

BOEM Environmental Studies Program

Fiscal Years 2014-2016 Studies Development Plan

Pacific OCS Region

U.S. Department of the Interior
Bureau of Ocean Energy Management
Pacific OCS Region
Camarillo, CA
2013

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Abbreviations and Acronyms

AC	alternating current
Approx.	Approximate
AWH	AW Hawaii Wind
bbls	barrels
BOEM	Bureau of Ocean Energy Management
BRD	Biological Resources Division, U.S. Geological Survey
CCS	California Current System
CESU	Cooperative Ecosystem Studies Unit
cf	cubic feet
CHIRP	Compressed High Intensity Radar Pulse
CPUE	catch per unit effort
DC	direct current
DOE	Department of Energy
DOD	Department of Defense
DOI	Department of the Interior
EFH	essential fish habitat
EMF	electromagnetic field
EPAct	Energy Policy Act of 2005
ESA	Endangered Species Act
ESP	Environmental Studies Program
ESPIS	Environmental Studies Program Information System
FERC	Federal Energy Regulatory Commission
FY	Fiscal Year
GIS	Geographic Information System
GLS	Global Location Service
GNOME	General NOAA Oil Modeling Environment
GPS	Global Positioning System
HECO	Hawaiian Electric Company
ITM	Information Transfer Meeting
km	kilometer
KV	kilovolt
LB	Long Beach
LGM	Last Glacial Maximum
ILTER	Long Term Ecological Research
m	meter
MARINe	Multi-Agency Rocky Intertidal Network
MHK	marine hydrokinetic
mllw	mean low low water
MW	megawatt

NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NNMREC	Northwest National Marine Renewable Energy Center
NOAA	National Oceanographic and Atmospheric Administration
NPS	National Park Service
NREL	National Renewable Energy Laboratory
NSL	National Studies List
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OOS	Ocean Observing Systems
OSU	Oregon State University
PaCSEA	Pacific Continental Shelf Environmental Assessment
PI	principal investigator
PISCO	Partners for Interdisciplinary Studies of Coastal Oceans
PMEC	Pacific Marine Energy Center
PRISM	Pacific Regional Intertidal Sampling and Monitoring
SDP	Studies Development Plan
SBC	Santa Barbara Channel
SMB	Santa Maria Basin
SPUE	sightings per unit effort
UCSB	University of California Santa Barbara
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WEC	wave energy converter

SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

The Environmental Studies Program (ESP) in the Pacific Outer Continental Shelf (OCS) Region (Pacific Region) started in 1973. Over its forty-year history, the Program has evolved in response to (1) change in the geographic areas of concern and study, (2) change in the emphasis of disciplines highlighted for research, (3) change in the status of the Region from a frontier to a mature oil and gas producing area (shifting the emphasis from prelease to postlease), and (4) change to a frontier area for renewable energy production. The Pacific Region's responsibility now encompasses ongoing oil and gas operations and potential renewable energy development from both wave and wind energy.

The area of importance for the Pacific Region stretches from the U.S.-Mexico border to the U.S. border with Canada, as well as the area around the State of Hawaii. The Pacific ESP is evolving and expanding our area of study commensurate with the emerging OCS renewable energy program, and with formation of Renewable Energy OCS Task Forces with the States of Oregon and Hawaii.

For the Fiscal Years 2014-2016 Studies Development Plan (SDP), the Pacific Region reached out to 32 major stakeholders for input. They included federal and state agencies and Tribal governments. The Pacific Region received 10 study ideas from stakeholders, including the National Oceanic and Atmospheric Administration (NOAA), U.S. Geological Survey (USGS), and the States of California, Oregon, Washington, and Hawaii. Several of those ideas formed the basis for studies proposed in this document.

Existing production and development activities on 43 producing oil and gas leases offshore southern California will continue. Annual production from these leases is currently 22 million barrels (bbls) of oil and 41 billion cubic feet (cf) of natural gas. It is expected that production from the majority of these facilities will continue for many years. Operators have replaced pipelines, drilled new wells, repaired infrastructure, and generally improved and increased production with long-term plans to continue. This SDP reflects the Bureau of Ocean Energy Management (BOEM) Pacific Region's need to continue to study environmental effects from ongoing oil and gas production operations.

This SDP also explains the need for information to regulate future renewable energy projects that may be proposed and implemented in the Pacific Region. These energy projects require studying areas well outside the oil and gas production area of southern California, as interest and resource potential for deepwater wind and wave energy facilities exist along the entire U.S. West Coast and offshore Hawaii. The interest for renewable energy along the West Coast has focused on wave energy conversion and floating wind off Oregon, and floating deepwater wind off the islands of Oahu and Hawaii. Hydrokinetic wave energy conversion devices are ready for testing offshore Oregon, and BOEM has received proposals for floating deepwater wind off Hawaii. Both states have expressed interest for offshore research leases. Interest for siting renewable energy is spreading to potential areas off California as well. Several companies have met

with BOEM to discuss their concepts for both wave and wind energy projects off California.

Alternate uses of existing oil and gas production platforms continue to be discussed on a limited basis. As the Pacific Region has matured, and as developed oil and gas field production has peaked and entered declines, new and innovative ideas for the use of the platforms have emerged. For example, an international company is exploring options for the development of a grid-connected technology testing facility near Platform Irene (in the Southern California Planning Area). Their concept is to use the platform's power cable for this project while the platform continues oil and gas activities. Once the oil and gas operations cease, the company would want the platform to remain as an alternate-use facility for renewable energy.

This document presents a strategy for the Pacific Region. For renewable energy studies, this plan focuses on all Pacific OCS Planning Areas offshore Washington, Oregon, and California, and includes the Hawaii OCS, where there is potential for renewable energy development. Studies related to oil and gas in the Southern California Planning Area support decisions for activities on existing producing leases.

The information obtained through these studies is important and relevant to decisionmaking. This information fulfills the following criteria:

- The study provides significant new or supplementary information useful for environmental assessment.
- The information provides insight into significant processes critical for understanding both natural and anthropogenic changes.
- The issue can be studied within science's present abilities or understanding of experimental methods to acquire the information.

The introduction of renewable energy projects and the level of future oil and gas activities offshore the Pacific Region will dictate changes in the strategy. Findings from current or future research may also affect the strategy and cause other avenues of research to be incorporated.

If you have any questions regarding this Pacific OCS Region Environmental Studies Development Plan, please contact Dr. Ann Scarborough Bull at (805) 389-7820 or ann.bull@boem.gov. You can also view the BOEM and Pacific Region study web pages through <http://www.boem.gov/Studies/> and <http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Pacific-Studies.aspx> respectively, for additional information.

1.2 Maps of the Region

Figure 1. Oil and Gas Leases and Facilities in the Pacific Region

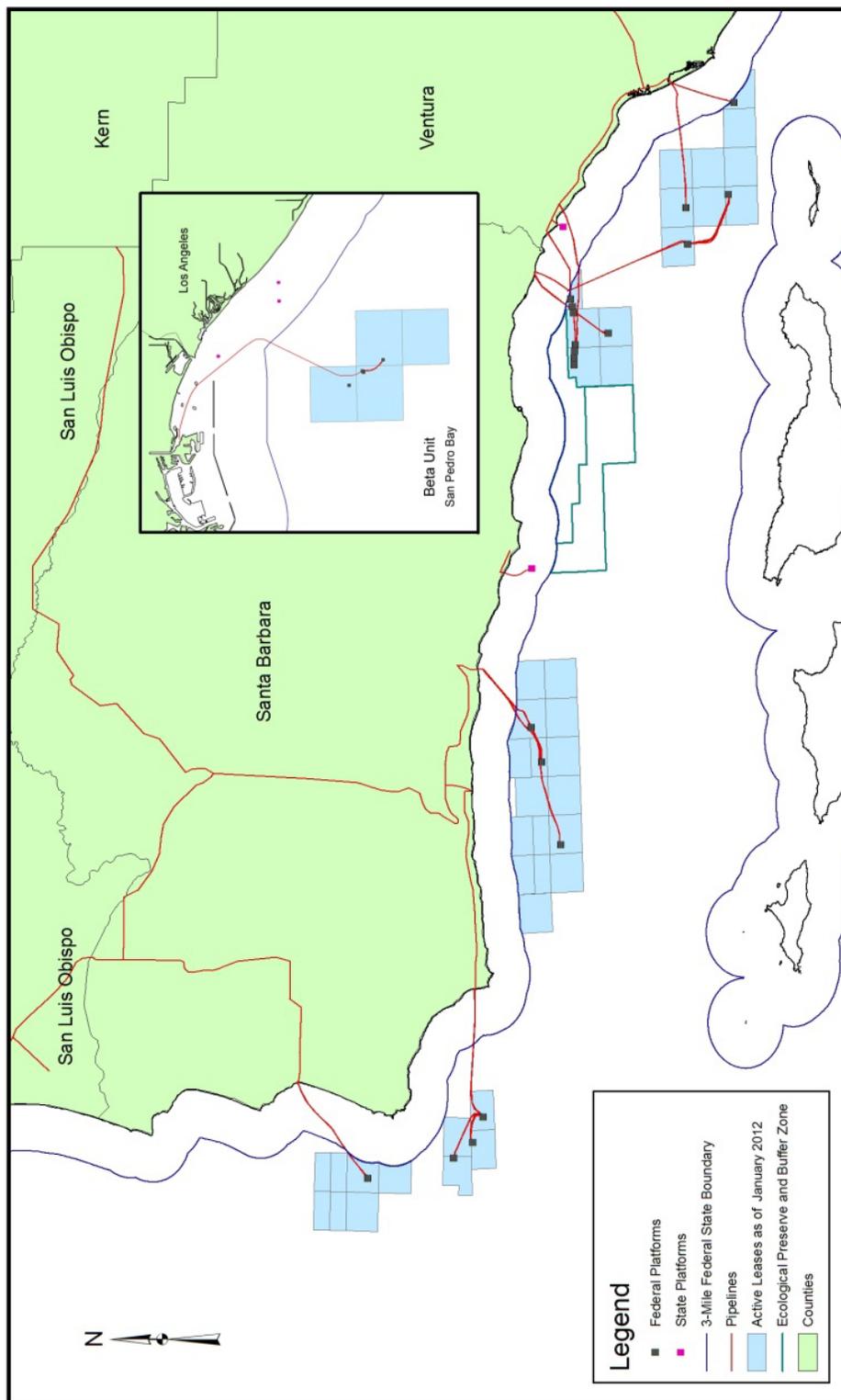


Figure 2. Wave Resource Potential for the U.S. West Coast and Hawaii (NREL, undated)

