Murrelets.

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Whitworth, D.L., Carter, H.R., Young, R.J., Koepke, J.S., Gress, F., and Fangman, S. **Initial recovery of Xantus's Murrelets following rat eradication on Anacapa Island, California.** *Marine Ornithology* 33(2): 131-137, 2005.

**Notes:** At Anacapa Island, California, breeding effort, hatching success and nesting distribution of Xantus's Murrelets *Synthliboramphus hypoleucus* increased in the years following the eradication of Black Rats *Rattus rattus* (2003-2005) as compared with pre-eradication years (2000-2002). Within sea-cave study areas, nest-site occupancy increased from 36% to 51%, nesting attempts increased 42%, hatching success increased from 42% to 80% and nest depredation decreased from 52% (by rats) to 7% (by endemic Deer Mice *Peromyscus maniculatus anacapa*). Post-eradication, murrelets and Cassin's Auklets *Ptychoramphus aleuticus* began nesting in habitats previously occupied by rats, including Cat Rock, where murrelet breeding was last reported in 1927. Initial post-eradication signs of recovery of Xantus's Murrelets at Anacapa Island are encouraging for eventual restoration of this important colony, but additional monitoring is needed to better document the rate and process of recovery.

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Pierre, J.P. and Norden, W.S. **Reducing seabird bycatch in longline fisheries using a natural olfactory deterrent.** *Biological Conservation* 130(3): 406-415, 2006.

**Notes:** Longline fisheries throughout the world have frequent and often fatal interactions with seabirds. We experimentally tested one possible solution to seabird-fisheries interactions that was proposed by a New Zealand longline fisherman. This involved dripping school shark *Galeorhinus galeus* liver oil on the ocean surface behind fishing vessels. We tested the efficacy of shark liver oil in reducing the numbers of seabirds attending fishing vessels and the number of dives seabirds executed in pursuit of pilchard *Sardinops neopilchardus* baits. We conducted trials in northern New Zealand where seabird assemblages include the globally vulnerable black petrel *Procellaria parkinsoni*. Shark liver oil was effective in reducing both seabird numbers and dives on baits, compared to canola oil and seawater control treatments. Comparisons of seabird responses to shark liver oil and vegetable oil suggest that shark liver oil acts as an olfactory or chemesthetic deterrent for seabirds. Further work should include testing the oil with additional seabird species and investigating active ingredients and habituation of seabirds to the oil in order to assess wider opportunities for long-term use of shark liver oil to reduce seabird bycatch.

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Sanderson, F.J., Donald, P.F., Pain, D.J., Burfield, I.J., and van Bommel, F.P.J. **Long-term population declines in Afro-Paleartic migrant birds.** *Biological Conservation* 131(1): 93-105, 2006.

**Notes:** We present the first continent-wide analysis of the population trends of European breeding birds to show that populations of Afro-Paleartic migrant birds have shown a pattern of sustained, often severe, decline. The mean trend of inter-continental migrants was significantly negative between 1970 and 1990 and non-significantly so between 1990 and 2000. Mean population trends were positively correlated between periods, suggesting little change in the trajectory of most migrant species' populations over this 30-year period. In both periods, trends of inter-continental migrants were significantly more negative than those of short-distance migrants or residents. This negative trend appeared to be largely, although not entirely, due to declines in species wintering in dry, open habitats in Africa. Analyses of trends of 30 closely related pairs of species, one a long-distance migrant and the other not, indicated significantly more negative trends in the former, irrespective of breeding habitat. Conservation action to address these declines is required under the Convention on Migratory Species and the Pan-European Biological and Landscape Diversity Strategy, to which most European countries are signatories and which aim, respectively, to conserve migratory species and to halt the loss of biodiversity by 2010. Our results indicate that more conservation action may be required outside Europe to achieve these targets. Further research is needed to assess whether the declines are caused by factors operating on the birds' wintering grounds, breeding grounds or on migration routes, and to identify ways to reverse them.

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Dias, M.P., Granadeiro, J.P., Lecoq, M., Santos, C.D., and Palmeirim, J.M. **Distance to high-tide roosts constrains the use of foraging areas by dunlins: Implications for the management of estuarine wetlands.** *Biological Conservation* 131(3): 446-452, 2006.

