Environmental Studies Program: Ongoing Study

Study Area(s): Washington-Oregon

Administered By: Pacific OCS Region

Title: Year-round and Diel Patterns in Habitat-use of Seabirds off Oregon (NSL #PC-14-03)

BOEM Information Need(s) to be Addressed: The State of Oregon and BOEM are actively engaged in marine spatial planning for siting of offshore energy projects within the territorial sea and OCS regions. *In situ* tests of commercial-scale wave energy converters (WEC) have occurred in recent years and the installation of the first WEC testing system was installed in the summer of 2012. The first installation and testing of grid-connected devices are planned to occur in 2013. While the initial focus is on WECs, offshore wind energy development is also being actively pursued off Oregon. Through recent retrospective studies, meetings, and gap analyses, several critical data needs for seabirds were highlighted. These data needs include quantitative information on year-round, diurnal/nocturnal, and weather-related patterns in movements, behaviors, residence time, and migration corridors for seabirds. The best way to fill these data gaps is through individual tracking studies complemented with direct observations. Over the past decade Oregon State University, USGS, and collaborators have used sophisticated telemetry techniques for behavioral tracking studies for several migratory seabird species that visit the California Current System (CCS). With recent technological advances, we can now expand these studies to include locally breeding and wintering species that dominate marine bird communities off Oregon and the Northern CCS. By integrating these data with physical variables we can improve predictive habitat-use models currently needed to inform site-specific and broad-scale marine spatial planning of the OCS. Results from tracking studies combined with previous transect surveys data will provide capability for comprehensive, spatially explicit vulnerability models for seabirds potentially impacted by wave- and wind-energy conversion device siting. Lastly, this study complements ongoing BOEM-supported habitat mapping and ranging behavior study in Hawaiian waters and adds significant new data to include in the *California Current System Seabird Telemetry Atlas*, currently in progress.

Total BOEM Cost: $750,000 **Period of Performance:** FY 2014–2019

Conducting Organization(s): Oregon State University and U.S. Geological Survey

Principal Investigators(s): Dr. Robert Suryan (OSU) and Dr. Josh Adams (USGS)

BOEM Contact(s): David Pereksta

Description:
Background: Oregon hosts approximately 1.2 million breeding seabirds and even more summer and winter migrants with at-sea residence times of days to months. Common Murres are the most abundant breeding bird (50% of breeding population), followed by

storm-petrels (37%), cormorants (5%), and gulls (2%). Common Murres, along with loons, grebes, and seaducks, are the most abundant overwintering species. At times of the year, shearwaters and albatrosses also are abundant. Several species, including the Short-tailed Albatross and Marbled Murrelet, are federally protected under the U.S. Endangered Species Act. Limited tracking data currently exist for larger bodied, non-resident species (albatrosses, Sooty and Pink-footed Shearwaters), and very little, if any, for numerically dominant breeding, overwintering, and migratory species. Oregon seabirds can be used to identify ocean regions of important community-level food-web interactions and trophic transfer of energy. Furthermore, some have adapted ranging behaviors, morphologies, and flight characteristics that capitalize on energy associated with predominant wind patterns and wave energy. Oregon seabirds face increasing threats at sea, including interactions with fisheries, pollution, and climate change. Increasing interest in ocean-based alternative energy and certain activities associated with development of these energy resources pose additional risks for seabirds. Seabird interactions with wind-turbine structures, lighted facilities, elevated power lines on land, and lighted ships at sea have been documented in many regions, and we lack comprehensive knowledge of seabird distribution and behavior to inform siting decisions and minimize risk to seabirds at sea.

Objectives: Emphasis will be to fill knowledge gaps identified in recent BOEM reports with three objectives:

(1) conduct multi-species and multi-scale quantification of at-sea habitat utilization and ranging behaviors for breeding and non-breeding seabirds off the Oregon coast,
(2) compare and integrate results with existing transect survey data, and
(3) compile and provide an analysis of remotely sensed and model-derived habitat data (e.g., chlorophyll concentrations, sea surface temperature, sea surface height, sea level pressure, and wind speed/direction) to examine habitat relationships that can be used to predict species' distributions and improve spatial vulnerability (i.e., risk) maps.