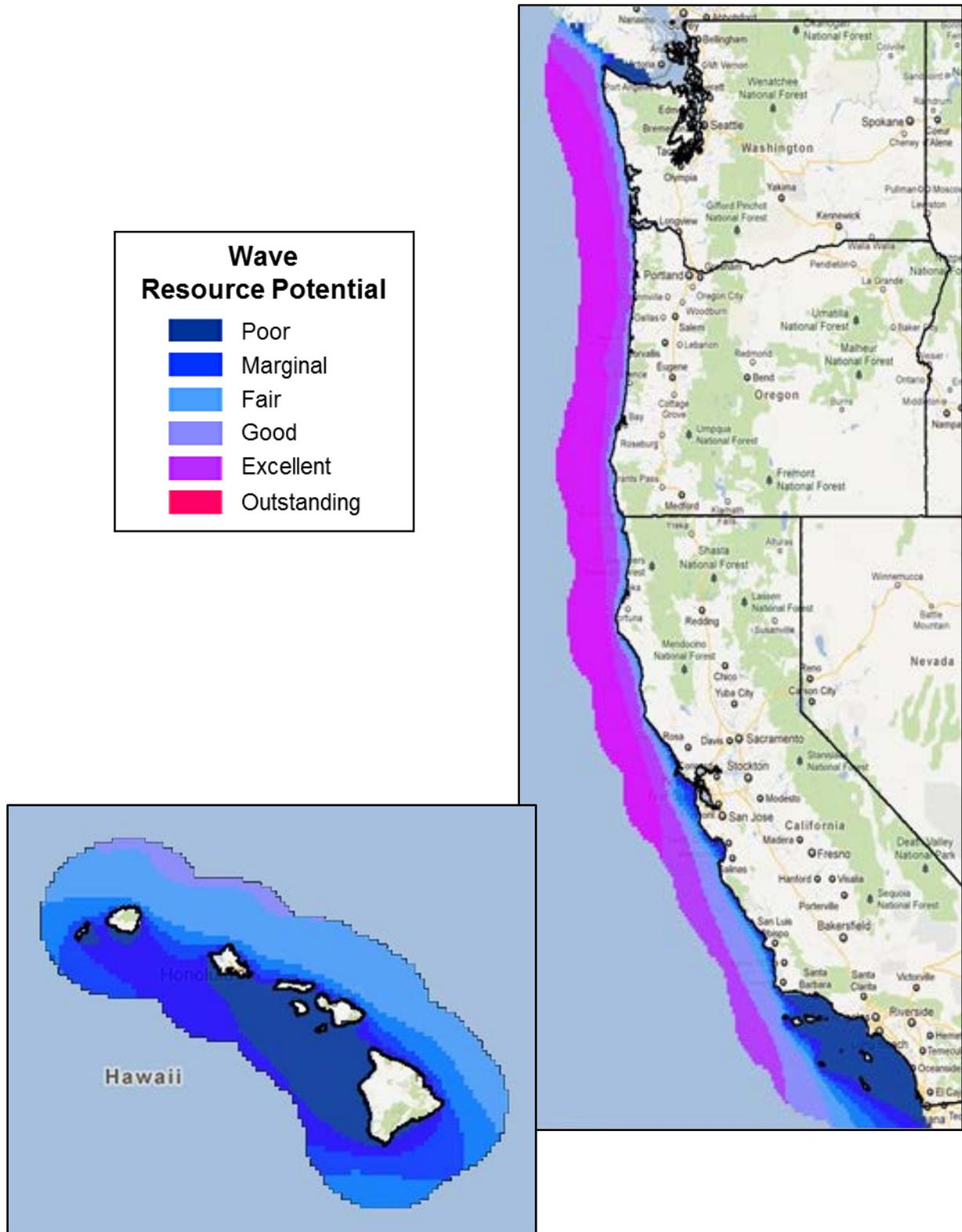
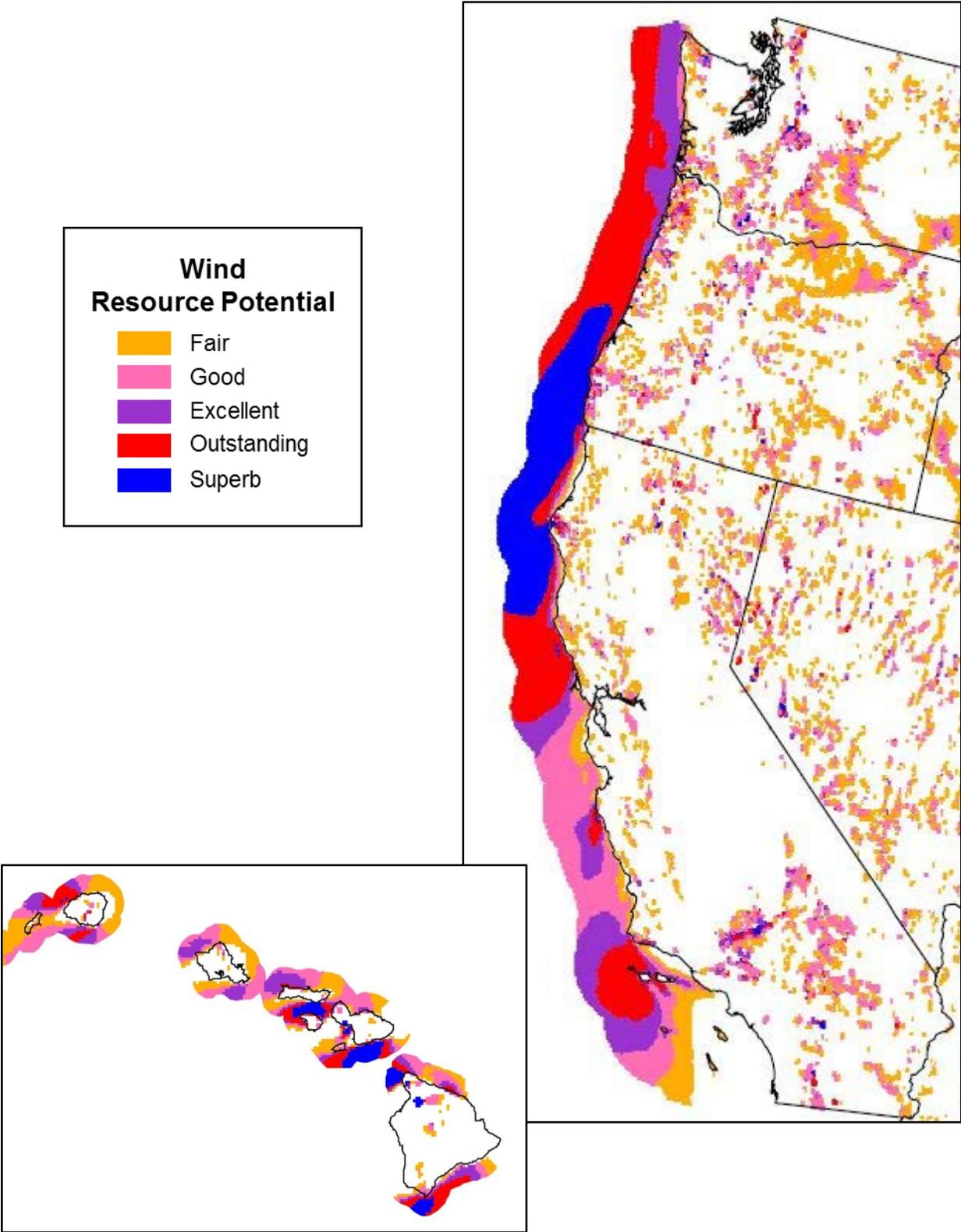


Figure 3. Wind Resource Potential for the U.S. West Coast and Hawaii (NREL, 2009)



1.3 Projected OCS Activities

The ESP supports BOEM decisions associated with leasing, exploration, and development of oil and natural gas, marine minerals, and renewable energy. Some studies serve needs associated with both conventional and renewable energy programs.

1.3.1 Oil and Natural Gas

Typically, the OCS oil and gas management program is addressed as prelease and postlease. Prelease activities include those leading to the development of a 5-year program in which oil and gas lease sales are scheduled. Due to repeated moratoria, the Pacific Region has not been included in a 5-Year Oil and Natural Gas Leasing Program since 1987. On July 14, 2008, President George W. Bush lifted the executive withdrawal of OCS lands from consideration for oil and gas leasing. The President also called for Congress to lift the annual moratorium and enact legislation to allow states to determine what happens off their coast and provide for sharing of revenues with those states that want to proceed with development. On September 30, 2008, the long-running leasing moratoria enacted annually as part of the Department of the Interior's (DOI) appropriations legislation was discontinued by Congress. However, the Pacific Region was not included for leasing in the Preliminary Revised Program for 2012-2017, which was announced by the President and the Secretary of Interior on March 31, 2010.

In the Pacific Region, postlease oil and gas activities are those associated with the development of the 43 producing leases in the Southern California Planning Area (Figure 1). Currently, 23 federal oil and gas platforms produce 22 million bbls of oil and 41 billion cf of natural gas per year. This rate could be sustained for the next several years, as federal lessees and operators continue to focus on the recovery of approximately 350 million bbls of oil in proven reserves. Studies identified in this SDP address information gaps and are geared to allow BOEM to conduct analyses that support the BOEM mission of environmental review of new oil and gas development plans as well as environmental review for the Pacific Region Bureau of Safety and Environmental Enforcement permitting and regulation of the oil and gas industry's ongoing production projects. Continued production at these facilities may present new information needs during the coming decades in order to maintain environmentally safe operations with the existing infrastructure.

Eventual decommissioning also remains an active issue. Studies are needed to address and monitor the environment adjacent to the existing facilities. For example, information from environmental studies was used in the recent assessments of the environmental effects of the drilling of certain new wells, the installation of new pipelines, and pipeline and power cable repair activities offshore Los Angeles and Santa Barbara counties. Environmental studies information was crucial to completion of National Environmental Policy Act (NEPA) documents for these activities.

1.3.2 Renewable Energy

BOEM was delegated responsibility for implementing an OCS renewable energy program with the passage of the Energy Policy Act of 2005 (EPAct). Alternative use of

existing OCS facilities is also authorized by EPO. Regulations implementing EPO were published in April 2009, and prospective developers of deepwater wind and wave energy conversion devices have started to develop proposals for projects on the Pacific OCS. Leasing and permitting OCS renewable energy development, permitting power cables on the OCS associated with renewable energy, and permitting repurposing of OCS facilities will involve new environmental considerations and, consequently, additional environmental studies. Several renewable energy developments for the Pacific Region occurred in Fiscal Year (FY) 2012.

Oregon Task Force

The Governor of Oregon, in a letter dated December 1, 2010, requested the formation of a BOEM-sponsored federal-state task force with the State of Oregon to address the use of the ocean for renewable energy development. The Oregon-focused task force supports and enhances the regional planning that is taking place through the partnership that the three West Coast states have with BOEM; this partnership is called the West Coast Governors Alliance on Ocean Health. The Secretary of the Interior accepted the request on December 30, 2010. The Pacific Region finalized a charter outlining the purpose, membership, and planned functions of the task force. Two task force meetings were held in 2012 in Portland, and one is planned for early summer 2013. The immediate focus of the BOEM Oregon Renewable Energy Task Force is to discuss available information about energy and environmental resources and to identify areas on the OCS with high renewable energy value and low use conflicts.

Oregon Research Lease Interest

The Northwest National Marine Renewable Energy Center (NNMREC) is a partnership between Oregon State University (OSU) and the University of Washington. OSU focuses on wave energy. At OSU, laboratories and wave tanks serve as an integrated, standardized test center for U.S. and international developers of wave energy. OSU and NNMREC have indicated that they will submit an application to BOEM for a research lease offshore Oregon in the third quarter of FY 2013. The coastal community of Newport has been chosen as the onshore connection to the offshore test facility within the research lease to be called the Pacific Marine Energy Center (PMEC). PEMEC is a planned \$25 million, "grid-connected" wave energy testing facility in state and OCS waters off Newport. Newport was selected by OSU and NNMREC because it offers the best advantages in cost, distance to shore, access to support services and onshore infrastructure, public support, and other factors.

