Field	Study Information
Title	Distribution and Abundance of Threatened Steller's Eiders in the Cook Inlet Planning Area: Use of Photographic Monitoring and Satellite Telemetry (AK-25-04)
Administered by	Alaska Regional Office
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Procurement Type(s)	Interagency Agreement
Performance Period	FY 2025–2027
Final Report Due	TBD
Date Revised	February 5, 2024
Problem	In 1997, the Alaska-breeding population of Steller's eiders was listed as a threatened species under the Endangered Species Act. Steller's eiders winter range extends east to Lower Cook Inlet and Kodiak Island, but distribution and population data have not been collected in this area since 2005. Information on movements and distribution within Cook Inlet at night, and potential risks of collision with wind and hydrokinetic facilities are unknown.
Intervention	Assess the distribution and population of Steller's eider during winter in Cook Inlet using emerging technologies including aerial photographic and machine learning (daytime distribution and abundance) and satellite telemetry (nighttime distribution). Development of these methods for Steller's eiders within the Cook Inlet Planning Area will provide updated data to assess energy development risks to an Endangered Species Act (ESA) listed species and advance new marine bird survey technologies with applications throughout all areas under BOEM jurisdiction.
Comparison	Determine if Steller's eider distribution and abundance in Cook Inlet has changed over the past 20 years. Determine if diurnal movements and roosting areas are near priority wind and hydrokinetic sites.
Outcome	A current and defensible understanding of the distribution and abundance of Steller's eider in Cook Inlet during day (foraging, resting) and distribution at night (roosting).
Context	Cook Inlet OCS

BOEM Information Need(s): In 1997, the U.S. Fish and Wildlife Service classified the Alaska breeding population of Steller's eider as Threatened under the ESA. Steller's eiders wintering in Cook Inlet and near Kodiak Island occur within BOEM's planning areas or in potential range of Gulf of Alaska oil spills. To assess the potential effects of offshore energy activities on Steller's eiders wintering in Cook Inlet, particularly in sites with the highest potential for wind and tidal energy, BOEM needs to understand distribution and population status.

Background: Steller's Eeders (*Polysticta stelleri*) that breed in Alaska are listed as threatened under the U.S. ESA. From the mid-1990s to mid-2000s, aerial and boat-based surveys (Agler et al. 1995, Larned

2006), and satellite telemetry (Rosenberg et al. 2014, Martin et al. 2015) described Steller eider molting and wintering sites in coastal waters proximate to the Cook Inlet Planning Area. Because Steller's eider distribution and abundance data from the Cook Inlet Planning Area are now over 20 years old, more current information is needed for BOEM to comply with ESA Section 7 consultation obligations and environmental assessment responsibilities under the National Environmental Policy Act (NEPA). Steller's eider distribution and abundance data are needed to assess potential impacts and identify feasible and effective conservation measures to avoid or minimize adverse effects associated with future conventional and renewable energy activities. Previous survey data is out of date, and also failed to address biases resulting from species identification, flock size estimation, and incomplete detection.

In "Distribution and movements of Alaska-breeding Steller's Eiders in the nonbreeding period" Martin et al. (2015) showed that Steller's eiders occur in deeper (>10m) water during winter. Specifically, they stated "[u]se of deep water (>10 m) was widespread among individuals and tended to occur after November [and] occupancy of deep water after November was significantly influenced by time of day ... with 36% ... of nighttime and 5% ... of daytime locations predicted to be in waters >10 m deep." This study showed that based on telemetry, Steller's eiders behaved as expected during the day (occurring in shallow waters less than 10m deep), but at night they flocked up and fed in deeper waters, although the maximum depth was not described in their paper. Steller's eiders were found to frequently use up to 30-m deep water almost exclusively at night during winter and that nighttime occupancy of deeper water habitats may be for resting and/or for consumption of zooplankton species, such as euphausiids, that are abundant and well known for their nocturnal vertical migrations in the water column (Martin et al. 2015). In summary, the authors state that "[r]egardless of the behavioral basis for the observed nighttime use of deep-water habitats, the presumption that Steller's Eiders almost exclusively occupy waters <10 m deep (e.g., Federal Register 2001) should be reevaluated. Recognizing that Steller's eiders use deeper-water offshore habitats during December through April could possibly improve the efficacy of environmental impact analyses, as well as the accuracy of population estimates obtained from aerial surveys."