Methods:

(1) Newly available micro-electronic tracking devices will be used to quantify at-sea movements and range behavior of breeding seabirds on the Oregon coast. Specifically, fine-scale, short-term (GPS) and coarse-scale, long-term (Argos, GLS) tracking devices will be deployed on breeding birds at or near important breeding colonies. Non-breeding/migratory species that use the CCS will be captured and outfitted at-sea or on breeding colonies prior to migration.

(2) Spatially explicit habitat modeling to combine seabird utilization with oceanographic habitat will be used to generate mapped species probability distributions and community-level hotspot areas.

(3) To evaluate three-dimensional risk, numerical models that relate flight behavior with fine-scale (2–6 km) winds and waves (c.f., *Hawaiian seabird ranging study*) will be generated and supplemented using direct observations during peak

migrations through the CCS. All new regional telemetry data will be integrated with existing telemetry-based information on at-sea utilization and behavior of non-breeding, migratory species (e.g., Short-tailed and Black-footed Albatrosses, Sooty and Pink-footed Shearwaters).

Results will include (1) raster-based maps of species utilization distributions within state and federal waters off Oregon (and throughout the CCS and U.S. exclusive economic zone) and (2) numerical models that relate environmental variables, including wind speed and direction, to seabird flight speed, direction, and altitude above the sea surface. Results will be provided in scientific presentations, peer-reviewed scientific papers, and in a readily accessible, comprehensive marine GIS package currently under development by USGS and collaborating scientists.

Current Status: OSU is tracking Common Murres and Western Gulls off of the Oregon coast and is conducting a retrospective analysis of tracking data to determine the best methods of calculating flight heights using biologging techniques. Satellite transmitters were deployed on Pink-footed Shearwaters and Common Murres to acquire their movement data, which will be used to analyze and map species-specific and multi-species community hotspots at sea off of Oregon and to inform energy planning needs within the California Current System. Ten Pink-footed Shearwaters were outfitted with satellite transmitters at colonies in Chile in April 2015; ten Common Murres were outfitted with satellite transmitters offshore from the Yaquina Head breeding colony in Newport with an additional eight outfitted with VHF tags; and ten Western Gulls were outfitted with archival GPS tags from a breeding colony in Yachats.

In 2016, OSU continued their efforts to develop a GSM/altimeter tag that will work for Western Gulls. After technology testing of the tags, 12 GSM linked solar powered GPS loggers were deployed; 4 at the Cleft-in-the-Rock colony, and 8 at the Hunters Island colony. Preliminary results included one bird from Cleft traveling down to Florence (Siuslaw River) and one bird from Hunters traveling down to Humboldt Bay, in Northern CA (this same bird was tracked by a recovered GPS tag to Crescent City, CA). At Cleft-in-the-Rock some birds made very stereotypical and repeated trips during the deployment period, and again like the archival tags tracks from Hunters Island were more off-shore than from Cleft-in-the-Rock. The initial deployments of the GPS/GSM tags provided proof of concept; however transmissions stopped from all 12 tags within 21 days of deployment. Nine additional GPS/GSM tag deployments on Western Gulls occurred in June 2017.

OSU assessed options for deployments on Common Murres in spring of 2016 and identified one logger that could be deployed on this species. Common Murres proved to be more difficult to track than hoped, but progress was made in 2016. Common Murres seem particularly sensitive to tag weight and size so based on past experiences two tags types of intermediate size were deployed in 2016; a 5 gram satellite tag (PTT) and 11 gram (GPS) archival tag with remote download. They maintained contact with 3 of the 4 birds outfitted with 5 g PTTs in the spring for 3–3.5 months. Two of the three birds maintained central-place-foraging trips to and from Yaquina Head, while the third bird left the area. They were very surprised to see extensive outer continental shelf foraging and regular trips from Yaquina Head up to the Columbia River plume and off the central