Oregon Commercial Lease Interest

In December 2012, the Department of Energy (DOE) awarded a \$4 million grant and up to \$47 million in total funding to support Principle Power's WindFloat Pacific Demonstration Project off Oregon. Principle Power plans to deploy five floating platforms that support 6-megawatt (MW) wind turbines in deep water offshore Oregon. This floating wind farm is planned on the OCS approximately 15 miles due west of the Port of Coos Bay. A full-scale prototype of the WindFloat system has been operating successfully and generating electricity off the coast of Portugal for nearly two years. The

DOE grant award was supported by the State of Oregon and the Port of Coos Bay. Principal Power has met with BOEM to discuss their project on several occasions, and BOEM expects a commercial lease application in the second or third quarter of FY 2013. Coordination with the Department of Defense (DOD) has determined that these prospective renewable energy sites are compatible with DOD operations.

Oregon Science Conference

The State of Oregon requested that BOEM hold a scientific marine renewable energy conference in 2012, and this conference was held November 28-29, 2012, at OSU in Corvallis. BOEM's objectives for the Oregon Marine Renewable Energy Environmental Science Conference were (1) to showcase completed and ongoing research that addresses environmental questions associated with wave and wind energy development in the Pacific Northwest, (2) to synthesize new research and existing information and distill it into products that agencies and resource managers can use, and (3) to identify and prioritize study gaps of the technologies or potentially affected systems that can be used for scientists, managers, and funders to focus future research efforts. The conference report will outline results from discussions of baseline, impact, and monitoring breakout groups, and document priority information needs. The draft report is due in the summer of 2013. Based on preliminary information from the conference, the Pacific Region considered the most immediate information needs when developing our proposed FY 2014 profiles.

Hawaii Task Force

The Governor of Hawaii, in a letter dated May 9, 2011, requested the formation of a BOEM-sponsored federal-state task force with the State of Hawaii to address the use of the ocean for renewable energy development. The Secretary of the Interior accepted the request on July 1, 2011. The Pacific Region finalized a charter outlining the purpose, membership, and planned functions of the task force. Two task force meetings were held in 2012 in Honolulu, and an additional meeting is planned for early summer 2013. Both research and commercial leasing are expected to be significant topics for future task force discussions.

Hawaii Research Lease Interest and Clean Energy Initiative

The University of Hawaii and the Natural Energy Laboratory of Hawaii have expressed written interest in obtaining OCS research leases offshore Oahu and the Big Island of Hawaii. Hawaiian Electric Company (HECO) is in the process of requesting proposals for 200+ MW renewable energy projects. HECO's draft request for renewable energy proposals was issued in March 2012 and specified that projects deliver renewable energy to the Oahu grid by the end of 2018. HECO is seeking proposals for an interisland transmission cable system, interconnection facilities, and other power transmission infrastructure to deliver power to Oahu from renewable energy projects on neighboring islands. A right-of-way grant is required from BOEM for any portions of the cable in OCS waters outside National Marine Sanctuaries. BOEM is a Cooperating Agency in developing DOE's *Hawaii Clean Energy Programmatic Environmental Impact*

Statement, which includes analysis of a potential OCS subsea power cable for interisland energy transmission.

Hawaii Commercial Lease Interest

In January 2013, BOEM received an unsolicited application for a commercial OCS wind lease off Oahu. The lease application contained the company's technical and financial qualifications. BOEM has determined that the applicant is qualified to acquire and hold a renewable energy lease or grant on the OCS. A separate company has informed BOEM that they plan to submit an unsolicited request for commercial OCS wind leases off Oahu and will be submitting information to BOEM on its legal, technical, and financial qualifications. BOEM is coordinating with DOD to determine areas that are compatible with current DOD operations off Hawaii for OCS renewable energy development.

California Research Lease Interest

An international company is exploring options for the development of a grid-connected technology testing facility on the OCS near federal Platform Irene (in the Southern California Planning Area). The company is coordinating with Sandia National Laboratories, DOE, DOD-Vandenberg Air Force Base, the Federal Energy Regulatory Commission (FERC), California Lt. Governor Gavin Newsom, the Electric Power Research Institute, and the platform operator (Plains Exploration and Production) to develop a proposal. A meeting was held on January 25, 2012, to discuss research lease requirements.

California Commercial Lease Interest

The City and County of San Francisco informed the Pacific Region on December 9, 2010, that they plan to submit a request for an OCS wave energy lease offshore San Francisco. They have a goal to generate 100 percent of the City's electricity from renewable sources by 2020. To date, BOEM has not received a proposal; however, the City and County have completed a few site-specific environmental studies that will assist them in project planning, and a preliminary technical design study is underway.

1.3.3 Marine Minerals Other than Oil and Gas

Marine mineral resources other than oil and gas exist on the Pacific OCS (e.g., sand and gravel, and strategic mineral resources containing copper, lead, zinc, gold, platinum, and rare earth minerals). Developers have periodically expressed interest in obtaining leases to develop these resources; however, there are no pending lease requests at this time. Although no studies specific to Pacific OCS marine mineral resources are ongoing or proposed in this SDP, there may be future information needs (including the need for environmental studies) as extraction methods and economic conditions improve and opportunities to explore and extract those resources become increasingly attractive to developers.

1.4 Identification of Information Needs

The Pacific Region's primary information needs for FY 2014-2016 fall into the following categories and support existing oil and gas production and/or potential renewable energy leasing activities.

1.4.1 Information Needs in Support of Existing Oil and Gas Production

Physical Oceanography

The General NOAA Oil Modeling Environment (GNOME) that BOEM Pacific Region currently uses to conduct oil spill risk analyses is restricted to geographic areas very near active oil and gas development locations in southern California. As a result, environmental analysts in the Pacific Region are limited in the geographic area and to short time periods over which they can model oil spill trajectories. The data input to the model needs to be updated and expanded to provide more accurate information to fulfill our responsibility to conduct offshore oil and gas risk analyses over a wider geographic area and longer time periods. The proposed study *Expansion of West Coast Oceanographic Modeling Capability* will allow BOEM analysts to conduct more accurate offshore oil and gas risk analyses.

1.4.2 Information Needs in Support of Renewable Energy Leasing

Habitat and Ecology

Oregon is at the forefront among West Coast states in planning for offshore renewable energy. *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 take place in 2013. 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 only feasible way to fill these data gaps is through individual tracking studies.

Over the past decade, OSU, USGS, and other 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 the smaller, locally breeding and wintering species that dominate marine bird communities off Oregon and the Northern CCS throughout most of the year. Furthermore, integrating these data with physical variables to generate more robust predictive habitat-use models is needed to inform broad-scale marine spatial planning of the OCS. The proposed study *Year-round and Diel Patterns in Habitat-use of Seabirds off Oregon* would integrate results from tracking studies with those from ongoing transect surveys (e.g., the BOEM-funded Pacific Continental Shelf Environmental Assessment [PaCSEA] study to map seasonal distributions among all seabirds in the northern CCS OCS region) will be critical for

comprehensive, spatially explicit impact vulnerability models for wave- and wind-energy conversion devices.

Fates and Effects

With the EPO Act authorization to regulate OCS renewable energy, new program considerations for BOEM include the regulation of a newly emerging offshore industry that will involve the deployment of prototype technology with uncertain environmental and engineering implications. As such, the safety and protection of the environment from this newly emerging industry are generally unknown, and the study of emerging technologies and monitoring renewable energy projects of opportunity in the Pacific Region shall provide effective analysis, mitigation, and management of those sources. In order for BOEM to make better decisions on renewable energy project siting, installation, and operations, the Bureau needs to monitor and observe the operations in the field for environmental impacts and develop mitigation measures to minimize environmental impacts. Data from monitoring the environment at and near offshore renewable energy projects would be used by BOEM to evaluate mitigation measures and project conditions of future OCS renewable energy projects and operations. The proposed study *Understanding and Mitigating the Effects of Marine Renewable Energy Technologies on the Coastal and Marine Environment in the Pacific OCS Region* would monitor short-term environmental data from offshore renewable energy projects and applications. The purpose of this study is to monitor the effects of marine renewable technologies, including marine hydrokinetic (MHK) and offshore wind devices, on the coastal and marine environments, and to develop effective mitigation strategies to reduce or avoid potential impacts from renewable technologies in the Pacific Region.

Marine Mammals and Protected Species

The erection and operation of floating deepwater wind turbines and other renewable energy devices may have a variety of effects on seabirds, most of which will vary by species based on their behavior at sea. Since its inception, the Pacific Region has gathered a large amount of information on Pacific seabirds. Experience from onshore wind development and wind development offshore in Europe suggests that siting of facilities is an important consideration for minimizing impacts to bird species. Presently, there are extensive seabird databases for the Pacific OCS that provide relative density estimates and distributions at sea along fixed transects. However, species-specific distributions and estimates can be improved and extended to areas between transects or in non-surveyed areas by incorporating appropriate environmental and oceanographic covariates to model continuous density distributions. The proposed study *Data Synthesis and High-resolution Predictive Modeling of Marine Bird Spatial Distributions on the Pacific OCS* will provide detailed information linking varying environmental and oceanographic conditions to seabirds within the Pacific OCS, and will help define habitat characteristics and identify mechanisms that aggregate seabirds. Thus, this study will use the most recent seabird distributional datasets combined with oceanographic habitat features in analytical models to predict occurrence and abundance of seabirds at sea.

Interdisciplinary Habitat and Ecology / Social and Economic Sciences

BOEM requires information about the level of impacts from seafloor power cables on marine fisheries. West Coast fishermen have expressed extreme concern over the potential effects of renewable energy power cables on their ability to harvest target species of rock and dungeness crabs. Fishermen are concerned that electromagnetic fields (EMF) associated with renewable energy power cables will present an electrified fence on the seafloor that their resource will not cross. If true, their ability to catch crab species near power cables could be negatively impacted. This study is designed to test the fear of crab fishermen that their target species will not traverse power cables, even in response to baited traps. Combined with the assistance of professional fishermen, submarine transmission cables that electrify communities and offshore oil platforms in the Pacific Region provide an opportunity to test the harvest of crab species across power cables. The proposed study *Potential Impacts of Submarine Power Cables on Crab Harvest* will help determine if crabs will cross the line. The information will be applicable to consideration of offshore renewable energy projects.

1.4.3 Information Needs in Support of Both Oil and Gas Production and Renewable Energy Leasing

Fates and Effects

Knowledge of how nearshore communities are being altered by climate change is essential to BOEM's ability to predict and detect the effects of offshore energy activities in these coastal ecosystems. Climate change is likely to substantially alter the physical processes structuring nearshore rocky reef ecosystems over the coming decades. In southern California, anticipated physical effects include increases in temperature and a reduction in ocean pH, as well as changes in the frequency and severity of wave disturbance events. The proposed study *Predicting and Detecting the Effects of Climate Change and Ocean Acidification Using Long-term Ecological Data* will use DOI long-term monitoring programs to predict how global climate change and ocean acidification will alter rocky reef ecosystems in southern California and to detect effects already underway. The study will increase our understanding of kelp forest dynamics, construct likely scenarios for future kelp forest communities, and determine whether ocean acidification has had measureable effects on vulnerable species thus far. This study will help BOEM managers predict and detect the effects of offshore energy activities by describing baseline environmental conditions and how they are shifting.

Habitat and Ecology

Continued archiving and long-term reliable curating of the collections of invertebrate specimens acquired through BOEM-sponsored projects are essential elements of biological quality assurance. This effort provides BOEM with the scientific credibility important to stakeholders' acceptance of decisionmaking in support of BOEM's offshore energy and minerals programs. BOEM conducts many biological projects in support of decisionmaking related to the development of offshore energy and mineral resources. These projects frequently result in the need to collect and archive invertebrate specimens. To that end, BOEM has maintained a long-term contract with the

Smithsonian Institution to house these collections. The proposed study *Collecting and Archiving Invertebrates from MARINE Sites for Deposition in the Smithsonian Institution with Local Replicate* seeks to collect a modest but comprehensive inventory of invertebrate vouchers from representative Multi-Agency Rocky Intertidal Network (MARINE) sites, supported by BOEM, and archive them at the Smithsonian Institution. A replicate collection, at the advice of the Smithsonian curators, would be housed in California, at the California Academy of Sciences Research, Invertebrate Zoology and Geology Collections Department.