Objectives:

- Assess distribution and describe habitats used by wintering Steller's eiders in Cook Inlet.
- Estimate the abundance of Steller's eiders in Cook Inlet during the winter.
- Evaluate the distribution and number of Steller's eiders relative to sites identified for potential wind and tidal energy development.

Methods: Modern marine bird monitoring techniques are transitioning from low level ocular aerial surveys to higher altitude aerial photographic surveys coupled with automated counting algorithms that account for bias, estimate precision, reduce disturbance to birds, and increase safety of survey crews (Weiser et al. 2022).

This study proposes using a Cessna 206 aircraft for eastern Cook Inlet and a Partnavia twin engine aircraft for western Cook Inlet. Each aircraft would be equipped with two Canon 5DS-R cameras and Canon 200mm f/2.8L II USM autofocus lenses mounted in the belly ports. Cameras will be angled away from each other at 5–6 degrees to avoid lateral photo overlap. The technology used will consist of AeroScientific's Aviatrix software, an aerial mapping and flight management system with airborne camera control to collect photographs at 1,000 ft at a 2 second trigger rate. Transects will be spaced 0.5 km apart and will be placed from shoreline to the 10 m bathymetry line. Three replicate surveys, each

requiring 40 flight-hours, with one each in late fall, midwinter, and early spring would be performed to determine distribution and abundance.

Steller's Eider overhead imagery collected by the U.S. Fish and Wildlife Service Alaska Region Migratory Bird Program in Nelson Lagoon Alaska in 2018-2019 will be used as a learning dataset with program YOLO to develop an automated identification and counting algorithm. The trained algorithm would then be used for Cook Inlet photographs to identify and enumerate Steller's eiders. Steller's eider density would then be calculated based numbers of birds in photographs and the sample fraction. A human verification step would follow using a random sample of photographs from which false positive and false negatives would be determined and applied to the density estimate as a correction factor. The final step would be estimation of population size and development of mapping products. Approximate cost of conducting three replicate surveys, each requiring 40 flight-hours, with one each in late fall, midwinter, and early spring is $275,000 (detailed budget available upon request).

To assess distribution of Steller's eiders in Cook Inlet at night, birds will be captured in select locations within the Cook Inlet Planning Area. Satellite transmitters will be implanted following a technique modified from Korschgen et al. (1996) and described by Mulcahy and Esler (1999). Transmitters are expected to weigh 38–40 g and be less than 5% of a bird's body mass at the time of capture. All transmitters will be programmed to transmit with a 60 sec pulse rate and a duty cycle to sample all hours of a day with the expected battery life of > 6 months. The transmitters will be equipped with sensors that monitor internal body temperature and battery voltage. GPS receivers will yield precise location data to allow a better understanding and synopsis about habitat use, daily movements, and the breeding derivation of the Steller's eiders that winter in Cook Inlet. A realistic budget including personnel costs, boat charters, transmitter purchases (n=30), equipment costs, veterinarian support, data management, oversight, and analysis totals approximately $310,000 (detailed budget available upon request).

Quarterly progress reports and a final report would be produced describing methods, results, management implications, and recommendations. GIS layers describing the distribution of Steller's eiders will be created and saved as a geodatabase. A peer reviewed publication would follow after completion of the project.

Specific Research Question(s):

1. What is the change in Steller’s eider distribution and abundance in the last 20 years?
2. What habitats are Steller’s eider using during the winter in Cook Inlet?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

References:

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