BOEM ENVIRONMENTAL STUDIES PROGRAM: Ongoing Studies

Region: Pacific OCS Region

Planning Area(s): All

Title: Developing and Applying a Vulnerability Index for Scaling the Possible Adverse Effects of Offshore Renewable Energy Projects on Seabirds on the Pacific OCS

BOEM Information Need(s) to be Addressed: The BOEM will likely receive proposals to develop offshore renewable energy projects on the Pacific OCS. While data exist on the distribution of seabirds on the Pacific OCS, there is little information regarding the effects that offshore Pacific coast renewable energy development will have. The proposed study increases the understanding of the flight behavior of seabirds and provides a means to rank and assess the vulnerability of specific seabird species on the Pacific OCS based on the habits and activities of birds at sea. This information coupled with existing information on distribution and abundance can provide a means to assess and advise site selection for renewable energy project in a manner that minimizes adverse effects to seabirds.

Total BOEM Cost: $600,000 **Period of Performance:** FY 2012-2015

Conducting Organization: USGS/BRD and USFWS

Principal Investigator: John Takekawa, Josh Adams and John Mason

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Description:

Background: One of the most pressing issues in marine and coastal research is determining the likely impact of offshore renewable energy projects on marine resources. The eastern Pacific near the coast of the western United States, and Hawaii and its surrounding waters, support many breeding seabirds and a variety of other bird species that migrate to or through these regions. A number of species of conservation concern occur in the Pacific Region, including several listed as threatened or endangered under the Endangered Species Act. The erection of offshore wind turbines or installation of wave hydrokinetic arrays may affect birds in several ways, including the risk of collision with the blades and other parts of the structure, and the displacement of individuals from otherwise suitable habitat. While data on the distribution and abundance of seabirds can advise the selection of locations for renewable energy projects, the habits and activities of birds at sea should be taken into account because vulnerability to effects will vary between species.

Understanding seabird flight characteristics is critical to evaluating the risk of collisions with blades and other parts of structures. While the design aspects of seabird flight have been investigated in detail, we still lack basic information about the height at which seabirds fly, as well as their flight directions with respect to prevailing wind directions. H. T. Harvey &

Associates possess data on the flying behavior of seabirds gathered over approximately 50 cruises during 20 years of at-sea surveys conducted along the west coast of the US, spanning the Pacific Ocean from pole to pole, and from the coast to Hawaii (1976-2006), with the major portion of data from the California Current (1985-2006). While some of these data have been analyzed, data on flight height as a function of wind speed and species of bird have not. Once the flight behavior data is analyzed, developing a sensitivity index for seabirds for the Pacific Region of BOEM will aid in evaluating the risks of offshore renewable energy development to the diversity of seabirds occupying this region.

Objectives: 1) Support the analysis of seabird flight behavior to inform the design, operations, and siting of offshore renewable energy projects; 2) develop a wind farm and wave array sensitivity index for seabirds on the Pacific OCS and off Hawaii; 3) apply the index to areas where offshore renewable energy development is most likely to occur; 4) summarize seabird vulnerability on digital maps with a grid size that matches offshore survey data; 5) develop levels of concerns that could act as a basis for selection of offshore renewable energy sites; 6) prepare a synthesis report that summarizes the analyses and findings; and 7) submit a modified version of the report to a peer-reviewed publication.

Methods: Generalized linear models will be used, including logistic regression, to test hypotheses regarding the flight height of seabird species and the potential effects of environmental variables (e.g., wind velocity, sea state). Indirect gradient analysis using non-metric multidimensional scaling and cluster analysis may aid in initially identifying patterns of behavior, and suggest options for constrained ordination techniques. Data on bird and wind velocities will be explored using statistical methods for circular distributions.

The index will be developed by ranking key vulnerability factors as Garthe and Hüppop (2004) did when scaling the possible effects of offshore renewable energy on seabirds in Europe. The factors they chose included flight maneuverability, flight altitude, percentage of time flying, nocturnal flight activity, disturbance by ship and helicopter traffic, flexibility in habitat use, biogeographical population size, adult survival rate, and threat and conservation status. These factors should be evaluated for relevance to evaluating seabirds in the Pacific Region and can be supplemented with others that would help refine the index (e.g., attraction to artificial lights; likelihood of resting on artificial structures rather than avoiding them).

Species evaluated in the index will include all seabirds expected to regularly occur on the Pacific OCS or off Hawaii. At a minimum, these will include species of waterfowl (7), loons (4), grebes (6), albatrosses (3), petrels (6), shearwaters (9), storm-petrels (8), tropicbirds (3), boobies (4), pelicans (1), cormorants (3), frigatebirds (3), phalaropes (2), gulls (11), terns (15), skuas (1), jaegers (3), and alcids (11).

The ranking of each factor for all species will be independently evaluated by a selected group of experts per factor. The experts would be chosen based on their experience with the species in the targeted regions or other areas where the species occur. The sensitivity index calculation would be similar to that identified by Garthe and Hüppop (2004), but may need to be adjusted if factors that were not considered in their index are incorporated. Once species-specific sensitivity indexes are developed, the scores will be integrated with existing distributional data to develop

vulnerability maps for areas of potential offshore renewable energy development. An index will be developed based on species density and sensitivity to offshore renewable energy development that will provide sensitivity values for surveyed grid cells at sea.

Current Status: Planned New Start. Interagency Agreement under development

Final Report Due: TBD

Publications Completed: None at this time.

Affiliated WWW sites: None at this time.

Revised Date: April 18, 2012