

STUDY TITLE: Seabird and Marine Mammal Surveys off the Northern California, Oregon, and Washington Coasts

REPORT TITLE: Pacific Continental Shelf Environmental Assessment (PaCSEA):
Aerial Seabird and Marine Mammal Surveys off Northern California, Oregon, and Washington,
2011-2012

CONTRACT NUMBER(S): M10PG00081, Task 1

SPONSORING OCS REGION: Pacific

APPLICABLE PLANNING AREAS: Northern California, Washington-Oregon

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BACKGROUND: Recent interest has increased in developing sources of renewable energy to reduce dependence on oil. Some of those sources will include power generation along the continental shelf of the U.S. Pacific coast beyond state waters. Marine birds and mammals comprise an important community of meso- and upper-trophic-level predators within the northern California Current System (NCCS). The NCCS is located within one of the world's four major eastern boundary currents and is characterized by an abundant and diverse marine ecosystem fueled seasonally by wind-driven upwelling which supplies nutrient-rich water to abundant phytoplankton inhabiting the surface euphotic zone. The oceanographic conditions throughout the NCCS fluctuate according to well-described seasonal, inter-annual, and decadal cycles. Such oceanographic variability can influence patterns in the distribution, abundance, and

habitat use among marine birds and mammals. Although there are an increasing number of studies documenting distributions and abundances among birds and mammals in various portions of the NCCS, there have been no comprehensive, large-scale, multi-seasonal surveys completed throughout this region since the early 1980s (off northern California; Briggs et al. 1987) and early 1990s (off Oregon and Washington; Brueggeman 1992). Here, USGS WERC provides science support for BOEM by leading a comprehensive seabird and marine mammal survey of the northern California, Oregon, and Washington coasts in order to build upon and provide a comparison with similar data from the earlier surveys.

OBJECTIVES: The three objectives for this study include: (1) conducting aerial at-sea surveys of seabirds and marine mammals in coastal shelf-slope waters off northern California, Oregon, and Washington, (2) summarizing population density results and conducting a 20-year comparison with 1989 surveys in Oregon and Washington, and (3) validating and enhancing aerial survey data for numerically abundant indicator species and important area breeding and migratory species. Adams et al. (2014) provides results from the first of these objectives, with the intention of providing additional reporting separately for the remaining objectives.

DESCRIPTION: USGS WERC conducted low-elevation aerial at-sea surveys to provide information on the distribution and abundance of marine birds and mammals as requested by BOEM, Pacific OCS Region. The primary survey area extended from Fort Bragg, California (39.3°N) to Grays Harbor, Washington (47°N) and focused on federal waters outside of the 3-mile state boundaries (Figure 1). We structured our at-sea surveys such that they would be comparable with historic transect lines off northern California (Briggs et al. 1987) and off Oregon and Washington (Brueggeman 1992). To ensure comparable spatial and temporal coverage with these similar historic datasets, we flew 32 east-west-oriented uniform transects (spaced at 15' latitude [27.8-km] intervals) when possible to the 2000-m isobath (includes shelf, slope, and rise waters). At the request of BOEM, we included 6 focal-area surveys nested within the overall broad transect survey area (Figure 1). Each focal-area survey consisted of ten, 25-km, parallel transect lines targeting shelf waters and spaced at 6-km intervals. This pattern (broad survey lines and focal-area survey lines) was replicated twice during each oceanographic season: summer (June-July), fall (September-October), and winter (January-February) during 2011 and 2012. During aerial surveys we recorded all sightings of marine animals, vessels, and floating objects from twin-engine, high-wing aircraft (Partenavia P-68, Aspen Helicopters, Oxnard, CA or Commander AC-500, GoldAero, Arlington, WA) along pre-determined 150-m (75 m per side) strip transects at 60 m above sea level. Surveys were flown at 160 km h⁻¹, and we used a GPS unit linked to a laptop computer that allowed us to simultaneously collect coordinates (WGS-84 map datum), sea surface temperature (SST [°C]) determined via a belly-mounted pyrometer, and ocean color data via an onboard radiometer.

