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Seabirds in Alaska

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About 100 million seabirds reside in marine waters of Alaska during some part of the year. Perhaps half this population is composed of 50 species of nonbreeding residents, visitors, and breeding species that use marine habitats only seasonally (Gould et al. 1982). Another 30 species include 40-60 million individuals that breed in Alaska and spend most of their lives in U.S. territorial waters (Sowls et al. 1978). Alaskan populations account for more than 95% of the breeding seabirds in the continental United States, and eight species nest nowhere else in North America (USFWS 1992).

Seabird nest sites include rock ledges, open ground, underground burrows, and crevices in cliffs or talus. Seabirds take a variety of prey from the ocean, including krill, small fish, and squid. Suitable nest sites and oceanic prey are the most important factors controlling the natural distribution and abundance of seabirds.

The impetus for seabird monitoring is based partly on public concern for the welfare of these birds, which are affected by a variety of human activities like oil pollution and commercial fishing. Equally important is the role seabirds serve as indicators of ecological change in the marine environment. Seabirds are long-lived and slow to mature, so parameters such as breeding success, diet, or survival rates often give earlier signals of changing environmental conditions than population size itself. Seabird survival data are of interest because they reflect conditions affecting seabirds in the nonbreeding season, when most annual mortality occurs (Hatch et al. 1993b).

Techniques for monitoring seabird populations vary according to habitat types and the breeding behavior of individual species (Hatch and Hatch 1978, 1989; Byrd et al. 1983). An affordable monitoring program can include but a few of the 1,300 seabird colonies identified in Alaska, and since the mid-1970's, monitoring efforts have emphasized a small selection of surface-feeding and diving species, primarily kittiwakes (*Rissa* spp.) and murres (*Uria* spp.). Little or no information on trends is available for other seabirds (Hatch 1993a). The existing monitoring program occurs largely on sites within the Alaska Maritime National Wildlife Refuge, which was established primarily for the conservation of marine birds. Data are collected by refuge staff, other state and federal agencies, private organizations, university faculty, and students.

Status of Monitored Birds

Kittiwakes

Kittiwakes are small, pelagic (open sea) gulls that range widely at sea and feed on a variety of small fish and plankton, which they capture at the sea surface. Black-legged kittiwakes (*Rissa tridactyla*) have been studied intensively because they are widely distributed and easy to observe. Among 10 locations for which population trend data are available, 3 show significant declines since the mid-1970's, 3 show increases, and 4 show no consistent trends (Fig. 1). The overall trend is unknown, although widespread declines are anticipated because of a downward

Courtesy S. Hatch, NBS

Dense colonies of common murres (*Uria aalge*) breed on bare cliff ledges—here on the Semidi Islands, western Gulf of Alaska.