BOEM facilitates research in support of decisionmaking related to the development of offshore energy and mineral resources. MARINE rocky intertidal surveys provide the backbone for the baseline characterization of intertidal biological communities that are vulnerable to impacts related to oil spills or potential dynamic changes from offshore renewable energy development. An important component of these studies is periodic assessment of the biodiversity at each site, and our analyses indicate that biodiversity surveys should be done once every 5-10 years. The full set of approximately 100 sites was last sampled in 2000-2002. MARINE partners and other users of biodiversity information have resampled approximately 60 of the 100 sites within the BOEM regions of interest (there are over 130 total biodiversity sampling sites). The proposed study *Strategic Resampling of Biodiversity Surveys at MARINE Sites: Completion of the Decadal Assessment* would focus on resampling the remaining 40 sites, thereby completing the decadal resampling of the biodiversity surveys.

Information Management

BOEM uses meetings and workshops to foster the exchange of information and to plan future study endeavors. The Pacific Region has not hosted an Information Transfer Meeting (ITM) since 1995, yet has a burgeoning and high-quality applied science program. The proposed study *West Coast Information Transfer Meeting* will be conducted by the Pacific Region to share results of BOEM-funded environmental studies. This type of a workshop is critical to informing the public and fellow colleagues about the science that is being funded and fostered by BOEM. Meeting discussions also assist in the planning and executing of the studies program. The Pacific Region intends to hold one ITM in 2014 that covers both conventional and renewable energy on the West Coast.

Interdisciplinary Habitat & Ecology / Social & Economic Sciences

BOEM is required under multiple federal statutes to consider the impacts of OCS activities on archaeological and biological resources. Currently, BOEM requires avoidance of areas identified through remote sensing data as having potential to be associated with submerged paleocultural landscape features. No ground-truthing, however, of any of these possible features has been conducted on the Pacific OCS. Additionally, submerged landforms may be associated with essential fish habitat (EFH) or other biologically sensitive areas, although it is unknown what geomorphological characteristics drive this sensitivity. The purpose of the proposed study *Archaeological and Biological Assessment of Submerged Landforms off the Pacific Coast* is to (1) use previously collected data of the seafloor to identify potential submerged landforms that

could indicate the presence of prehistoric archaeological sites on the Pacific OCS, (2) collect fine-scale survey and coring data to ground-truth these features, (3) analyze and describe archaeological and biological resources associated with the subject features, and (4) develop a model that can be used to interpret remote sensing data and seafloor maps in other areas along the Pacific Coast in order to better identify submerged prehistoric sites and classify their associated resources.

1.5 New Starts for FY 2013 and Ongoing Studies

Table 1 lists FY 2013 New Starts and Ongoing Studies managed by the Pacific Region. Profiles of these “current” studies can be found at <http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Studies/Current-Environmental-Studies.aspx>.

Table 1. BOEM Pacific Region New Starts for FY 2013 and Ongoing Studies

NSL #	Study Title	Planning Area(s)	Start FY	Partners
New Starts*				
Fates & Effects				
PC-13-04	Understanding the Role of Offshore Structures in Managing Potential <i>Watersipora subtorquata</i> Invasions	All PAC	2013	UCSB (thru CESU)
Habitat & Ecology				
PC-13-03	Habitat Affinities and At-sea Ranging Behaviors among Main Hawaiian Island Seabirds	HI	2013	USGS/BRD
Information Management				
PC-13-06	A Marine Biogeographic Assessment of the Main Hawaiian Islands	HI	2013	NOAA
Physical Oceanography				
PC-13-05	Predicting the Consequences of Wave Energy Absorption from Marine Renewable Energy Facilities on Nearshore Ecosystems	All PAC	2013	USGS/BRD
Social & Economic Sciences				
PC-13-01	Maritime Cultural Resources Site Assessment in the Main Hawaiian Islands	HI	2013	NOAA
Interdisciplinary				
PC-13-02	Using Ongoing Activities as Surrogates to Predict Potential Ecological Impacts from Marine Renewable Energy	All PAC	2013	DOE (thru NOPP)
<i>*Note: The procurement of any study is contingent upon availability of funding.</i>				

NSL #	Study Title	Planning Area(s)	Start FY	Partners
Ongoing Studies				
Fates & Effects				
PC-11-03	Renewable Energy <i>in situ</i> Power Cable Observation	All PAC	2011	UCSB (thru CESU)
PC-12-04	Nocturnal Surveys for Ashy Storm-Petrels and Xantus's Murrelets at Offshore Oil Production Platforms, Southern California	SC	2012	
Habitat & Ecology				
PC-10-01	Regional Importance of Manmade Structures as Rockfish Nurseries	SC	2010	USGS/BRD
PC-10-02	MMS MARINe (Multi-Agency Rocky Intertidal Network)	SC, CC, NC	2010	UCSC, UCSB, UCLA
PC-10-07	Survey of Benthic Communities near Potential Renewable Energy Sites Offshore the Pacific Northwest	WA-OR	2010	OSU (thru CESU)
PC-11-02	DOI Partnership: Distinguishing Between Human and Natural Causes of Change in Nearshore Ecosystems Using Long-term Data from DOI Monitoring Programs	SC	2011	NPS, USGS, UCSB (thru CESU)
PC-12-02	Biological Productivity of Fish Associated with Offshore Oil and Gas Structures on the Pacific OCS	SC	2012	UCSB, OC (thru CESU)
PC-12-03	Pacific Regional Intertidal Sampling and Monitoring (PRISM) Study	SC	2012	UCLA
PC-12-07	Analysis of Fish Populations at Platforms off Summerland, California	SC	2012	UCSB, OC (thru CESU)
Information Management				
PC-10-x13	Bayesian Integration for Marine Spatial Planning and Renewable Energy Siting	WA-OR, NC	2010	DOE, NOAA (thru NOPP)
Marine Mammals & Protected Species				
PC-10-05	Seabird and Marine Mammal Surveys off the Northern California, Oregon and Washington Coasts	WA-OR, NC	2010	USGS/BRD, USFWS
PC-11-04	Southern Sea Otter Range Expansion and Habitat Use and Interaction with Manmade Structures	SC	2011	USGS/BRD

NSL #	Study Title	Planning Area(s)	Start FY	Partners
PC-12-01	Developing and Applying a Vulnerability Index for Scaling the Possible Adverse Effects of Offshore Renewable Energy Projects on Seabirds on the Pacific OCS	All PAC	2012	USGS/BRD, USFWS
PC-12-06	Characterizing and Quantifying Sea Lion and Seal Use of Offshore Manmade Structures off California	SC	2012	NMFS
PC-12-x11	Oregon Marine Renewable Energy Science Conference	WA-OR, NC	2012	OSU (thru CESU)
Social & Economic Sciences				
PC-10-08 a & b	Renewable Energy Visual Evaluations	WA-OR, NC, SC	2010	DOE (thru NOPP)
PC-11-01	Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence on the Pacific OCS	WA-OR, NC, CC, SC	2011	
No NSL # (regional funds)	Pacific Regional Ocean Uses Atlas	WA-OR, HI	2012	NOAA
No NSL # (regional funds)	Characterization of Tribal Cultural Landscapes	WA-OR, NC, CC, SC	2012	NOAA
Interdisciplinary				
PC-07-01	Environmental Mitigation Monitoring	SC	2007	
Planning Area Codes				
SC = Southern California Planning Area		WA-OR = Washington-Oregon Planning Area		
CC = Central California Planning Area		HI = Hawaii OCS		
NC = Northern California Planning Area		All PAC = SC + CC + NC + WA-OR + HI		
Partner Codes				
Partners providing funds, equipment or other in-kind contributions to study efforts:				
BRD = Biological Resources Division, U.S. Geological Survey				
CESU = Cooperative Ecosystem Studies Unit				
DOE = Department of Energy				
NMFS = National Marine Fisheries Service				
NOAA = National Oceanographic and Atmospheric Administration				
NOPP = National Oceanographic Partnership Program				
NPS = National Park Service				
OC = Occidental College				
OSU = Oregon State University				
UCLA = University of California Los Angeles				
UCSB = University of California Santa Barbara				
UCSC = University of California Santa Cruz				
USFWS = U.S. Fish and Wildlife Service				
USGS = U.S. Geological Survey				
USGS/BRD = U.S. Geological Survey/Biological Resources Division				

SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

This section provides a tabular summary and profiles of Pacific Region studies proposed for the FY 2014 national studies list (NSL) (section 2.2) and FY 2015 NSL (section 2.3).

Reference information about the Pacific Region ESP can found at:

Pacific Studies homepage:

<http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Pacific-Studies.aspx>

Current Pacific Studies:

<http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Studies/Current-Environmental-Studies.aspx>

Recently Completed Pacific Studies:

<http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Studies/Completed-Studies.aspx>

2.2 Profiles of Studies Proposed for the Fiscal Year 2014 NSL

This Pacific Region FY 2014-2016 SDP includes study profiles that uniquely support conventional energy or renewable energy, and study profiles that support both renewable and conventional energy. The SDP includes profiles within the disciplines of fates and effects, habitat and ecology, information management, marine mammals and protected species, physical oceanography, and social and economic sciences. The profiles represent studies to assess and monitor the physical and social environment. Several proposed studies represent multiyear, multidisciplinary efforts aimed at studying a variety of resources within the Pacific Region. Studies envision coordinated efforts through interagency agreements and cooperative agreements with other federal and state agencies and universities.

Ten new studies supporting ongoing and potential future activities in the Pacific Region are proposed for the FY 2014 NSL. The studies are listed in Table 2 and described in the succeeding profiles.

Table 2. BOEM Pacific Region Studies Proposed for the Fiscal Year 2014 NSL

SDP Page Number	Discipline	Regional Ranking	Study Title
23	PO	1	Expansion of West Coast Oceanographic Modeling Capability
25	IN (HE/SE)	2	Potential Impacts of Submarine Power Cables on Crab Harvest
27	MM	3	Data Synthesis and High-resolution Predictive Modeling of Marine Bird Spatial Distributions on the Pacific OCS
29	IN (HE/SE)	4	Archaeological and Biological Assessment of Submerged Landforms off the Pacific Coast
31	IM	5	West Coast Information Transfer Meeting
33	FE	6	Predicting and Detecting the Effects of Climate Change and Ocean Acidification Using Long-term Ecological Data
35	FE	7	Understanding and Mitigating the Effects of Marine Renewable Energy Technologies on the Coastal and Marine Environment in the Pacific OCS Region
37	HE	8	Collecting and Archiving Invertebrates from MARINe Sites for Deposition in the Smithsonian Institute with Local Replicate
39	HE	9	Year-round and Diel Patterns in Habitat-use of Seabirds off Oregon
41	HE	10	Strategic Resampling of Biodiversity Surveys at MARINe Sites: Completion of the Decadal Assessment
Discipline Codes			
AQ = Air Quality		FE = Fates & Effects	
HE = Habitat & Ecology		IM = Information Management	
IN = Interdisciplinary		MM = Marine Mammals & Protected Species	
PO = Physical Oceanography		SE = Social & Economic Sciences	

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California

Title: Expansion of West Coast Oceanographic Modeling Capability

BOEM Information Need(s) to be Addressed: BOEM analysts in the Pacific Region are limited in the geographic area where they can model oil spill trajectories. Data input to the model needs to be updated to enable a finer spatial and temporal resolution. Expanding the geographic range and data precision will allow BOEM analysts to conduct more accurate offshore oil and gas risk analyses. Expanding oceanographic modeling capability for oil and gas across southern California would meet the needs of BOEM Pacific Region's offshore oil and gas program.

