

## Environmental Studies Program: Ongoing Study

Title	Updating Status and Trends of Seabirds and Forage Fish in Lower Cook Inlet (AK-16-09)
Administered by	Alaska Regional Office
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Conducting Organizations(s)	USGS
Total BOEM Cost	\$300,000
Performance Period	FY 2018-2021
Final Report Due	April 2021
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PICOC Summary	
<i>Problem</i>	Information on seabird populations and forage fish stocks in Lower Cook Inlet (LCI) is outdated. New information on population dynamics and current trends is needed due to ongoing environmental change occurring in the LCI.
<i>Intervention</i>	This study will conduct field surveys to assess current abundance, distribution and species composition of forage fish around seabird colonies (Chisnik and Gull Islands) in LCI through demographic data on seabirds and their prey base.
<i>Comparison</i>	Study results will document changes in seabird and forage fish populations over time.
<i>Outcome</i>	The analysis will contrast the functional response of seabirds to prey fluctuations, relate trends in birds and fish, and directly measure local changes in the environment to the larger scale indices of climate change.
<i>Context</i>	Cook Inlet

**BOEM Information Need(s):** Seabird densities in lower Cook Inlet are among the highest in Alaska—one reason why the greatest damage to marine bird populations from the Exxon Valdez oil spill occurred there. Resident and migratory seabirds are supported by abundant local stocks of key forage fish species such as herring, sand lance and juvenile pollock. Monitoring of seabird populations and forage fish stocks in potential oil and gas lease areas has been a BOEM priority for decades, both to mitigate impacts of development and to assess the impact of potential oil spills. Both tasks are compromised when population estimates are outdated, and prediction of resilience to development or spills is enhanced by knowledge of population dynamics and current trends. Following intensive investigations of seabirds and forage fish in lower Cook Inlet during 1995-2000, collection of such data in lower Cook Inlet has been limited. The information collected in this new study will be used to support environmental analyses for potential future lease sales and exploration, development, and production activities in Cook Inlet.

**Background:** USGS led seabird and forage fish studies in lower Cook Inlet during 1995-1999 to assess the recovery of seabird populations following the 1989 Exxon Valdez oil spill. The original project was designed to measure the foraging and population responses of six seabird species to fluctuating forage fish densities around three seabird colonies in lower Cook Inlet (Barren, Chisik and Gull islands). These studies included at-sea surveys for forage fish (hydroacoustics, trawling, seining and associated oceanographic measurements) while measuring aspects of seabird breeding biology (egg and chick production, chick growth, population status and trends) and foraging behavior (diets, feeding rates, foraging time) at the three colonies. The most detailed data were collected on Common Murres (*Uria aalge*) and Black-legged Kittiwakes (*Rissa tridactyla*), the most commonly monitored species in Alaska. The breeding biology and population trend of seabirds differed markedly between colonies relative to persistent geographic differences in forage fish abundance, which were in turn related to persistent oceanographic structuring of habitat in lower Cook Inlet.

Fifteen years have passed since these studies were completed, and little comparable work has been conducted during the interim. Anecdotal reports suggest that major ecosystem changes have occurred, including rather large changes in ocean temperature from warm to cold and back to warm that may influence the timing of breeding and reproductive success of birds on Gull and Chisik Islands. Whether these changes have resulted in changes to the population trajectories observed in the 1990s remains unknown. Additionally, in the winter of 2015/2016 there has been a massive die-off of Common Murres, possibly due to starvation. Murre die-offs have occurred in previous winters, but not in the numbers Alaska is seeing. A return to lower Cook Inlet to gather new data on seabird demography and forage fish communities will help establish the range of natural variability in population parameters in relation to environmental factors and provide an updated baseline of ecosystem condition in advance of new oil and gas leasing.

**Objectives:** This study will conduct a pilot year of field surveys which will focus on assessing the prey base around seabird colonies (Chisnik and Gull Island) in lower Cook Inlet, while also gathering basic demographic data on seabirds at the colonies. This pilot year may broaden into a larger planned study, which has the following overarching objectives:

- Assess the current abundance, distribution and species composition of forage fish near the two main seabird colonies in lower Cook Inlet over four years.
- Assess foraging behavior (diets, feeding rates, foraging time) at the three colonies.
- Census current populations of murres and kittiwakes at their colonies in lower Cook Inlet and assess average levels of annual production over four years.
- Compare findings for fish and seabirds with data collected in 1995-1999 and relate trends to long-term environmental changes in ocean climate.

**Methods:** To facilitate comparisons with data from the prior studies, similar protocols for measuring food availability and seabird population biology will be employed, with some refinements. Forage fish abundance will be assessed using mid-water trawls

(CPUE, catch composition) and acoustic surveys (biomass in MT/km<sup>2</sup>) around each colony. Densities of seabirds and marine mammals, and sea surface temperature/salinity will also be recorded continuously on transects. A CTD profiler will measure temperature, salinity, chlorophyll, and turbidity at depth on selected stations. USGS researchers will coordinate and collaborate with the NOAA Kasitsna Bay Laboratory in collection of oceanographic data and provide all data to the NOAA Kachemak Bay National Estuarine Research Reserve data archives.

At the colonies researchers will census kittiwakes and murrelets on established monitoring plots, measure reproductive success of adult birds, and collect data on diet composition of adults and chicks. If USGS researchers obtain supplementary funding from other sources (e.g., EVOSTC, NPRB) the work may be expanded to monitor foraging time budgets at colonies, and resume banding studies to measure annual adult survival rates of murrelets and kittiwakes. Researchers will coordinate and collaborate with the USFWS Alaska Maritime National Wildlife Refuge on studies of seabirds at Chisik and Barrens islands, and with the Seldovia Native Corporation for studies on Gull Island.

Methods of data analysis will center on contrasting the functional responses of seabirds to prey fluctuations within and between decades of study and relating trends in birds and fish to directly measured local changes in the environment (e.g., temperature, salinity) and to larger scale indices of climate change (e.g., ENSO, Pacific Decadal Oscillation, Global Warming Trend). It will be important to quantify these sources of natural variability to evaluate possible future trends under different climate scenarios and distinguish these from potential direct human impacts of OCS oil and gas exploration and development or oil spills in Cook Inlet.

**Specific Research Question(s):**

1. How has forage fish and seabird populations changed since USGS led seabird and forage fish studies in LCI during 1995-1999?
2. What are the climate factors occurring in Cook Inlet are affecting fluctuations in seabird population and their prey and what are the anticipated long-term effects?

**Current Status:** Completed

**Publications Completed:** Awaiting Final Report

**Affiliated WWW Sites:**

<http://www.boem.gov/akstudies/>

<https://marinecadastre.gov/espis/#/search/study/100139>