**Notes:** Shorebirds are declining all around the world, mostly due to deterioration of the estuarine habitats used in winter and migration. Estuaries cover small areas, so it is essential to guarantee that shorebirds can access all the tidal flats where they usually feed at low-tide. Studying use of space by dunlins (*Calidris alpina*) in the Tagus estuary (Portugal), we noted that lack of suitably located high-tide roosts can limit the access of shorebirds to feeding habitats. Density of dunlins on foraging areas declined significantly with distance to the nearest roost, and fewer than 20% individuals foraged more than 5 km from two roosts where they were dye-marked. So to permit full access to feeding areas it is important to maintain a network of suitably located high-tide roosts. We developed a GIS modelling methodology to evaluate the adequacy of existing roost networks, and to estimate the consequences of losing or creating new roosts. The methodology requires maps with the location of roosts and foraging habitats, and knowledge of the distances that birds are willing to fly to reach foraging areas. It quantifies the proportion of foraging areas close to the existing roosts and the average distance that birds have to fly to reach potential feeding sites. Applying this methodology to the Tagus estuary we concluded that lack of roosts probably explains why the intertidal flats in the north-west of the estuary are underused by shorebirds. A modelling exercise suggested that this gap could be eliminated by creating a roost in an old drained wetland area. We also modelled the impact of the loss of two roosts that are currently threatened. Without them almost half of the available feeding areas will be too far from roosts to be efficiently used by dunlins, and possibly by other shorebirds.

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Durell, S.E.A.L., Stillman, R.A., Caldow, R.W.G., McGrorty, S., West, A.D., and Humphreys, J. **Modelling the effect of environmental change on shorebirds: A case study on Poole Harbour, UK.** *Biological Conservation* 131(3): 459-473, 2006.

**Notes:** An individuals-based model, MORPH, was used to assess the quality of Poole Harbour, UK, for five overwintering shorebirds: dunlin *Calidris alpina*, redshank *Tringa totanus*, black-tailed godwit *Limosa limosa*, oystercatcher *Haematopus ostralegus* and curlew *Numenius arquata*. Site quality, and the effect of environmental change, was measured as predicted overwinter survival. Dunlin had the highest prey biomass densities and were the least likely to be affected by reductions in their food supply, lower temperatures or loss of terrestrial habitats. Black-tailed godwits and curlew had the lowest prey biomass densities and were the most likely to be affected by reductions in their food supply, lower temperatures and loss of terrestrial habitats. All five shorebird species were seriously affected by simulated sea-level rise. Conservation issues identified for the Poole Harbour SPA were the relatively low densities of larger size classes of polychaete worms, the importance of maintaining and

managing surrounding terrestrial habitats and the effect of sea-level rise on the length of time for which intertidal food supplies are available.

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Sullivan, B.J., Reid, T.A., and Bugoni, L. **Seabird mortality on factory trawlers in the Falkland Islands and beyond.** *Biological Conservation* 131(4): 495-504, 2006.

**Notes:** Specifically tasked seabird observers were placed onboard demersal (bottom) finfish trawlers operating in the Falkland Islands in 2002/2003 to investigate the level of seabird mortality caused by the fleet. The observers were tasked to record seabird interactions during shooting, trawling and hauling operations during 157 days of coverage. It is estimated that > 1500 seabirds, predominantly Black-browed albatross (*Thalassarche melanophrys*), were killed by finfish trawlers during this period. Significant levels of mortality were also recorded on the Patagonian Shelf, north of the islands. Birds were killed after being dragged underwater by the warp cable while feeding on factory discharge at the stern of the vessel. An unknown proportion of these birds slide down the cable and become impaled on a splice in the cable, which was situated on average at 90 +/- 40 m from the waters surface, and are subsequently hauled onboard. The incidence of mortality caused by the many large trawling fleets around the world that discharge factory waste and attract large bodied seabirds (e.g. albatross and large petrels) requires immediate investigation.

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Ryan, P.G., Dorse, C., and Hilton, G.M. **The conservation status of the spectacled petrel *Procellaria conspicillata*.** *Biological Conservation* 131(4): 575-583, 2006.

