

Environmental Studies Program: Ongoing Study

Title	GPS Tagging of Seabirds to Obtain Areas of Foraging Aggregations and Forage Fish Schools in Lower Cook Inlet (AK-21-06)
Administered by	Alaska Regional Office
BOEM Contact(s)	Sean Burrell (sean.burrell@boem.gov)
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PICOC Summary	
<i><u>Problem</u></i>	Research suggests that recent seabird population declines and breeding failures in the Cook Inlet Planning Area are the result of a warming environment and changes in the marine ecosystem. Given these changing environmental conditions, a better understanding of baseline distribution and foraging habitat requirements is needed to provide environmental managers with tools to assess the potential cumulative effects of oil and gas-related activities on seabird populations in the Cook Inlet Planning Area.
<i><u>Intervention</u></i>	This study will focus on capturing adult kittiwakes and murrelets at colonies and fitting them with GPS units to document their foraging movements in Cook Inlet.
<i><u>Comparison</u></i>	Results will be evaluated in the context of extensive historical data to help document changes in seabird populations and foraging areas in Cook Inlet.
<i><u>Outcome</u></i>	This study will link seabird foraging success to foraging locations and species of forage fish at these locations, and will help identify important foraging hotspots within the Cook Inlet Planning Area.
<i><u>Context</u></i>	Cook Inlet Planning Area

BOEM Information Need(s): Given the population decline of seabirds in the Cook Inlet Planning Area, BOEM needs more detailed information on the temporal and spatial distribution of seabird foraging activities, forage fish aggregations and type of forage at these aggregations. This study will support BOEM NEPA analyses for potential future Cook Inlet lease sales, exploration plans and development and production plans, providing information to: 1) better assess the potential cumulative impacts of oil and gas related activities on Cook Inlet seabirds, 2) better define sensitive resource areas for Oil Spill Risk Analyses (OSRA), and 3) help develop mitigation measures and strategies to reduce potential disturbance to seabird populations due to OCS oil and gas related activities.

Background: The 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 response of seabirds to fluctuating forage fish densities around seabird colonies in lower Cook Inlet. Major ecosystem changes have occurred since

those surveys were conducted, including a persistent (2014-2016) marine heat wave (MHW) in the North Pacific (aka “the Blob”), an associated murre die-off of unprecedented scale, and acute failures at murre breeding colonies (Piatt et al. 2020). The USGS OCS program supported research in 2016-2019 that repeated historical studies of 1995-2001, and a follow-on study (AK-20-10) will continue surveys to quantify the impact of the MHW on seabirds and their prey in Lower Cook Inlet (LCI), and to characterize recovery over time.

Objectives:

- Track seabird movements and diving behavior with GPS and activity loggers to identify hotspot foraging areas, and link breeding biology and body condition to foraging success and the density/quality of prey concentrations.
- Provide the location of foraging areas to help further assess the spatial distribution of forage fish aggregations and seabird foraging aggregations, in lower Cook Inlet.

Methods: This study will complement ongoing BOEM-supported efforts assessing seabird and forage fish status, trends, and ecology in LCI. Researchers will capture adult kittiwakes and murrelets at LCI colonies, fit them with GPS units to the tail feathers (kittiwakes) or lower back (murrelets) as described by Elliott et al. (2013, 2014), and collect blood samples. For both species, GPS points will be recorded every 1 minute while the bird is not diving. The units also will record dive duration for murrelets (kittiwakes do not dive). The strong relationship between dive duration and dive depth will allow researchers to infer dive depth and thereby obtain three-dimensional information on bird movement. After 5 days of data collection, capture sites will be revisited, all tagged birds recaptured, and devices redeployed on new birds, to maximize sample size. Because the units download to a base station, data will be collected even if recapture is problematic. During the recapture and tag removal, a second blood sample will be taken, and body mass will be measured to examine change in body mass and metabolites and identify successful foraging periods.

Important foraging sites will be identified based on factors such as the frequency and persistence of foraging visits to a site and whether visits to a site resulted in a successful foraging period. Foraging sites will be visited through efforts of a separate study (AK-20-10) to determine the characteristics of the forage fish aggregations (e.g., density, species, energetic value) and seabird aggregations at each site.

Specific Research Question(s):

1. Where are the most important and persistent feeding aggregation sites in lower Cook Inlet?
2. Are these foraging hotspots defined by particular prey species concentrations or other environmental characteristics?

Current Status: Ongoing; Fieldwork underway

Publications Completed: None

Affiliated WWW Sites: <http://www.boem.gov/akstudies/>

References:

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- Elliott KH, Chivers LS, Bessey L, Gaston AJ, Hatch SA, Kato A, Osborne O, Ropert-Coudert Y, Speakman JR, Hare JF (2014) Windscares shape seabird instantaneous energy costs but adult behavior buffers impact on offspring. *Movement Ecol* 2:17
- Piatt, J.F., Parrish, J.K., Renner, H.M., Schoen, S.K., Jones, T.T., Arimitsu, M.L., Kuletz, K.J., Bodenstein, B., García-Reyes, M., Duerr, R.S. and Corcoran, R.M., 2020. Extreme mortality and reproductive failure of common murrelets resulting from the northeast Pacific marine heatwave of 2014-2016. *PLoS one*, 15(1), p.e0226087.