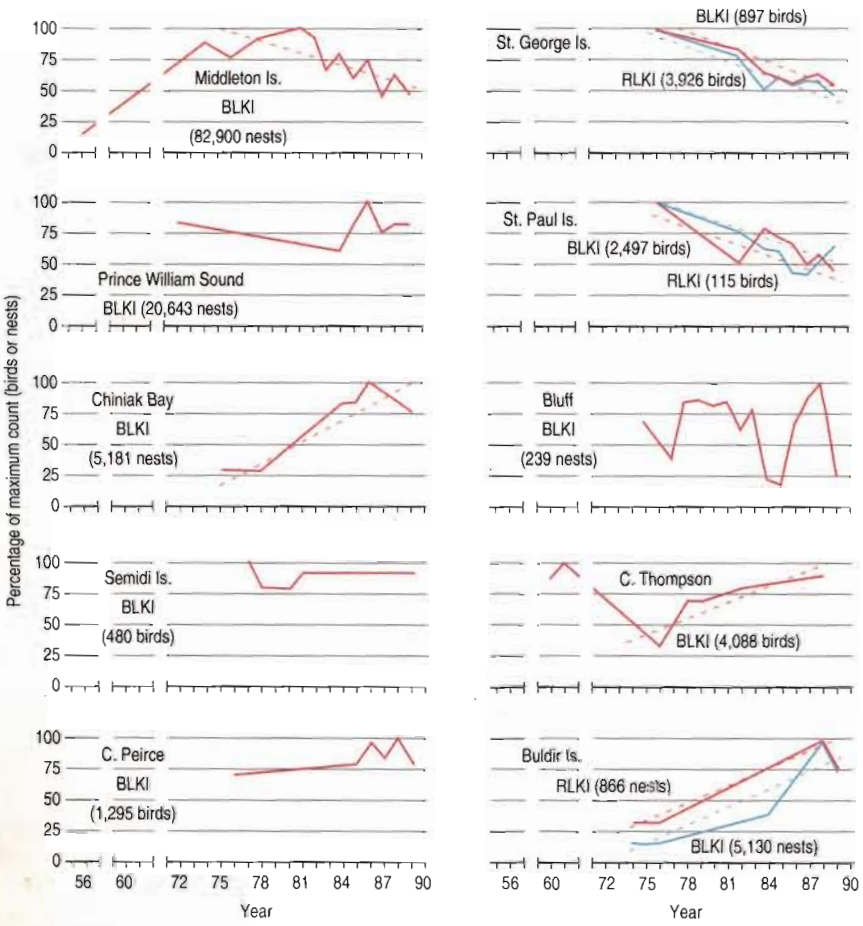

Fig. 1. Population trends of black-legged kittiwakes (BLKI) and red-legged kittiwakes (RLKI) at selected colonies in Alaska. The maximum count of birds or nests is indicated for each location. Dashed lines indicate significant regressions ($P < 0.05$) of data collected since 1970 (P is a measure of the confidence that the decline or increase is statistically reliable. $P < 0.05$ indicates a high probability that the population trend depicted actually occurred). *See* Hatch et al. 1993a and references cited therein for data sources.

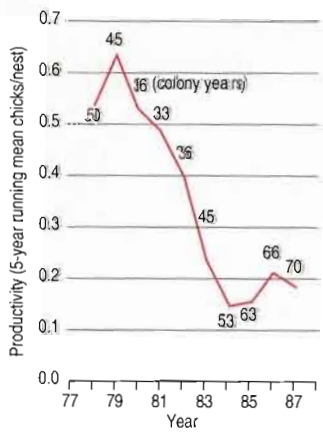

Fig. 2. Productivity (chicks fledged per nest built) of black-legged kittiwakes in Alaskan colonies, 1976-89. The number of colony-years included in each mean is indicated. *See* Hatch et al. 1993a for raw data.

trend in the production of offspring (Fig. 2); some large colonies fail chronically. On Middleton Island, for example, breeding has been a total or near-total failure in 10 of the last 12 years (1983-94; Hatch et al. 1993a; Hatch, unpublished data). The colony is declining at an average rate of 7% per year (equal to adult mortality), suggesting there is no recruitment (Hatch et al. 1993b). If survival estimates obtained on Middleton apply generally, the near-term future of kittiwakes is unfavorable because average productivity of 0.2 chicks per pair (Fig. 2) is inadequate to maintain populations.

Where red-legged kittiwakes (*R. brevirostris*) have been monitored, they show population trends similar to black-legged kittiwakes (Fig. 1). In 1989 their population was down by 50% in the Pribilof Islands, but they were more numerous at Buldir Island than in the mid-1970's (Byrd and Williams 1993). Because most of the world population of red-legged kittiwakes breeds in the Pribilofs (75% on St. George Island), their decline at that location is cause for concern.

Murres

Murres are large-bodied, abundant, and wide-ranging seabirds that feed mostly on schools of fish they pursue by diving underwater, sometimes to depths of 100-200 m (330-650 ft). Repeated counts of one or both murre species (common murre, *Uria aalge*, and thick-billed murre, *U. lomvia*) are available for 12 locations in Alaska (Fig. 3). Since 1970 common murres have declined significantly at two colonies, and thick-billed murres have declined at one. Murres (species not distinguished) increased at two colonies over the same period. Between the 1950's and the 1970's, murres increased at one location (Middleton Island) and declined at another (Cape Thompson), but they have since been relatively stable at both colonies. In 1989 the *Exxon Valdez* oil spill killed substantial numbers of common murres at several colonies in the Gulf of Alaska (Piatt et al. 1990a).

Available data are insufficient to identify overall trends. Murres are relatively consistent producers of young, averaging 0.5-0.6 chicks per pair annually in both species (Byrd et al. 1993).

Threatened and Endangered Species

No breeding seabirds are currently listed as threatened or endangered in Alaska. The short-tailed albatross (*Diomedea albatrus*), with fewer than 1,000 individuals surviving, breeds in Japan but visits Alaskan waters during most months of the year. The species is vulnerable to incidental take by commercial fishing gear, especially gill nets and longlines (Sherburne 1993).

Three species that breed in Alaska were recently listed as category 2 (possibly qualifying for threatened or endangered status, but more information is needed for determination): the red-legged kittiwake, marbled murrelet (*Brachyramphus marmoratus*), and Kittlitz's murrelet (*B. brevirostris*). As noted previously, red-legged kittiwakes have declined substantially on the Pribilof Islands (Fig. 1). Marine bird surveys conducted in Prince William Sound in 1972-73 and 1989-93 suggest a significant decline of marbled murrelets in that area (Klosiewski and Laing 1994). This finding is corroborated by Audubon Christmas Bird Counts from coastal sites in Alaska, which reveal a downward trend since 1972 (Piatt, unpublished data). Kittlitz's murrelet also showed a decline in the Prince William Sound surveys (Klosiewski and Laing 1994). With an estimated population of fewer than 20,000 birds range-wide (van Vliet 1993), this species is one of the rarest of auks (Family Alcidae). Both murrelets were adversely affected by the *Exxon Valdez* oil spill (Piatt et al. 1990a).

