Environmental Studies Program: Ongoing Study

Title	Quantifying Sea Otter Abundance, Distribution, and Foraging Intake in Cook Inlet Alaska, Using Unmanned Aircraft Systems (UAS) Technology (AK-20-04)
Administered by	Anchorage, Alaska Office
BOEM Contact(s)	TBD
Conducting Organizations(s)	TBD
Total BOEM Cost	TBD
Performance Period	FY 2020–2023
Final Report Due	TBD
Date Revised	October 16, 2019
PICOC Summary	
Problem	In Lower Cook Inlet (LCI), sea otter occurrence overlaps much of the Outer Continental Shelf (OCS) lease area (Garlich-Miller *et al.*, 2018). Currently, information is limited on the effects of oil and gas development activities (*e.g.*, seismic surveys and drilling infrastructure) on sea otter distribution and behavior. Additionally, more information is needed on the level of connectivity between the eastern and western LCI sea otter stocks.
Intervention	This study will assess spatial and temporal patterns of use by females with pups and the status of the LCI sea otter population relative to the available food resources as indexed by foraging energy intake rates. Genetic samples from a representative number of sea otters will be obtained from stocks in both eastern and western LCI to determine the level of variation between eastern and western stocks.
Comparison	Researchers will use UAS-based sea otter surveys to compare sea otter distribution patterns and quality of different areas of offshore foraging habitats between. Further, data from offshore foraging habitats will be compared with nearshore sea otter foraging data collected under separate U.S. Geological Survey (USGS) studies (Coletti *et al.*, 2016) including additional USGS/U.S. Fish & Wildlife Service (USFWS) work in the LCI that will begin in Fiscal Year (FY) 2019.
Outcome	Information gained from this study will inform incidental take authorizations under the Marine Mammal Protection Act (MMPA) for USFWS management needs and inform BOEM's National Environmental Policy Act (NEPA) analyses.
Context	Cook Inlet

BOEM Information Need(s): Sea otters are protected under the MMPA and one of the LCI stocks is listed under the Endangered Species Act (ESA). Scientists need to understand the effects of seismic activities and potential future oil and gas activities on sea otter behavior and habitat to minimize impacts. This study will provide data on sea otter (*Enhydra lutris*) distribution, abundance, habitat quality, feeding and resting habitats, and level of genetic isolation between eastern and western stocks in LCI. This

research will provide baselines for monitoring sea otter responses to oil and gas development activities and will inform incidental take authorizations under the MMPA. Study results will support BOEM analysts and decision-makers in relation to cumulative assessment for NEPA analyses for lease sales, exploration plans, and development and production plans.

Background: Traditional, manned aerial observer-based surveys are routinely used to estimate abundance (Bodkin and Udevitz 1999), and shore-based observations of foraging otters are a sensitive metric for population status and habitat quality (Dean *et al.*, 2002; Coletti *et al.*, 2016). The LCI presents unique constraints to the use of traditional research methods, and this study would apply innovative technology employing UAS to identify important sea otter feeding and resting areas in LCI, as well as address questions regarding seasonal differences in sea otter distributions. Sea otters appear tolerant of small vertical take-off and landing (VTOL) UAS, indicating that collecting offshore sea otter forage data from UAS in the OCS is achievable. In addition, a collaborative project involving USFWS and USGS will capture and radio tag sea otters in LCI in FY 2019, which will provide a sample of animals for targeted UAS work along with additional logistic support for this project.

Objectives:

- Document sea otter distribution and habitat use patterns relative to oil and gas development activities at appropriate temporal and spatial scales.
- Develop a cost effective and statistically defensible methodology to use UAS for multi-replicate, seasonal abundance surveys in LCI that also document annual changes in sea otter distribution and habitat use.
- Assess offshore habitat quality and sea otter foraging behavior for comparison with nearshore land-based foraging data.
- Evaluate the genetic variations between the eastern and western LCI stocks.

Methods: USGS researchers will work with the National Park Service (NPS) and USFWS partners to continue development of a photo-based survey plan that can be transferred to UAS platforms. The team will develop UAS protocols to collect survey imagery and foraging observation data, select UAS platforms (*e.g.*, marine capable fixed wing platforms for surveys and VTOL platforms for foraging observations), select sensors (*e.g.*, forward-looking infrared thermal camera and digital single-lens reflex camera, lens and red-green-blue filter combinations for surveys, and ultra-high definition 1080p+ video camera for foraging observations), optimize flight patterns, and develop statistical procedures to account for diving sea otters (*i.e.*, availability bias) that will allow unbiased estimates of true abundance from photo-based surveys. During testing both manned and UAS platforms will be compared utilizing vessel-based observers to “ground-truth” results. In addition, UAS-based sea otter foraging observations piloted from vessels will provide estimates of energy recovery rates in offshore habitats that can be compared to traditional nearshore land-based foraged data. Blood samples will be collected from a representative number of sea otters from both the eastern and western LCI stocks for genetic analysis.

Specific Research Question(s):

1. What effect might oil and gas development activities have on seasonal sea otter abundance and distribution in LCI?
2. Where are sea otter resting and foraging habitats in LCI and which habitats are of highest quality based on use and prey quality?
3. Are UAS surveys a better alternative than manned aircraft surveys with respect to image quality and disturbance levels to sea otters?
4. How much genetic isolation exists between eastern and western stocks of LCI sea otters?

Current Status: Planned new start

Publications Completed: None

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

References:

Bodkin, J. L., and M. S. Udevitz. 1999. An aerial survey method to estimate sea otter abundance. Marine Mammal Survey and Assessment Methods:13-26.

Coletti, H. A., J. L. Bodkin, D. H. Monson, B. E. Ballachey, and T. A. Dean. 2016. Detecting and inferring cause of change in an Alaska nearshore marine ecosystem. Ecosphere 7:e01489-n/a.

Dean, T. A., J. L. Bodkin, A. K. Fukuyama, S. C. Jewett, D. H. Monson, C. E. O'Clair, and G. R. VanBlaricom. 2002. Food limitation and the recovery of sea otters following the '*Exxon Valdez*' oil spill. Marine Ecology Progress Series 241:255-270.

Garlich-Miller, J. L., G. G. Esslinger, and B. P. Weitzman. 2018. Aerial Surveys of Sea Otters (*Enhydra lutris*) in Lower Cook Inlet, Alaska, May, 2017. USFWS Marine Mammals Management Technical Report MMM 2018-01. Available at: https://www.fws.gov/alaska/fisheries/mmm/seaotters/pdf/2017_Cook_Inlet_Sea_Otter_Survey_Final_Report.pdf