Approx. Cost: (in thousands) \$240

Period of Performance: FY 2014-2016

Description:

Background: The oil spill model, General NOAA Oil Modeling Environment (GNOME), which BOEM Pacific Region currently uses to conduct oil spill risk analyses, is limited in geographic area to active oil and gas development locations in southern California. The data input to the model needs to be updated and expanded to provide more accurate information to fulfill our responsibility to conduct offshore oil and gas risk analyses over a wider geographic area. The Integrated Ocean Observing Systems along the West Coast of the U.S. maintain and enable real-time data of wind, waves, and currents offshore coastal California. These data are typically stored in a format that can be brought into oceanographic models. Conducting a re-analysis or hindcast of the available oceanographic data would enable analysts and decision makers to see how wind, waves, and currents vary seasonally and yearly. Broadening the geographic range of available data and acquiring, compiling, and converting real-time data into a format to run in oil spill models will improve BOEM Pacific Region's ability to conduct oil spill risk analysis in southern California.

Objectives:

- Expand the geographic area that BOEM Pacific Region is able to examine for oil and gas risk analyses.
- Provide more up-to-date and accurate data for oil spill models.

Methods: This project will run a multi-year hindcast, or re-analysis, of winds, waves, and currents along the coast of California. This will be accomplished through acquiring and converting existing data, incorporating the data into oceanographic models, running these models, and interpreting the results. The project would be completed in three sub-systems: (1) Winds would be calculated at high horizontal and temporal resolution and validated using existing datasets; (2) A wave model would be forced by the wind model results and be validated through in situ measurements; and (3) The ocean model would be run at high resolution and include temperature, salinity, and

currents, assimilate *in situ* data, and be forced by the hindcast wind model results. This three-phase analysis will provide a more accurate representation of processes driving oceanographic conditions. The end products will be (1) data products that can be incorporated into NOAA's GNOME model for oil spill risk analysis; (2) visual outputs of oceanographic conditions along the coast of California; (3) assembled products and data that will be publicly available and can be incorporated into oceanographic models for future analyses; and (4) information that will be in a format compatible with other BOEM analysis requirements (e.g., Multipurpose Marine Cadastre and Environmental Studies Program Information System [ESPIS]).

Revised Date: January 15, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): All

Title: Potential Impacts of Submarine Power Cables on Crab Harvest

BOEM Information Need(s) to be Addressed: BOEM requires information concerning the level of impacts from seafloor power cables on marine fisheries. West Coast fishermen have expressed extreme concern over the potential effects of renewable energy power cables on their ability to harvest target species of rock and dungeness crabs. Fishermen are concerned that electromagnetic fields (EMF) associated with renewable energy power cables will present an electrified fence on the seafloor that their resource will not cross. If true, their ability to catch crab species near power cables could be negatively impacted. This study is designed to test the fear of crab fishermen that their target species will not traverse power cables, even in response to baited traps. Combined with the assistance of professional fishermen, submarine transmission cables that electrify communities and offshore oil platforms in the Pacific Region provide an opportunity to test the harvest of crab species across power cables. The information will be applicable to consideration of offshore renewable energy projects.

Approx. Cost: (in thousands) \$600

Period of Performance: FY 2014-2017

Description:

Background: Renewable energy technologies will focus on the generation of electricity. In all cases, we expect the individual devices will be interconnected with power cables to transmit the electricity to a platform or gathering site, and that a single cable will connect the entire facility to shore. Proper shielding can block electric fields but not magnetic fields. One of the potential impacts from energized power cables may be the local attraction or repulsion of economically important crab species due to EMF. Several commercial crab and lobster species are found in the immediate vicinity of the existing cables within areas where fishermen harvest. These species include rock crab (*Cancer spp.*) and dungeness crab (*Metacarcinus magister*). Although there are many factors that control crab response to bait, commercial fishermen successfully harvest, hold, and market crab species on the Pacific Coast. The dungeness crab fishery is the most-valued single-species fishery for Oregon, the highest-valued invertebrate fishery for Washington, and among the top four-valued invertebrate fisheries for California. Rock crab is next in value to dungeness crab for California.

In the Pacific Region, there are at least two adjacent 35 KV cables, several miles long, located within the same corridor on the seafloor within the Santa Ynez Unit offshore Southern California Planning Area that electrify oil platforms. Both of these cables use the industry standards of the power cables that would be used for connecting devices (35 KV) within renewable energy installations. These cables were emplaced concurrently by the manufacturer. These cables provide a unique opportunity to perform a pilot project using commercial rock crab fishermen to test the fear of crab fishers that target species will not traverse power cables in response to baited traps.

Market research discussions have been held with Stephanie Munz, president of the Commercial Fishermen of Santa Barbara, who has indicated the project is feasible and of interest. Should the pilot project prove effective, dungeness crab fishers in San Francisco Bay, Puget Sound, and/or Juneau, Alaska, will be approached for involvement. Only locations where power cables and commercial crab fishing overlap will be useful, as will a variety of AC or DC cables at various KV. Knowledge gained from this study will be directly applicable to review of renewable energy projects.

With the assistance of commercial fishermen, we will trap, hold, mark, and release economically important crabs on the opposite side of power cables from baited traps and in a nearby control area with no cables. We will compare catch of crab species to determine catch per unit effort (CPUE) for marked animals at control versus cable areas. Data will directly respond to fishermen's concerns about the target species moving across power cables to be harvested and will inform NEPA assessments of renewable energy projects.

Objectives: The objective of this study is to determine if rock crab and dungeness crab will traverse power cables and be caught in commercial traps.

Methods: Perform power analyses to determine number of crabs, number of traps, and number of trials needed.

Pilot project for cancer crabs:

- Hire a commercial cancer crab fisher of Santa Barbara
- Coordinate with appropriate permitting agencies
- Catch, mark, and hold cancer crabs
- Place baited traps up current at Santa Ynez Unit power cables and in a control area away from cables
- Release crabs down current from power cables and at similar distance from control traps
- Maintain traps, monitor, and record catch per fishermen's practice

Analyze the pilot project and revise the experimental approach as necessary. If the pilot project provides necessary data to determine CPUE, determine the location and KV of power cables within dungeness crab commercial fishing areas, and choose at least two locations of variable type and KV.

Dungeness crab:

- Hire a commercial dungeness crab fisher of the region
- Coordinate with appropriate permitting agencies
- Catch, mark, and hold dungeness crabs
- Place baited traps up current at power cables and in a control area away from cables
- Release crabs down current from power cables and at similar distance from control traps
- Maintain traps, monitor, and record catch per fishermen's practice

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

Title: Data Synthesis and High-resolution Predictive Modeling of Marine Bird Spatial Distributions on the Pacific OCS

BOEM Information Need(s) to be Addressed: Experience from onshore wind development and wind development offshore in Europe suggests that siting of facilities is an important consideration for minimizing impacts to bird species. Presently, there are extensive seabird databases for the Pacific OCS that provide relative density estimates and distributions at sea along survey transects. However, species-specific estimates of distribution, relative abundance, and occurrence probability can be improved and extended to areas between transects or in non-surveyed areas by incorporating appropriate environmental and oceanographic covariates to model continuous density distributions. The resulting high-resolution maps of predicted long-term average patterns of seabird occurrence and abundance will provide critical information for renewable energy siting and allow BOEM to predict and evaluate potential environmental effects of management actions and project approvals throughout the Pacific OCS.

Approx. Cost: (in thousands) \$600

Period of Performance: FY 2014-2016

Description:

Background: The proposed study will provide detailed information linking varying environmental and oceanographic conditions to seabirds within the Pacific OCS and will help define habitat characteristics and identify mechanisms that aggregate seabirds. Thus, this study will use the most recent seabird distributional datasets, combined with oceanographic habitat features in analytical models, to predict occurrence and abundance of seabirds at sea.

Maps of seabird distribution and uncertainty in knowledge of distribution are a basic information need to assess impacts of offshore development on marine birds. Discussions during the USFWS Marine Bird Science and Offshore Wind Workshop and the BOEM Wind Energy Workshop in 2011 emphasized the importance of identifying areas of persistent aggregations of birds (“hotspots”) that may be threatened by offshore wind energy development as well as areas where birds do not aggregate (“coldspots”).

Sampling of the marine environment is difficult due to weather and other logistics; therefore, approaches such as predictive population modeling have been recommended to aid agencies in assessing the potential impacts of development on wildlife. Other modeling efforts have been conducted in this region, but the only full regional-scale effort (Nur et al., 2011) was limited in spatial resolution (3-10 km), depending on environmental predictors used; coarser than the BOEM lease block scale), only produced useable results for a small subset of species, and did not provide a spatially explicit assessment of model uncertainty or model performance, limiting its

applicability in risk assessment. Moreover, since the time of this study, higher resolution oceanographic datasets have become widely available (e.g., chlorophyll and sea surface temperature at 1.1 km resolution), new descriptions of ocean habitat features have been found to vastly improve predictions of seabird abundance (e.g., Suryan et al., 2012), and new seabird survey data have been collected. On the Atlantic OCS, predictive models of seabird occurrence and abundance developed by NOAA's National Centers for Coastal Ocean Science have been successfully developed at <1 km resolution, with associated maps of uncertainty, and have already proven useful in BOEM's environmental assessment processes (Kinlan et al., 2012).

Objectives: Increase BOEM's understanding of marine bird distribution on the Pacific OCS by (1) predictively modeling marine bird distribution on the Pacific OCS, taking into account all available data and relationships with environmental variables; and (2) mapping the predictive distribution of marine birds to identify areas of persistent aggregation and avoidance.

Methods: The proposed study will identify, collect, and synthesize available quantitative scientific seabird survey data for the Pacific OCS off California, Oregon, and Washington collected over the last 50 years and merge these in a common database. This will entail researching the history of datasets, making appropriate contacts, forming partnerships, and developing metadata. Sightings will be extracted from databases by species to identify species and groups of interest, combine species into functional groups where necessary, develop standardized effort metrics and relative indices of occurrence and abundance, and develop dataset and taxa-specific uncertainty estimates/weights. Five major seabird datasets from the Pacific OCS have already been identified for use in this study. Environmental and oceanographic predictors will be identified, collected, formatted, and processed for the Pacific OCS. Exploratory data analysis will be conducted and modeling methods chosen that account for multiple datasets with different levels of confidence and measurement error; account for different spatial and temporal support; and adapt existing methods that have been successfully applied in other regions. Model methods will be refined to maximize predictive performance for the Pacific OCS.

Predictive modeling will produce gridded, high-resolution (~1 km horizontal grid) predictive maps of presence probability and sightings per unit effort (SPUE) for bird species and groups of interest, including maps of seasonal climatological means and quantiles that are integrated to produce annual climatologies and uncertainty maps. Model predictions will be provided for presence probability and SPUE within BOEM lease blocks or similar sets of polygonal planning areas provided by planning bodies by performing spatial simulation and calculating ensemble statistics for each lease block. Predictive maps will be combined across species and groups to identify hotspots and coldspots of abundance and diversity and/or occurrence of multi-species assemblages of interest with a limited, targeted effort based on guidance from BOEM, USFWS, USGS, and other interested parties on multi-species patterns of interest. Reports and data, including digital versions of predictive maps and uncertainty, will be in a format that is compatible with the BOEM Multipurpose Marine Cadastre and similar BOEM datasets.