SIGNIFICANT CONCLUSIONS: Throughout the entire PaCSEA survey area, average densities (\pm SE) at sea for all marine birds combined were similar between fall (23.7 ± 1.9 birds km⁻²) and winter (24.0 ± 1.9 birds km⁻²) and least during summer (16.3 ± 2.2 birds km⁻²). Marine bird densities at sea varied according to bathymetric domain and season. Throughout the entire PaCSEA study area average densities (\pm SE) for all marine birds combined were greatest over the inner-shelf domain (<100-m depth) during fall (49.4 ± 5.0 birds km⁻²) and similar during winter (37.4 ± 4.6 birds km⁻²) and summer (37.5 ± 6.4 birds km⁻²). Within the outer-shelf domain

(100 – 200-m depth), average densities for all marine birds combined were greatest during winter (34.6 ± 4.2 birds km^{-2}), lesser during fall (16.2 ± 1.7 birds km^{-2}), and least during summer (6.9 ± 1.1 birds km^{-2}). Within the farthest offshore waters over the continental slope domain (200 – 2000-m depth) average densities for all marine birds combined were greatest during fall (10.0 ± 2.2 birds km^{-2}) and winter (9.3 ± 1.5 birds km^{-2}), and lesser during summer (6.2 ± 1.4 birds km^{-2}).

STUDY RESULTS: Overall, we recorded 15,403 sightings of 59,466 individual marine birds (12 families, 54 species). During winter, seven species groupings comprised >90% of the total number of birds counted (19,033) with Common Murres (*Uria aalge*) representing the majority of individuals counted (70.4% of total). The remaining six most abundant taxa included: Surf/White-winged Scoters (*Melanitta perspicillata*/*M. fusca*; 4.8% of total), Herring/Thayer's Gulls (*Larus argentatus*/*L. thayeri*; 3.8% of total), Cassin's Auklets (*Ptychoramphus aleuticus*; 3.8% of total), Glaucous-winged Gulls (*Larus glaucescens*; 3.7% of total), Black-legged Kittiwakes (*Rissa tridactyla*; 2.0% of total), and Western Gulls (*Larus occidentalis*; 1.9% of total). During summer, five species comprised >95% of the total number of birds counted (17,063) with the majority comprised of Common Murres (54.1% of total) and Sooty Shearwaters (*Puffinus griseus*; 34.4% of total). The remaining three most abundant taxa included: Fork-tailed Storm-Petrels (*Oceanodroma furcata*; 3.3% of total), Western Gulls (2.1% of total), and Leach's Storm-Petrels (*Oceanodroma leucorhoa*; 1.1% of total). During fall, nine species comprised >85% of the total number of birds counted (23,376) with the majority comprised of Common Murres (50.0% of total) and Sooty Shearwaters (10.5% of total). The remaining seven taxa included Cassin's Auklets (5.2% of total), Surf/White-winged Scoters (5.1% of total), Fork-tailed Storm-Petrels (3.8% of total), Red/Red-necked Phalaropes (*Phalaropus fulicarius*/*P. lobatus*; 3.2% of total), California Gulls (*Larus californicus*; 3.1% of total), Northern Fulmars (*Fulmarus glacialis*; 2.7% of total), and Sabine's Gulls (*Xema sabini*; 2.2% of total).

We observed 16 cetacean species and five pinniped species. Among the Mysticeti (baleen whales), humpback whales (*Megaptera novaeangliae*) were most frequently observed (114 sightings of 264 individuals) during summer and fall mostly over the outer-shelf and slope waters; however, individuals were also seen within the Siltcoos, Nehalem, Fort Bragg, and Eureka Focal Areas. We recorded 11 Odontoceti (toothed whale) species. Harbor porpoises (*Phocoena phocoena*) were the most frequently sighted (164 sightings of 270 individuals). Harbor porpoises were present year-round and most frequently sighted within the inner-shelf domain throughout the entire study area in all seasons. Harbor porpoises occurred in all six Focal Areas, with noteworthy aggregations within the Eureka, Siltcoos, and Grays Harbor Focal Areas. We recorded 246 sightings of 375 individual pinnipeds (5 species). California sea lions (*Zalophus californianus*) were the most frequently sighted and were present year-round with slightly more sightings recorded during the fall. California sea lions showed a decreasing frequency of sightings and relative abundance with distance from shore across the bathymetric domains surveyed, being most frequently observed over the inner-shelf. Northern elephant seals (*Mirounga angustirostris*), harbor seals (*Phoca vitulina*), and northern fur seals (*Callorhinus ursinus*) were observed occasionally during all seasons with harbor seals occurring nearshore (usually within 10 km of the coast) and northern fur seals almost exclusively beyond the shelf break (> 200-m depth), especially during winter off Oregon and Washington. Northern (Steller's) sea lions (*Eumetopias jubatus*) were uncommonly sighted during winter and fall.