Washington coast. It is uncertain whether these long foraging trips are due to anomalous conditions of 2016 or routine during the summer time. The 11 g UvA tags allowed precise mapping of where the bird was on the colony with the high resolution GPS data and accurate timing of colony departure and return. The accelerometer data allowed them to determine when the bird was resting, diving, and flying. Unfortunately, soon after deploying the tags, the birds no longer returned close enough to the colony to connect and download data to the base station. Given the success of Common Murre tracking using the 5 g PTTs, a second test deployment of four tags took place in August. During the first 1.5 months after deployment, three of four tags provided longer term tracking data. Tracks from these birds are considerably different than the birds tracked during May and June in that the birds in the fall are remaining closer to shore for the most part, especially off Newport, OR. Tags were deployed on four Common Murres in August 2016; one of which continued to transmit until the end of December 2016. That is likely the longest deployment of a sutured attached tag on a small to medium-sized diving bird. Four additional deployments occurred in June 2017 near Yaquina Head.

No additional deployments are planned for Pink-footed Shearwaters, but tagging of Black-footed and Laysan Albatrosses commenced on Midway Atoll in January of 2016. GPS dataloggers and accelerometer altimeters were deployed on 38 birds and 20 datasets of paired GPS and fine-scale altimetry data were obtained. This dataset will allow for a direct comparison of GPS and altimetry data. Additionally, we will be able to look at flight behaviors in relationship to flight altitude and wind speed and direction.

Twenty PTTs were deployed on Pacific Loons on their Alaskan breeding grounds in June of 2016. Five of these were deployed on birds breeding on the North Slope in and the other 15 were deployed on birds breeding on the Yukon-Kuskokwim Delta. By fall, Pacific Loons started to make their way south to the Aleutian Islands. Seventeen of these PTTs have transmitted in the last week of September. We anticipate that some of these birds will spend some time off the Oregon Coast during the fall and winter, and one of them passed through Oregon waters on its way south.

Preliminary analysis of the number of satellites used by GPS data loggers indicated that this type of GPS logger is optimized to quickly determine location fixes, but not to obtain the highest accuracy of flight altitudes. To obtain paired GPS and altimeter data on one of our focal species (Black-footed Albatross) we deployed GPS loggers and accelerometer/altimeters on albatrosses on Midway Atoll. The altimeter loggers recorded barometric pressure and temperature at 1 sec that must be converted to altitudes. Due to the changes in ambient pressure experienced by birds throughout our study period, pressure at sea level needs to be calculated each time a bird lands on the water. Preliminary flight heights were calculated from barometric / temperature loggers deployed on chick-brooding albatrosses. The initial results suggest that birds are flying at ~12 m off the water and that birds fly higher during the day and during transiting flights. Flight heights are possibly overestimated due to low pressures surrounding a flying bird. So depending on the speed and local flow direction the static pressure reading will change, even at constant altitude. However at the speeds that these birds fly, these effects should be relatively small (~2 m of altitude).

Analysis of GPS flight altitudes continued and preliminary results were presented at the Pacific Seabird Group Meeting in February 2016. In addition, an abstract entitled 'Comparative flight behavior of Hawaiian albatrosses' was presented at the International Albatross and Petrel Conference in September 2016 and at the Pacific Seabird Group Meeting in February 2017.

Tracking of Western Gulls and Common Murres continued through the fall of 2017, and tracks of Pacific Loons during their spring and fall migrations through Oregon waters continued to be recorded from tags that were deployed in 2015. Now that all the tracking data for the project has been collected (with the exception of a handful of Western Gulls and Pacific Loons), OSU will collate and standardize the datasets. This task as largely been accomplished for a number of species and they are working on obtaining additional datasets from collaborators.

Final Report Due: December 31, 2019

Publications Completed: None

Affiliated WWW Sites: https://marinecadastre.gov/espis/#/search/study/26992

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