Revised Date: March 22, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): Southern California, Northern California,
Washington-Oregon

Title: Archaeological and Biological Assessment of Submerged
Landforms off the Pacific Coast

BOEM Information Need(s) to be Addressed: BOEM is required under multiple statutes (e.g., Outer Continental Shelf Lands Act, NEPA, Endangered Species Act, and National Historic Preservation Act [NHPA]) to consider the impacts of OCS activities on archaeological and biological resources. Currently, BOEM requires avoidance of areas identified through remote sensing data as having potential to be associated with submerged paleocultural landscape features. No ground-truthing, however, of any of these possible features has been conducted on the Pacific OCS. Additionally, submerged landforms may be associated with essential fish habitat (EFH) or other biologically sensitive areas, although it is unknown what geomorphological characteristics drive this sensitivity. The purpose of this study is to use existing data of the seafloor to (1) use previously collected data of the seafloor to identify potential submerged landforms that could indicate the presence of prehistoric archaeological sites on the Pacific OCS, (2) collect fine-scale survey and coring data to ground-truth these features, (3) analyze and describe archaeological and biological resources associated with the subject features, and (4) develop a model that can be used to interpret remote sensing data and seafloor maps in other areas along the Pacific Coast in order to better identify submerged prehistoric sites and classify their associated resources. BOEM will use this information in NEPA documents, and NHPA, ESA, and EFH consultations, as well as government-to-government consultations with Native American tribes. Further, this information will inform decisions regarding lease sales, notices to lessees, information to lessees, and will be useful in developing mitigation measures.

Approx. Cost: (in thousands) \$900 **Period of Performance:** FY 2014-2017

Description:

Background: Because the spatial jurisdiction of BOEM lies entirely offshore beneath the surface of the water, a fundamental starting point that aids all phases of BOEM decisionmaking on the OCS is to characterize the seafloor. USGS and NOAA have conducted extensive hydrographic surveys along the Pacific Coast. Additionally, a nearly completed BOEM study, *Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence on the Pacific OCS* (POCS Inventory), will provide a digital elevation model of the Pacific OCS paleolandscape and an analysis of where potential offshore paleocultural landforms might be expected. The next step in the process is to identify areas that suggest a high potential for the presence of submerged prehistoric sites and ground-truth some of these target areas. Paired with these archeological investigations will be a survey of submerged landforms potentially associated with EFH or other biologically sensitive areas. For example, the edge of the Hueneme Submarine Canyon (a submerged landform) hosts the only known skate egg

nursery on the Pacific OCS (Love et al., 2008); other features may also be significant. This study will attempt to determine if landforms and sites are being identified correctly from the geophysical data acquired under guidelines published in NTL 2006-P03, and if these buried landforms actually are preserved prehistoric sites.

Objectives: The objectives of this study are to conduct field investigations of areas that have been identified as having a high potential to be associated with paleocultural landforms and develop and field test a geospatial model that will aid in the identification and classification of potential paleocultural landforms from existing remote sensing data and seafloor maps in areas along the Pacific Coast.

Methods: Four tasks will be performed.

(1) *Evaluate existing remote sensing data and review current theories on sea level rise during the Last Glacial Maximum (LGM) to identify high probability areas for further testing.* Extensive seafloor mapping data collected by BOEM, NOAA, and USGS, historical information on sea level changes, modeling from the POCS Inventory, and anthropological and biological information in the scientific literature will be used to identify submerged relict features that could represent paleolandforms and may function as loci for sensitive ecological resources.

(2) *Conduct fine-scale survey and ground-truth at least four submerged landform features.* Various methods will be used to ground-truth identified features, including state-of-the-art remote sensing technology (e.g., bathymetric echo sounders; side-scan and high-resolution [CHIRP] sub-bottom sonar; high penetration sub-bottom sonar; and magnetometers [for targeted application], remotely operated vehicles, and core samples). Cores will be taken from each site and analyzed to identify, date, and characterize potential archaeological sites and to assist in reconstructing the region's paleoenvironment. Video transects across the features will identify biological resources.

(3) *Analyze new data for possible indicators of prehistoric human activity and biological resources associated with paleolandforms.* Analysis for identifying potential paleocultural landforms will include, at a minimum, remote sensing and coring data collected through this effort, a review of existing theories on sea level rise during the LGM, human migration patterns, and terrestrial analogs, among others. Assessment of biological resources will include a seafloor habitat description according to the Coastal and Marine Ecological Classification Standard, and an estimate of the species richness and density of important species, including corals and managed fish species.

(4) *Develop and refine a model that can be used to interpret remote sensing data and seafloor maps in other areas along the Pacific Coast.* Analyses will include recommendations for processing future remote sensing data collected to support BOEM-permitted activities on the Pacific OCS and for appropriate survey parameters to better identify these resources.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

Title: West Coast Information Transfer Meeting

BOEM Information Need(s) to be Addressed: BOEM uses meetings and workshops to foster the exchange of information and to plan future study endeavors. The Pacific Region has not hosted an Information Transfer Meeting (ITM) since 1995, yet has a burgeoning and high-quality applied science program. The ITM will be held by the Pacific Region to share results of BOEM-funded environmental studies. This type of a workshop is critical to informing the public and fellow colleagues about the science that is being funded and fostered by BOEM. Meeting discussions also assist in the planning and executing of the studies program. The Pacific Region intends to hold one ITM in 2014 that covers both conventional and renewable energy on the West Coast, and another ITM in 2015 or 2016 for renewable energy in Hawaii.

Approx. Cost: (in thousands) \$150

Period of Performance: FY 2014-2016

Description:

Background: The purpose of the ITM is to foster sharing of information among participants about current research, accomplishments, or issues of concern to BOEM. Presentations at the ITM will pertain to BOEM's Pacific OCS renewable energy and oil and gas programs, as well as regional environmental, social, or economic concerns, or current OCS industry activities or technologies. The Pacific Region held many ITMs during the 1980s and 1990s. The meetings were originally held annually; however, due to budget constraints and the fact that leasing for conventional energy was curtailed and there was a corresponding and significant decrease in Pacific Region studies, a decision was made to no longer hold Pacific Region ITMs. BOEM will hold a two-day ITM in 2014 on the West Coast to include completed and ongoing studies for both conventional and renewable energy. Past ITMs have convened 200-400 attendees comprised of BOEM scientists, other federal and state agency partners, industry, academia, contractors, media, and the general public. ITMs are most productive when handled by a contractor, when held at a venue other than a BOEM office, and when proceedings are produced.

Objectives: The objective of this study is to conduct an ITM for exchange of information, either through broad, general topics or specific topics.

Methods: BOEM will work with a contractor to plan and implement a West Coast ITM in 2014. Tasks will include, but not be limited to, (1) identifying a suitable meeting location, venue, and date; (2) developing an effective meeting format and schedule; (3) identifying and inviting presenters; (4) promoting the meeting to attendees; and (5) preparing pre- and post-meeting materials.

Revised Date: January 15, 2013

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Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): All

Title: Predicting and Detecting the Effects of Climate Change and Ocean Acidification Using Long-term Ecological Data

BOEM Information Need(s) to be Addressed: The purpose of this study is use DOI long-term monitoring programs to predict how global climate change and ocean acidification will alter rocky reef ecosystems in southern California and to detect effects already underway. The need for this study is to increase our understanding of kelp forest dynamics, construct likely scenarios for future kelp forest communities, and determine whether ocean acidification has had measureable effects on vulnerable species thus far. These results will help BOEM managers predict and detect the effects of offshore energy activities by describing baseline environmental conditions and how they are shifting. The study may also inform collaborative ocean-stewardship efforts in which BOEM participates, including in support of the National Ocean Policy and West Coast Governors Alliance, both of which have identified ocean acidification as a priority area.

Approx. Cost: (in thousands) \$250

Period of Performance: FY 2014-2015

Description:

Background: Climate change is likely to substantially alter the physical processes structuring nearshore rocky reef ecosystems over the coming decades. In southern California, anticipated physical effects include increases in temperature and a reduction in ocean pH, as well as changes in the frequency and severity of wave disturbance events. It is unclear how these changes in the physical environment will influence the ecological communities on southern California's reefs, but knowledge of how these communities will change is critical to BOEM's ability to predict and detect the effects of offshore energy activities in these coastal ecosystems.

In nearshore waters off southern California, climate change is occurring within a system already strongly influenced by several natural sources of interannual and interdecadal climate variability, including the Pacific Decadal Oscillation, the North Pacific Gyre Oscillation, and the El Niño-Southern Oscillation. In one sense, this background variability poses an obstacle to studying the effects of climate change in this region. To detect long-term anthropogenic change, the influence of these natural variations must be described. However, this historical variability also presents a key opportunity for studying the effects of climate change. Because in many cases the anticipated future state of key environmental drivers is not unprecedented, analysis of the historical responses of kelp forest ecosystems to natural climate variability can be used to anticipate likely future outcomes of anthropogenic climate change.

Fortunately, data exist to perform these analyses, including 30 years of data on kelp forest community structure collected by two DOI bureaus (USGS and National Parks

Service [NPS]). Previous work funded by BOEM began a syntheses of these data (in partnership with University of California Santa Barbara), and much of the work necessary to make the data useful for analyses has already been done. The timespan of these data includes periods much warmer than the present (including two of the strongest El Niños on record) and a wide range of wave and upwelling conditions. Long-term data on several key environmental drivers are available to supplement this biological dataset.

In addition to helping predict the effects of climate change, the understanding derived through these analyses will aid in detecting ongoing effects of change. For example, we could better detect the effects of ocean acidification on nearshore ecosystems with a better understanding of their natural dynamics. We have strong evidence from laboratory studies that the decreasing pH of nearshore waters can have strong negative effects on calcifying organisms, particularly those that depend on aragonite for building their shells and skeletons. However, to detect the effects of acidification in nature, we must account for variability in other environmental factors.

Objectives: The goal of this study is to predict how global climate change and ocean acidification will alter rocky reef ecosystems in southern California and to detect effects already underway. The study will increase our understanding of kelp forest dynamics, construct likely scenarios for future kelp forest communities, and determine whether ocean acidification has had measureable effects on vulnerable species thus far. These results will help BOEM plan for future changes in nearshore ecosystems, and will help managers predict and detect the effects of offshore energy activities.

Methods: Historical data on kelp forest communities will be analyzed to determine how key environmental drivers have changed kelp forest communities over the past 30 years. Because multiple drivers have changed over this period, structural equation modeling will be employed to isolate the interacting effects of each driver. These effects will be incorporated into predictive models of future rocky reef communities. Scenarios for the future state of environmental drivers will then be assembled from the literature, and models will predict future community change based on past dynamics and likely oceanographic conditions. The effects of ocean acidification will be evaluated by classifying species in the long-term data based on their vulnerability to acidification (e.g., reliance on calcification, aragonite dependence – long-term data include more than 30 species of invertebrates and algae, encompassing the full range of vulnerability to acidification). The dynamics of vulnerable and less vulnerable species will be compared to determine whether a divergence has occurred. Spatial gradients in upwelling will also be examined to test whether species vulnerable to acidification have suffered steeper declines in areas characterized by more corrosive upwelled waters.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): All

Title: Understanding and Mitigating the Effects of Marine Renewable Energy Technologies on the Coastal and Marine Environment in the Pacific OCS Region

BOEM Information Need(s) to be Addressed: The purpose of this study is to research the effects of marine renewable technologies, including marine hydrokinetic (MHK) and offshore wind devices, on the coastal and marine environments, and to develop effective mitigation strategies to reduce or avoid potential impacts from renewable technologies in the Pacific Region. With the Energy Policy Act of 2005 (EPAAct) authorization to regulate OCS renewable energy, new program considerations for BOEM include the regulation of a newly emerging offshore industry that will involve the deployment of prototype technology with uncertain environmental and engineering implications. As such, the safety and protection of the environment from this newly emerging industry are generally unknown, and the study of emerging technologies and monitoring renewable energy projects of opportunity in the Pacific Region shall provide effective analysis, mitigation, and management of those sources.

