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Where we work

The Alaska Maritime National Wildlife Refuge's 3.4 million acres include spectacular volcanic islands of the Aleutian chain, expansive seabird cliffs of the remote Pribilofs and islands adjacent to the Alaska Peninsula, icebound lands washed by the Chukchi Sea, and majestically forested islands in southeast Alaska. This wide range of nesting habitats supports internationally significant numbers (some 40 million individuals representing more than 60 species) of seabirds.

How do we monitor this vast resource? Unfortunately it is impossible to visit every seabird colony every year. Instead, we selected a network of nine sites (roughly 500 miles apart) for detailed annual monitoring, and dozens of "intermittent" sites in between, which are visited less frequently.

Photo: Steve Hillebrand

What we study

We have two broad objectives:

1. Conserve our trust species
2. Test hypotheses about causes of change to understand ecosystem processes.

We don't have the resources to study all of the seabird species nesting on the Refuge, so we selected a subset that represents distinct foraging guilds (piscivores and planktivores, surface-feeders and divers, near- and offshore feeders). We also target some species like red-legged kittiwakes, red-faced cormorants and whiskered auklets for which our Refuge represents a substantial portion of their range.

Our annual metrics are timing of breeding, reproductive success, population trend, diet, and adult survival. We conduct population counts every 2-5 years because numbers of these long-lived birds tend to vary at a decadal scale. We monitor other parameters every year because they vary on an annual scale and relationships will help us understand the causes of observed population change.

Alaska Maritime National Wildlife Refuge

Seabird Monitoring 2011

Black-legged Kittiwakes

Photo: Tom Calloyd & Mary Frische

In this Issue

Photo: Brie Drummond

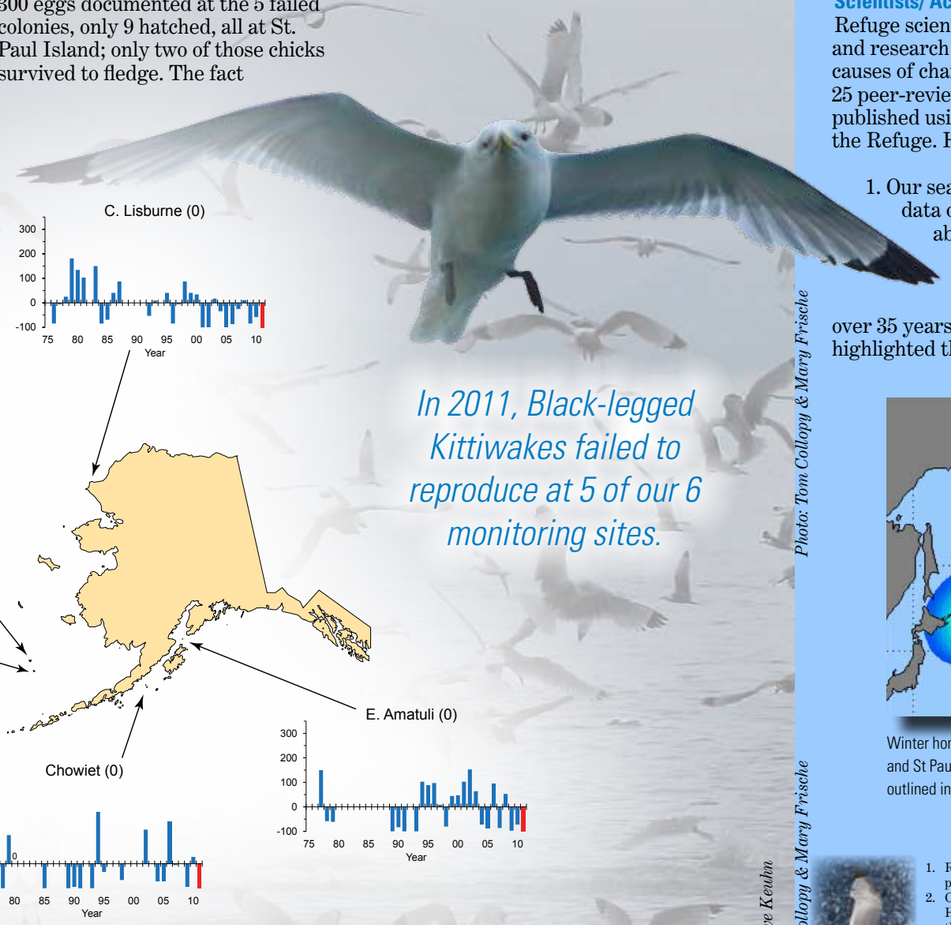
Biological Technician Stephanie Walden with a kittiwake that is temporarily marked with blue color to avoid recapturing the same bird for corticosterone sampling and productivity studies. The color wears off after a few days.

Black-legged Kittiwakes

are small cliff-nesting seabirds that make their living in the open ocean, only visiting land for the brief breeding season when Refuge biologists unlock their pelagic secrets. Found around the pole in the northern hemisphere, these birds breed in colonies of a few to tens of thousands, sometimes interspersed with their relatives, red-legged kittiwakes, which are found only in the Bering Sea. They feed at the ocean surface on fish and macrozooplankton.

In 2011, black-legged kittiwakes had widespread reproductive failure at our monitoring sites. No chicks or very few fledged at 5 of the 6 sites. Reproductive failure can come at any time of the nesting cycle (i.e., egg laying, hatching, or chick rearing). At failed colonies in 2011, almost no eggs were laid and adults often didn't incubate the few eggs that we did observe. Of the nearly 300 eggs documented at the 5 failed colonies, only 9 hatched, all at St. Paul Island; only two of those chicks survived to fledge. The fact that the failure was widespread and occurred early in the season could mean it was related to broad oceanographic conditions from the previous winter or even the previous breeding season, rather than local conditions during the nesting period. In contrast, Buldir Island, in the distant western Aleutians, had above-average reproductive success.