Other Species

Scant information is available to assess numerical changes for most seabird species in Alaska. We know that some species were seriously reduced or locally extirpated by foxes introduced to islands in the 1800's and early 1900's. About 450 islands from southeastern Alaska to the western Aleutians were used as release sites for arctic (*Alopex lagopus*) and red foxes (*Vulpes vulpes*) (Bailey 1993). The species most affected included open-ground nesters such as gulls (*Larus* spp.), terns (*Sterna* spp.), and fulmars (*Fulmarus glacialis*), and burrowing birds like ancient murrelets (*Synthliboramphus antiquus*), Cassin's auklets (*Ptychoramphus aleuticus*), tufted puffins (*Fratercula cirrhata*), and storm-petrels (*Oceanodroma* spp.). In spite of natural die-offs and eradication efforts, foxes remain on about 50 islands to which they were introduced (Bailey 1993).

Recent counts suggest that fulmars are increasing at two of their major colonies (Semidi Islands and Pribilof Islands), and several small colonies have been established since the mid-1970's (Hatch 1993b). Counts of least and crested auklets (*Aethia pusilla* and *A. cristatella*) also indicate possible increases at two colonies in the Bering Sea (Piatt et al. 1990b; Springer et al. 1993).

Red-faced cormorants (*Phalacrocorax urile*) declined about 50% on the Semidi Islands between 1978 and 1993, while pelagic cormorants (*P. pelagicus*) increased on Middleton Island between 1956 and the mid-1970's (Hatch, unpublished data). Glaucous-winged gulls (*Larus glaucescens*) increased on Middleton from none breeding in 1956 to more than 20,000 birds in 1993 (Hatch, unpublished data); this species has also shown marked increases following removal of introduced foxes at several sites in the Aleutian Islands (Byrd et al. 1994). Marine bird surveys in Prince William Sound (Klosiewski and Laing 1994) suggest that arctic terns (*Sterna paradisaea*), glaucous-winged gulls, pelagic cormorants, horned puffins (*Fratercula corniculata*), and pigeon guillemots (*Cepphus columba*) have all declined in that area. Terns and guillemots have recently increased on several Aleutian Islands following fox removal (Byrd et al. 1994).

Factors Affecting Seabirds

Alaskan seabirds are killed incidentally in drift gill nets used in high seas (DeGange et al. 1993), and oil pollution poses a significant threat, as demonstrated by the *Exxon Valdez* spill. There is little doubt, however, that the introduction of exotic animals, especially foxes, but also rats, voles, ground squirrels, and rabbits has been the most damaging source of direct mortality associated with human activity (Bailey 1993). Unlike one-time catastrophes, introduced predators exert a continuous negative effect on seabird populations.