Environmental monitoring data of offshore renewable energy projects and applications would be used by BOEM to evaluate mitigation measures and project conditions of future OCS renewable energy projects and operations. In order for BOEM to make better decisions on renewable energy project siting, installation, and operations, the bureau needs to monitor and observe the operations in the field for environmental impacts and develop mitigation measures to ensure safe and environmentally sound projects. Information from the renewable energy monitoring studies will help decisionmakers develop more feasible and scientifically defensible regulatory oversight of projects and mitigation measures to ensure the key EPAAct mandates of safety and protection of the environment.

Approx. Cost: (in thousands) \$700

Period of Performance: FY 2014-2019

Description:

Background: With the passage of the EPAAct and amendments to the Outer Continental Shelf Lands Act (OCSLA), the Secretary of Interior was granted authority to regulate the production, transportation, or transmission of renewable energy sources on the OCS. Examples of OCS renewable energy include wind, wave, tidal, solar, and hydrogen.

An integral part of implementing the EPAAct and OCSLA requires BOEM to conduct NEPA environmental reviews and to prepare environmental documents, such as environmental impact statements and environmental assessments on renewable energy projects. In order to conduct these environmental evaluations, BOEM requires environmental data regarding the potential environmental impacts associated with offshore renewable energy technologies and facilities to assist Pacific Region

decisionmakers prior to issuance of leases and rights-of-way. Many of the environmental documents developed for those projects will require environmental mitigation measures and associated permit conditions in subsequent decision documents. Demonstrated compliance with mitigation measures and project conditions will allow BOEM to ensure that OCS renewable energy projects proceed in an environmentally sound and timely manner.

This study is a re-design of the former *Environmental Mitigation Monitoring* (PC-01-07) study, which initially commenced in FY 1997, had contract continuations in FY 2002 and FY 2008, and is scheduled to end in mid-FY 2013. These successful studies resulted in 12 Task Orders primarily designed to evaluate, through field monitoring and observations, environmental mitigation effectiveness of measures and project conditions required of post-lease Pacific OCS oil and gas operations. Examples of successful Task Orders included multiple disciplines involving marine and coastal birds, marine mammals, H₂S dispersion zones, produced water studies, physical and chemical profiling of Pacific OCS shell mounds, abandoned well-head surveys, etc. This study model will now be applied exclusively to the offshore renewable energy sector.

Objectives: The study objectives are to research, observe, sample, and/or monitor offshore renewable energy applications and technologies in the Pacific Region to determine potential environmental effects on the coastal and marine environment. Additional objectives will be the evaluation of the technologies and commensurate impacts to develop technology specific mitigation measures, best management practices, and project conditions to ensure safe and environmentally sound renewable energy applications. The study will provide BOEM with the needed information and ability to comply with BOEM regulations, NEPA requirements, and other bureau requirements.

Methods: Methodology may consist of actual site monitoring to determine the environmental effects of various renewable energy device technologies and applications. Although the Pacific Coast of the U.S. will be the primary focus of actual site or project monitoring initially utilizing offshore renewable projects proposed off Oregon, all areas within the Pacific Region may be reviewed or studied as appropriate. Additional research may include, but not be limited to, literature surveys, oceanographic and sediment modeling, and summary of knowledge reviews. Examples of potential future field monitoring studies in conjunction with Pacific Region projects of opportunity could include (1) An assessment of the potential effects of renewable energy equipment on nearshore wave energy conditions; (2) Potential alteration of nearshore sediment movement from various MHK technologies; (3) Transmission cable installation techniques in deep-sea environments; (4) Infrastructure needs to support offshore wind and MHK facilities; (5) The effects of offshore renewable facilities on navigational and communication systems; and (6) The monitoring and measuring of noise effects from the installation and operation of offshore renewable energy devices. The type of data collected will be determined by Pacific Region environmental managers and scientists as specified by the particular project, and would depend on the specified approval conditions.

Revised Date: April 1, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

Title: Collecting and Archiving Invertebrates from MARINe Sites for Deposition in the Smithsonian Institution with Local Replicate

BOEM Information Need(s) to be Addressed: Continued archiving and long-term reliable curating of invertebrate specimen collections acquired through BOEM-sponsored projects are essential elements of biological quality assurance. This effort provides BOEM with the scientific credibility important to stakeholders' acceptance of decisionmaking in the support of BOEM's offshore energy and minerals programs.

Approx. Cost: (in thousands) \$225

Period of Performance: FY 2014-2015

Description:

Background: BOEM funds research in support of decisionmaking related to the development of offshore energy and mineral resources. These projects frequently result in the need to collect and archive invertebrate specimens. To that end, BOEM has maintained a long-term contract with the Smithsonian Institution to house these collections. This study seeks to collect a modest but comprehensive inventory of invertebrate vouchers from representative Multi-Agency Rocky Intertidal Network (MARINe) sites, supported by BOEM, and archive them at the Smithsonian Institution. A replicate collection, at the advice of the Smithsonian curators, would be housed in California, at the California Academy of Sciences Research, Invertebrate Zoology and Geology Collections Department. This study is intended to provide funding for a one-time collection of specimens. Future collections would be covered by the BOEM-MARINe Cooperative Agreement; ongoing maintenance of the specimens at the Smithsonian is covered by the referenced BOEM/Smithsonian contract.

Taxonomy is a critical component to the ecological interpretation of biological data. Voucher specimens deposited in natural history collections are the only reliable means to verify the identity of species used in biological studies. Recognized benefits of voucher specimen archival include (1) Permitting long-term study of organisms, (2) Permitting correction of identifications, (3) Resolution of species limits, and (4) Verifying published results (Biological Survey of Canada, 2003). In the case of MARINe, a long-term study of rocky intertidal systems spanning 30 years and two coastlines, voucher collections are needed to document species identifications in our data, and document observed changes in species over space and time. Ultimately, these collections may allow researchers to track changes in species morphology, size, and range distribution from climate change. Because MARINe sampling is conducted by over a dozen teams spanning several decades, documentation of these species is vital to the research effort. The only existing voucher collection for MARINe was taken at 12 sites in 2002-2003.

MARINE sites extend from Alaska to Mexico across seven biogeographic zones. This study effort will focus on the middle four biogeographic zones in the Pacific Region, with a denser concentration of sites in the areas of highest biological transition (i.e., the Santa Barbara Channel zone).

Objectives: The purpose of this study is to provide:

- Authentic documentation of species identified in MARINE field studies and reports
- Consistency in archival methods and repository within MARINE and BOEM
- Quality assurance for biological data generated through the BOEM ESP and the credibility of offshore energy resources decisionmaking
- Preservation of federally funded biological samples and providing for their availability for scientific study into the future

Methods: A subset of the 138 MARINE sites, at 25-30 locations, would be visited and voucher collections taken. In the first year of the study, sampling strategy would be perfected at a few pilot locations before broadcasting it to other locations. It is preferred to collect a more comprehensive collection at fewer sites. The intent is to collect representative specimens of different age classes, morphologies, and size ranges for the MARINE Core invertebrate species and locally important species (such as those near or beyond biogeographic range limits), non-native species, and locally unique species. We anticipate that 15-25 species will be vouchered at any one site (out of a total of 50-75 possible species along the coastline). Photos showing the animals in the wild, locational information, tissue samples, and other data will also be collected. Curators have indicated they prefer to have a variety of information submitted with the specimens for context. A standardized approach will be used, as discussed with Smithsonian curators.

There are three phases to the study: (1) field collection, (2) lab validation and labeling, and (3) packaging and shipping. It is important that the species are identified in connection with local expertise and consistent with published data at that site. For the field collection, we anticipate a team of 4-6 people would be needed at each site to carry out the various functions in one site per tide. This team would consist of the MARINE field principal investigator (PI) for that site (if possible) or a regular field team member, together with the PI or team member from the taxonomy group processing the samples and other field biologists familiar with the site and local species. The lab validation phase is essential to ensuring that the specimens are identified correctly, labeled correctly, entered into the database, and the metadata are with them. The packaging and shipping phase is also not trivial and will take time and materials to complete efficiently and carefully.

A report providing a systematic list of all vouchered specimens in phylogenetic order, a comprehensive site list with specific locality data, and a collection of DVDs containing digital images of the vouchered specimens would be produced and submitted to the museums with the specimens and provided to BOEM.

Revised Date: March 18, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): Washington-Oregon

Title: Year-round and Diel Patterns in Habitat-use of Seabirds off Oregon

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.

Approx. Cost: (in thousands) \$750

Period of Performance: FY 2014-2016

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.

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

Title: Strategic Resampling of Biodiversity Surveys at MARINe Sites: Completion of the Decadal Assessment

BOEM Information Need(s) to be Addressed: Multi-Agency Rocky Intertidal Network (MARINe) long-term sampling provides the backbone for the baseline characterization of intertidal biological communities that are vulnerable to impacts related to oil spills or wave/wind energy development. A critical need of these studies is periodic assessment of the biodiversity at each site. The information attained from the biodiversity sampling is used in conjunction with the long-term sampling to determine the magnitude of impact (long-term surveys) and the extent of impact on the biological community (biodiversity assessment).

Approx. Cost: (in thousands) \$275

Period of Performance: FY 2014-2016

Description:

Background: There are two key MARINe protocols: the long-term monitoring protocol and the biodiversity protocol. BOEM, NPS, and nearly thirty other partners fund the long-term monitoring protocol at over 130 sites. Originally, BOEM and Partners for Interdisciplinary Studies of Coastal Oceans (PISCO) co-funded the biodiversity protocol. PISCO independently funded this work from 2003 to 2011. PISCO's funding ended and, since 2011, other partners (primarily State partners) have funded sampling at a majority of the sites. This study proposes to complete the remaining unfunded sites so that each of the approximately 100 sites in BOEM areas of interest have been sampled using the biodiversity protocol at least once in the past 10 years.

BOEM funds research in support of decisionmaking related to the development of offshore energy and mineral resources. MARINe rocky intertidal surveys occur along the U.S. West Coast adjacent to OCS oil-producing areas and projected wave energy developments. The design of these surveys has been vetted by multiple agencies and is the backbone of the West Coast-wide network of intertidal surveys. The goal of these surveys is to provide a robust approach to measure the impact related to punctuated and long-term effects related to oil spills and/or energy development projects. This goal has been met and MARINe long-term datasets have been used successfully to assess oil spill-related impacts as well as other impacts (e.g., shipwrecks, effluent discharge). However, it was clear from the onset of this program (in 1992) that while the long-term surveys were very effective at providing information that could be used to determine the magnitude of impact, additional information was required to fully determine the biological impact. In response to this understanding, the biodiversity survey protocol was developed by the MARINe Science Panel and has been conducted periodically at over 130 sites for over a decade. Analysis of an opportunistic tanker spill (the 2007 Cosco Busan spill off San Francisco Bay) confirmed that the information provided by biodiversity surveys supported and enhanced the data from long-term studies by our

MARINe NPS partner to make a very robust analysis of the effects of that spill in the rocky intertidal.