STUDY PRODUCT(S):

Adams, J., J. J. Felis, J. W. Mason, and J. Y. Takekawa. 2014. Pacific Continental Shelf Environmental Assessment (PaCSEA): aerial seabird and marine mammal surveys off northern California, Oregon, and Washington, 2011-2012. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Pacific OCS Region, Camarillo, CA. OCS Study BOEM 2014-003. 267 pages.

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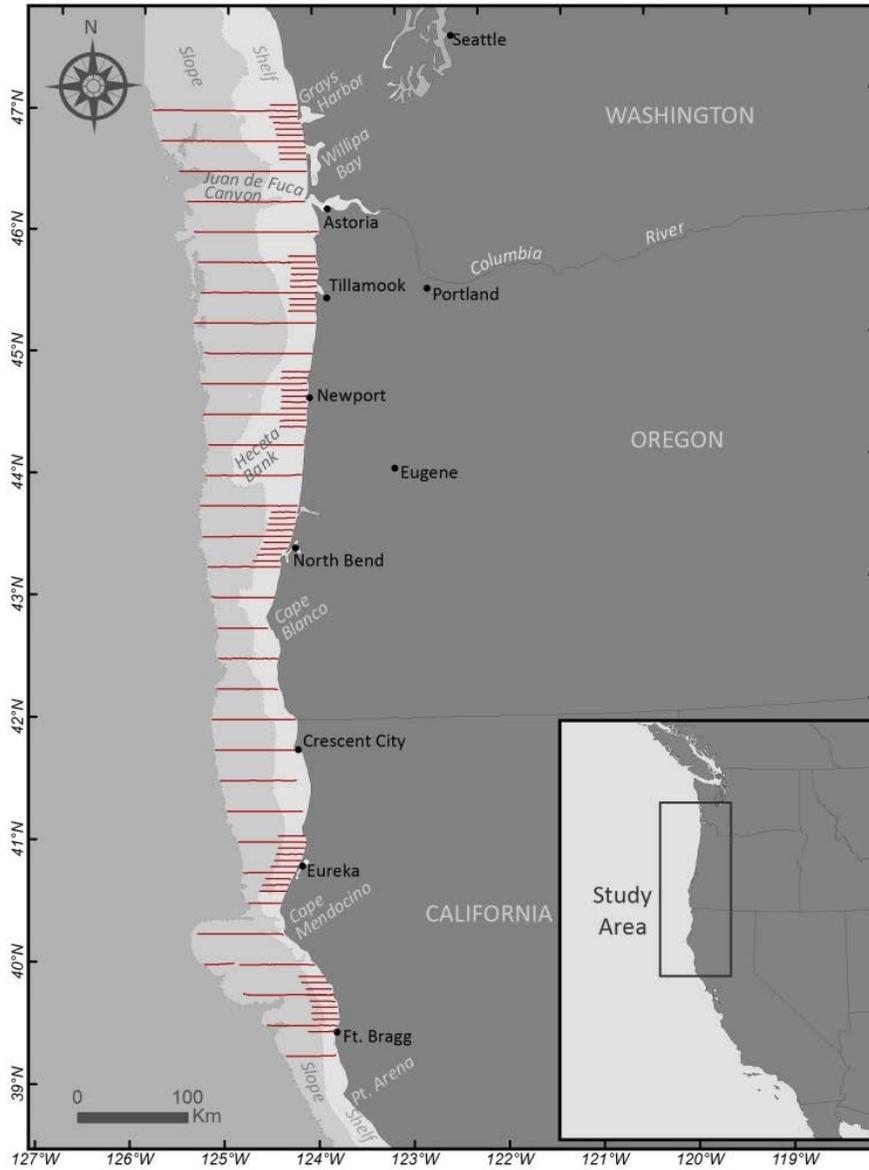


Figure 1. Pacific Continental Shelf Environmental Assessment (PaCSEA) study area showing 32 broad transects, six focal-area transect zones, and geographic place names referenced in text.