**Notes:** The spectacled petrel *Procellaria conspicillata* is listed as critically endangered due to its small population size and ongoing mortality on long-lines. Spectacled petrels were counted in 2004, repeating a census made in 1999 at their sole breeding locality, Inaccessible Island. The 2004 survey took place earlier in the breeding season than the previous count, allowing for more robust estimates of burrow occupancy. During early incubation, birds responded to call playback at 69% of burrow entrances, but birds in at least 8% of burrows remained silent. Birds in shallow burrows were less likely to respond to playback than were those in deep burrows. Two repeat trials at 100 marked nests showed that at least 61% of apparently 'unoccupied' burrows were occupied on subsequent checks, resulting in an overall occupancy estimate of 91%. Occupancy was equally high in peripheral colonies. The apparent spatial extent of colonies increased slightly from 1999, and the estimate of total burrow numbers increased by 50%, from 5900 burrows in 1999 to 8900 in 2004. Validation surveys indicated that burrow numbers were underestimated (84 +/- 3%) to the same extent as that in 1999 (85 +/- 4%), and repeat checks of one colony where all nests were marked showed that even careful counts underestimated actual numbers of burrows by up to 10%. This suggests there are some 11-12,000 burrows, and assuming 90% occupancy, the adult population is likely to be at least 20,000 birds. The population has increased over the last five years, continuing the apparent recovery from a very small population size in the early 20th century. Despite this increase, demographic models indicate that the population remains at risk from relatively small increases in mortality, if mortality is determined primarily by fishing effort. Mitigation of long-line mortality remains the key conservation goal for this species.

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Nevoux, M. and Barbraud, C. **Relationships between sea ice concentration, sea surface temperature and demographic traits of thin-billed prions.** *Polar Biology* 29(6): 445-453, 2006.

**Notes:** Understanding the effects of environmental variations on ecosystems is a major topic in ecology. In this study, we estimated demographic parameters of a seabird population, the thin-billed prion (*Pachyptila belcheri*) at Kerguelen Islands, and then tested for relationships with inter-annual variations of climatic indices, using long-term capture-recapture data. The annual adult survival probability was 0.825 +/- 0.009 and the breeding success was 0.519 +/- 0.090. Sea surface temperature anomalies were negatively related with breeding success. By contrast, winter sea ice concentration in the Antarctic seasonal ice zone seemed to negatively influence adult survival. This suggests a connection between sub-Antarctic and Antarctic ecosystems. The actual context of large climatic changes in the Austral Ocean seems to explain a large part of the decreasing trends observed for both the breeding success and the adult survival. Thus, a decrease of the population size of thin-billed prions at Kerguelen could be strongly suspected in the near future.

Viera, V.M., Le Bohec, C., Cote, S.D., and Groscolas, R. **Massive breeding failures following a tsunami in a colonial seabird.** *Polar Biology* 29(8): 713-716, 2006.

**Notes:** Natural catastrophic events such as tsunamis may induce drastic decreases in breeding success of animal populations. We evaluate the impacts of flooding on the reproductive success of king penguins (*Aptenodytes patagonicus*) in the Crozet Archipelago. On 26 December 2004, a magnitude-9 earthquake created a large tsunami that flooded a colony at 6,500 km from the epicentre of the earthquake. On 30 January 2005, severe waves again flooded the colony. About 17-20% of the surface of the colony was impacted during each flood and 44% of the breeding birds abandoned their egg or chick following the two floodings. Although about 11% of birds laid another egg after the tsunami, none reproduced again after the second flood that happened later in the breeding season. Our results show that the tsunami directly affected the reproductive success of seabirds nesting near the coast.

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De Villiers, M., Bause, M., Giese, M., and Fourie, A. **Hardly hard-hearted: heart rate responses of incubating Northern Giant Petrels (*Macronectes halli*) to human disturbance on sub-Antarctic Marion Island.** *Polar Biology* 29(8): 717-720, 2006.

**Notes:** Guidelines for visitors to sub-Antarctic Marion Island recommend 15 and 100 m minimum approach distances for breeding Northern (*Macronectes halli*) and Southern (*Macronectes giganteus*) Giant Petrels, respectively. Using artificial eggs containing FM transmitters, we measured the heart rate responses of incubating Northern Giant Petrels to pedestrian approaches. The mean resting heart rate was 80 beats per minute. Heart rates increased upon the detection of a person approximately 40 m away, and continued to increase during the approach to 5 m. Maximum increases over resting heart rate in response to natural disturbances and human approach were 97 and 204%, respectively. Northern Giant Petrels appear at least as sensitive to human disturbance as their congeners. While low-key disturbance is unlikely to affect this solitary breeder as severely as it would the colonial Southern Giant Petrel, improved protection from disturbance could be achieved by restricting human passage through breeding colonies of Northern Giant Petrels to defined paths.