Population trends at these colonies were evaluated over the entire range of years for which we have data, as well as for just the most recent decade (2002-2011). Despite frequent breeding failures, black-legged kittiwake populations increased over the long-term at Cape Lisburne and Buldir Island, and remained stable at the other monitored colonies. Since 2002, kittiwakes have increased at Cape Lisburne and Chowiet Island; remaining stable elsewhere.



In 2011, Black-legged Kittiwakes failed to reproduce at 5 of our 6 monitoring sites.

Graphs indicate the percent departure from the average site productivity (chicks fledged/nest). 2011 productivity is in parentheses next to each island's name.

How is Refuge Science Being Used?

Refuge Management

Our 40-year kittiwake data set directly benefits Refuge management by telling us the status and trends of species. It allows us to distinguish between normal fluctuations and the effects of threats (e.g. oil spills, fisheries bycatch, introduced predators, and climate change).

Fisheries Management

Refuge monitoring data are used by the North Pacific Fisheries Management Council too, as some of the ecosystem indicators used to shape fisheries regulations and make allocation decisions.

http://access.afsc.noaa.gov/reem/ecoweb/Eco2010.pdf

Scientists/ Academia

Refuge scientists rely on collaborations and research to help understand the causes of change. Each year, more than 25 peer-reviewed scientific articles are published using data collected by or on the Refuge. Here are a few examples:

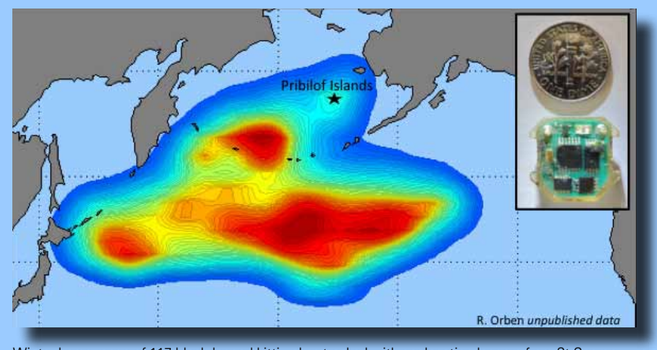
1. Our seabird diet studies provide data on availability and abundance of zooplankton and forage fish species. We analyzed patterns in kittiwake and murre diets over 35 years in the Pribilofs, which highlighted the importance of pollock in kittiwake diets and the absence of capelin since the late 1970s. Kittiwake diet differences on St. Paul and St. George Islands likely reflect differences in foraging location between islands. Diets were related to broad-scale oceanographic conditions but not to more local physical variables.

2. Analysis of seabird demographic data, (which included Refuge research and independent fisheries data from around the globe) identified a threshold of about 1/3 of the maximum biomass of forage fish abundance, below which seabirds consistently experienced reduced and more variable productivity.

3. Kittiwakes were studied at several Refuge colonies to test whether inter-annual changes in climate cause nutritional stress and impact productivity. Researchers found that anticipated climate warming might enhance kittiwake survival in the short-term in the Bering Sea shelf region while having negative impacts on birds breeding in the Gulf of Alaska and western Aleutians.

4. No one previously knew where black-legged kittiwakes winter – now we do. Rachael Orben, U.C., Santa Cruz put geolocator tags on kittiwakes in the Pribilofs for 3 years to record their journeys. The tags record light levels to calculate location. The map below reveals the wintering grounds of Pribilof birds.

Photo: Tom Collopy & Mary Frische



Winter home range of 117 black-legged kittiwakes tracked with geolocation loggers from St George and St Paul Islands over 3 winters from 2008-2011. 95% of locations are found within the area outlined in blue, and higher use areas gradate to red.

Photo: Dave Kenlm

1. Renner, HM, Mueter, F, Drummond, BA, Warzybok, JA, and Sinclair, E. In press. Patterns of change in diets of two piscivorous seabird species during 35 years in the Pribilof Islands. Deep Sea Research II.
2. Cury, PM, Boyd, IL, Bonhommeau, S, Anker-Nillsen, T, Crawford, RJM, Furness, RW, Mills, JA, Murphy, EJ, Osterblom, H, Paleczny, M, Piatt, JF, Roux, J, and Sydeman, WJ. 2011. Global seabird response to forage fish depletion - one-third for the birds. Science 334: 1703-1706.
3. Satterthwaite, WH, Kitaysky, AS, and Mangel M. In press. Linking climate variability, productivity and stress to demography in a long-lived seabird. Marine Ecology Progress Series.
4. R Orben, unpubl. data.
5. Kitaysky, AS, Piatt, JF., Hatch, SA., Kitaiskaia, V, Benowitz-Fredericks, ZM, Shultz, MT., and Wingfield, JC. 2010. Food availability and population processes: severity of nutritional stress during reproduction predicts survival of long-lived seabirds. Functional Ecology 24: 625.

5. Researchers used Refuge data to study the link between nutritional stress, fecundity, and survival of kittiwakes in Cook Inlet. The stress hormone corticosterone was negatively correlated with food abundance and is likely a reliable measure of food availability. Corticosterone influences survival during reproduction, and predicted the disappearance of individuals. The results suggest that nutritional stress is one of the major factors defining population processes in kittiwakes.

Photo: Steve Hillebrand