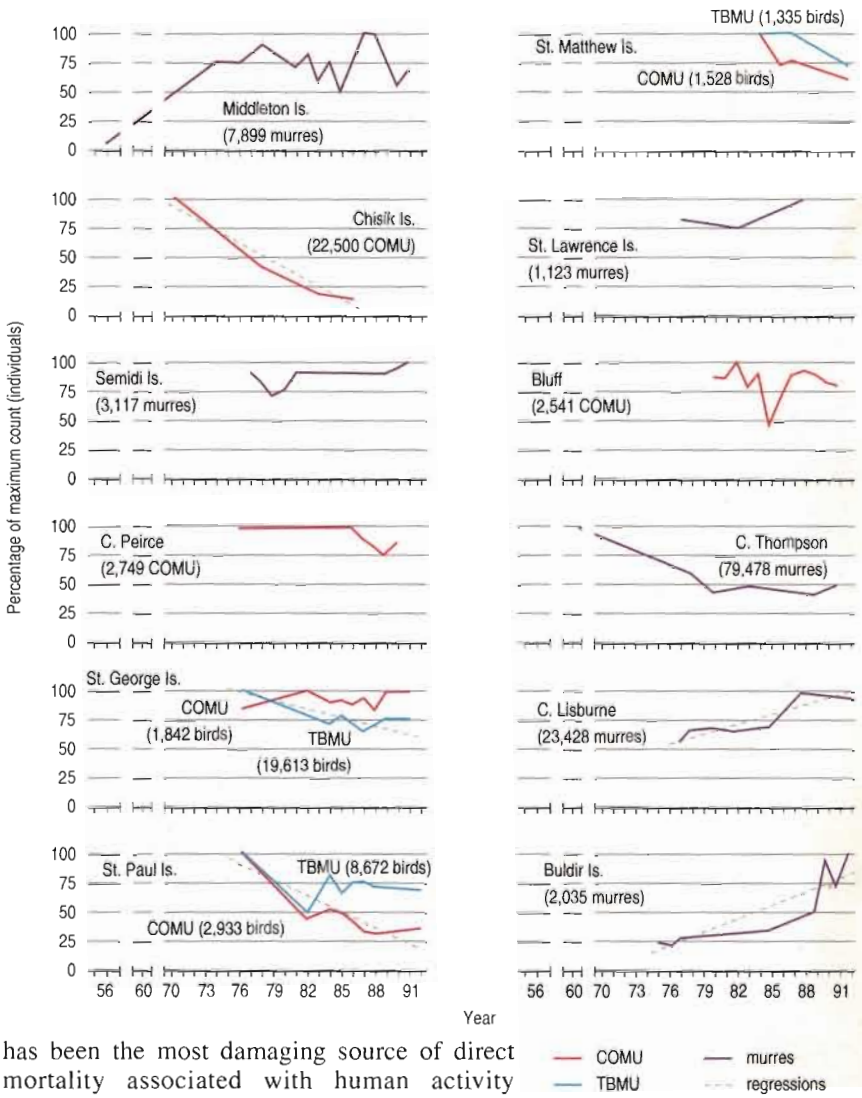

Fig. 3. Population trends of common murres (COMU) and thick-billed murres (TBMU) at selected colonies in Alaska. Counts of "murres" included unspecified numbers of common and thick-billed murres. The maximum count of individuals is indicated for each location. Dashed lines indicate significant regressions ($P < 0.05$) of data collected since 1970. *See* Hatch 1993a for data sources.

Changes in food supply, whether natural or related to human activity, are another important influence on seabird populations. The postwar period from 1950 to the 1990's has seen explosive growth and constant change in commercial fisheries of the northeastern Pacific (Alverson 1992). Driving these changes, or in some cases possibly driven by them, are major shifts in the composition of marine fish stocks. In the Gulf of Alaska, for example, a shift occurred in the late 1970's and early 1980's toward greater abundance of groundfish (cod, *Gadus macrocephalus*; various flatfishes; and especially walleye pollock, *Theragra chalcogramma*), possibly at the expense of small forage species such as herring (*Clupea harengus*), sandlance (*Ammodytes hexapterus*), and capelin (*Mallotus villosus*; Alverson 1992) (Fig. 4). Coincident with these changes, diets of a variety of seabirds such as murres, murrelets, and kittiwakes have shifted from being predominantly capelin-based

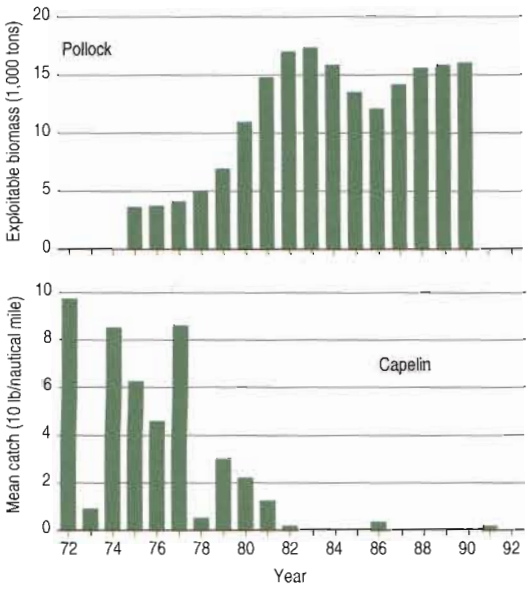

Fig. 4. Temporal changes in marine fish stocks of the Gulf of Alaska: total pollock biomass (age 2+) from stock assessment surveys by the National Marine Fisheries Service, 1975-90 (above; Marasco and Aron 1991), and catch per unit effort of capelin in midwater trawls in Pavlov Bay, western Gulf of Alaska, 1972-92 (below; P. Anderson, NMFS, unpublished data).

to pollock-based (Piatt, unpublished data). Seabird declines and breeding failures correspond to the shift, as do drastic declines in harbor seals (*Phoca vitulina*) and northern sea lions (*Eumetopias jubatus*) in the Gulf of Alaska (Merrick et al. 1987; Pitcher 1990).

The wholesale removal of large quantities of fish biomass from the ocean is likely to have major, if poorly known, effects on the marine ecosystem. An emerging issue is whether fish harvests are altering marine ecosystems to the detriment of seabirds and other consumers like pinnipeds and whales.

The relative role of fishing and natural environmental variation in regulating these systems is another matter for long-term research. In any case, seabird monitoring will continue to provide valuable insights into marine food webs, especially changes that affect the ocean's top-level consumers, including humans.

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