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Poncet, S., Robertson, G., Phillips, R.A., Lawton, K., Phalan, B., Trathan, P.N., and Croxall, J.P. **Status and distribution of wandering, black-browed and grey-headed albatrosses breeding at South Georgia.** *Polar Biology* 29(9): 772-781, 2006.

**Notes:** Long-term studies at Bird Island, South Georgia, show that numbers of wandering, black-browed and grey-headed albatrosses have been decreasing since the late 1970s. To determine the status of the total South Georgia population, all known colonies were censused in 2003/2004 using a combination of yacht-based digital photography and ground counts. The breeding population estimates from this census are 1,553 pairs of wandering albatross, 74,296 pairs of black-browed albatross and 47,674 pairs of grey-headed albatross. A 30% decline since 1984 was recorded for wandering albatross, and comparison of a sample of black-browed and grey-headed albatross colonies on the mainland of South Georgia photo-censused in both 1985/1986 and 2003/2004 indicates similarly substantial population declines. Unless these decreases can be halted or reversed, doubt will exist as to the long-term viability of these species of albatross at South Georgia.

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Putz, K., Rey, A.R., Schiavini, A., Clausen, A.P., and Luthi, B.H. **Winter migration of rockhopper penguins (*Eudyptes c. chrysocome*) breeding in the Southwest Atlantic: is utilisation of different foraging areas reflected in opposing population trends?** *Polar Biology* 29(9): 735-744, 2006.

**Notes:** Rockhopper penguins (*Eudyptes chrysocome*) breeding on Staten Island, Argentina, were satellite tracked in 2002 and 2003 during the onset of their winter migration. After their moult, the dispersal of 24 birds was monitored for a mean period of 50.0 +/- 40.3 days. Birds travelled at a mean velocity of 3.1 +/- 1.1 km/h. The mean minimum distance travelled was 1,640 +/- 1,425 km; the maximum distance to the colony was generally less than 1,000 km, although one bird travelled more than 2,000 km from the colony. The penguins dispersed over an area totalling about 1.3 million km<sup>2</sup>, ranging from 50 to 62°S and from 49°W in the Atlantic to 92°W in the Pacific, and covering polar, sub-polar and temperate waters in oceanic regions as well as shelf waters. Despite the very wide dispersal, both temporally and spatially, two important wintering grounds for rockhopper penguins from Staten Island could be identified, both located over shelf regions: one extended from Staten Island

to the north along the coast of Tierra del Fuego up to the Magellan Strait; the other was located over the Burdwood Bank, an isolated extension of the Patagonian Shelf to the south of the Falkland Islands. The Drake Passage also appeared to be an important area for wintering penguins, although dispersal was far more widely spread. Comparison with data obtained during winter from rockhopper penguins originating from the Falkland Islands showed that the area off the coast of Tierra del Fuego was used more or less exclusively by birds from Staten Island, whereas the Burdwood Bank was shared with penguins coming from southern colonies in the Falkland Islands. The implications of these findings are discussed with regard to (a) opposing population trends of rockhopper penguins in the Southwest Atlantic, and (b) the urgent need to establish adequate conservation measures for species and habitat protection.

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Sullivan, B.J., Brickle, P., Reid, T.A., Bone, D.G., and Middleton, D.A.J. **Mitigation of seabird mortality on factory trawlers: trials of three devices to reduce warp cable strikes.** *Polar Biology* 29(9): 745-753, 2006.

**Notes:** Experimental trials were conducted onboard a stern trawler to identify the relative efficacy of three emerging mitigation measures (tori lines, warp scarer and Brady baffler) designed to reduce seabird mortality caused by warp cable strikes. The use of mitigation measures was clearly shown to substantially reduce seabird mortalities from collisions between seabirds and warp cables. Based on an established significant relationship between contact rate and seabird mortality, when using contact rate as an index of mortality there was a clear performance hierarchy of the three measures. Tori lines and the warp scarer were significantly more effective at reducing contacts than the Brady Baffler, whilst tori lines represent a smaller, but still significant, improvement on the warp scarer. While further testing would be required under local environmental and operational conditions, our findings are likely to have application for many trawl fisheries around the world.