While the long-term surveys must be done biannually, our analyses indicate that the biodiversity surveys need to be done only once every 5-10 years. The full set of approximately 100 sites was last sampled as a set in 2000-2002. However, we are fortunate in that there are many other users of biodiversity information and funding from those partner organizations has provided resampling of approximately 60 of the 100 sites within the BOEM regions of interest (there are over 130 total biodiversity sampling sites). This proposed project is focused on sampling the remaining 40 sites, thereby completing the decadal resampling of the biodiversity surveys.

Objectives: The purpose of this study is to provide:

- The completion of the decadal resampling of the biodiversity surveys that complement the MARINe long-term datasets
- Integration of these data into our existing MARINe database
- Comparison of biodiversity results across the 10 years (on average) between surveys
- Linkage of biodiversity data to long-term data forming the current baseline condition for MARINe sites within BOEM regions of interest

Methods: Sites that have not been sampled in the past 8-10 years would be identified for biodiversity sampling. The standardized approach used for this complementary MARINe protocol can be found at <http://www.eeb.ucsc.edu/pacificrockyintertidal/methods/index.html> (see [Biodiversity Survey Protocol](#)).

All biological data collected are spatially explicit in xyz-space, allowing for detailed georeferenced three-dimensional mapping of species distribution. This not only provides information concerning the current distribution of species along the coast, it also allows for the determination of site-specific shifts in distribution (particularly in vertical distribution) over time. This information, together with long-term monitoring assessments, is combined to provide a comprehensive assessment of the magnitude and biological significance of the recovery trajectory from the impact. It also provides foundational information to assess shifts attributable to climate change. This is essential information when assessing impacts from all disturbances and may be particularly informative in assessments related to oil or wave energy development.

Revised Date: March 18, 2013

2.3 Profiles of Studies Proposed for the Fiscal Year 2015 NSL

Five new studies supporting ongoing and potential future activities in the Pacific Region are proposed for the FY 2015 NSL. The studies are listed in Table 3 and described in the succeeding profiles.

Table 3. BOEM Pacific Region Studies Proposed for the Fiscal Year 2015 NSL

SDP Page Number	Discipline	Study Title
45	IM	Hawaii Information Transfer Meeting
47	FE	Food Webs Impacts from Ocean Energy Projects: Cascading Effects from the Loss of Drift Macrophytes in Sandy Beach Ecosystems
49	HE	BOEM-MARINe
51	FE	DOI Partnership II: Developing Improved Methods for Detecting Impacts from OCS Energy Activities Using Long-term Data from DOI Monitoring Programs
53	PO	West Coast Physical Oceanographic Assessment
Discipline Codes		
AQ = Air Quality		FE = Fates & Effects
HE = Habitat & Ecology		IM = Information Management
IN = Interdisciplinary		MM = Marine Mammals & Protected Species
PO = Physical Oceanography		SE = Social & Economic Sciences

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Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): Hawaii

Title: Hawaii Information Transfer Meeting

BOEM Information Need(s) to be Addressed: BOEM uses meetings and workshops to foster the exchange of information and to plan future study endeavors. The Pacific Region has not hosted an Information Transfer Meeting (ITM) since 1995, yet has a burgeoning and high-quality applied science program. The ITM will be held by the Pacific Region to share results of BOEM-funded environmental studies. This type of a workshop is critical to informing the public and fellow colleagues about the science that is being funded and fostered by BOEM. Meeting discussions also assist in the planning and executing of the studies program. The Pacific Region intends to hold one ITM in 2014 that covers both conventional and renewable energy on the West Coast, and another ITM in 2015 or 2016 for renewable energy in Hawaii.

Approx. Cost: (in thousands) \$200 **Period of Performance:** FY 2015-2016

Description:

Background: The purpose of the ITM is to foster sharing of information among participants about current research, accomplishments, or issues of concern to BOEM. Presentations at the ITM will pertain to BOEM's Pacific OCS renewable energy program as well as regional environmental, social, or economic concerns, or current OCS industry activities or technologies. The Pacific Region held many ITMs during the 1980's and 1990's. The meetings were originally held annually; however due to various budget constraints and the fact that leasing for conventional energy was curtailed and there was a corresponding and significant decrease in Pacific Region studies, a decision was made to no longer hold Pacific Region ITMs. In 2015 or 2016, BOEM will hold an ITM in Hawaii to include completed and ongoing studies for renewable energy. It is likely that the Hawaii ITM will partner with other federal agencies to communicate research activities in the marine regions off Hawaii. Scheduling of the ITM will depend on the progress of ongoing studies specific to Hawaii. Past ITMs have convened 200 to 400 attendees comprised of BOEM scientists, other federal and state agency partners, industry, academia, contractors, media, and the general public. ITMs are most productive when handled by a contractor, when held at a venue other than a BOEM office, and when proceedings are produced.

Objectives: The objective of this study is to conduct an ITM in Hawaii for exchange of information, either through broad, general topics or specific topics.

Methods: BOEM will work with a contractor to plan and implement a West Coast ITM in 2015 or 2016. Tasks will include, but not be limited to, (1) identifying a suitable meeting location, venue, and date; (2) developing an effective meeting format and schedule; (3) identifying and inviting presenters; (4) promoting the meeting to attendees; and (5) preparing pre- and post-meeting materials.

Revised Date: January 15, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): All

Title: Food Webs Impacts from Ocean Energy Projects: Cascading Effects from the Loss of Drift Macrophytes in Sandy Beach Ecosystems

BOEM Information Need(s) to be Addressed: Southern California's coastline is dominated by sandy beaches, which are highly vulnerable to oil spills and changes in wave exposure; yet we know very little about these ecosystems. Drift macrophytes, including kelp and other algae and seagrasses, provide important trophic support and habitat for seabirds and fishes on sandy beaches and the associated surf zone. Since oil spills or changes in wave energy from offshore energy projects may affect the input and presence of drift macrophytes, information is needed on how this may cause cascading effects in nearshore food webs. Of particular concern are protected species, such as the Western Snowy Plover, and commercially important fishes, such as white seabass, California grunion, California halibut, and various surfperches. Study results will enable scientists and managers to evaluate possible impacts from offshore oil and gas and renewable energy activities to sandy beaches, and develop options to mitigate these impacts. Since drift macrophytes are important resources on sandy beaches in other regions, such as the Pacific Northwest and Gulf of Mexico, this information will be applicable across regions other than southern California.

Approx. Cost: (in thousands) \$475

Period of Performance: FY 2015-2018

Description:

Background: Intertidal and shallow subtidal coastal ecosystems are at high risk from the release of contaminants into the marine environment by oil spills and discharges, since contaminants accumulate at the land-sea interface. Drift macrophytes, such as kelp and other algae and seagrasses, sorb oil and other contaminants, and are often removed as part of the cleanup process, resulting in high exposures for organisms living within the macrophytes, and losses of drift macrophytes to sandy beach ecosystems. Additionally, the input rate and presence of drift macrophytes may be affected by reductions in local wave energy, an impact that may occur from marine hydrokinetic projects. Primary production on sandy beaches is limited, and their food webs, including fishes and seabirds, depend partly on drift macrophytes for trophic support. Drift macrophytes may also be used as habitat for managed fish species, such as the white seabass (*Atractoscion nobilis*), and various surfperches. However, we have no quantitative information on which fish species use drift macrophytes, and to what extent loss of drift macrophytes will affect sandy beach food webs.

Cascading effects of losses of drift macrophytes are likely to differ between different biogeographic regions. In the Pacific Region, oil platforms are present in three locations: offshore Long Beach (LB), the Santa Barbara Channel (SBC), and the Santa Maria Basin (SMB), with most platforms (16 of 23 total) in SBC. These locations

correspond to different biogeographic regions of the coast. The role of drift macrophytes in sandy beach and surf zone food webs and as juvenile fish habitat is also highly likely to differ across the year, due to physical patterns (e.g., storm wave energy and water temperature) and biotic patterns (e.g., bird migrations and larval settlement of both fishes and invertebrates). We will evaluate the role of drift macrophytes as a trophic and habitat resource for fishes and birds in these three areas, and seasonally, to determine spatial and temporal patterns of the importance of drift macrophytes for different species, including the white sea bass, grunion, the brown pelican, and California least tern.

Objectives: The overall objective of this study is to provide spatially and temporally detailed information about the use of drift macrophytes in beach ecosystems, particularly use by juveniles of economically and culturally important fishes, including white sea bass and grunion, and by seabirds, including the brown pelican and the endangered California least tern, so that managers can evaluate possible impacts to sandy beach ecosystems from offshore oil and gas activities, and develop options to mitigate these impacts. Specifically, we will (1) measure abundance of drift macrophytes along beaches over time and space, (2) determine the influence of drift macrophyte abundance and composition on abundance of (a) juvenile fishes and (b) invertebrates known to be important food for fishes and shorebirds, and (3) evaluate areas and species at highest risk from loss/contamination of drift macrophytes.

Methods: The study would involve nearshore sampling of abundance and composition of drift macrophytes, fishes, and seabirds. Invertebrates important as food sources to seabirds and fishes, such as amphipods and sand crabs, will also be surveyed. Seasonal sampling will be done at sites spanning the three locations occupied by oil platforms (LB, SBC, and SMB), and will be followed by statistical analyses of spatial and temporal patterns in community structure of drift macrophyte assemblages. Anticipated products for the proposed work include peer-reviewed scientific publications and compiled data and metadata archived in an accessible format that facilitates future syntheses and environmental analyses required under NEPA.

Specific methods would include (1) Beach seine sampling to measure drift macrophytes and fish abundance and composition. Fishes will be identified and measured, and a subsample analyzed for gut contents to determine diet. (2) Drift macrophytes will be subsampled to characterize associated small invertebrate fauna that may be important trophic resources for fishes and birds. (3) Bird abundance at the sites will be measured using visual censuses, and feeding behavior in relation with drift macrophytes will be quantified. (4) Sand crabs (*Emerita* spp.) and beachhoppers, which are known to be important food sources for shorebirds, will be censused. (5) Following survey work, smaller-scale experimental studies will be done to determine use of drift macrophytes as settlement substrate for juvenile fishes.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

Title: BOEM-MARINE

BOEM Information Need(s) to be Addressed: Ongoing monitoring of rocky intertidal sites adjacent to OCS production facilities allows BOEM to directly assess potential and/or real impacts to the coastline from OCS operations. With these data, BOEM can directly assess impacts to shoreline resources from OCS activities by differentiating between naturally caused impacts and other anthropogenic impacts, including impacts from OCS oil and gas production and accidental oil spills, and provides the baseline for evaluation of future marine renewable energy projects (e.g., wave energy off Oregon). The study implements BOEM's Outer Continental Shelf Lands Act mandate to monitor the marine and coastal environments adjacent to OCS operations.

Approx. Cost: (in thousands) \$2,075 **Period of Performance:** FY 2015-2019

Description:

Background: Potential impacts to the shoreline are of particular concern in the Pacific Region because OCS operations are located very close to shore. Public concern about these potential impacts has a considerable effect on the program. BOEM and its 38 partners in MARINE (Multi-Agency Rocky Intertidal Network) biannually monitor over 130 established shoreline rocky intertidal sites using a targeted assemblage protocol from California to British Columbia. MARINE also uses a complimentary biodiversity protocol to sample an additional 130+ sites from Alaska to Mexico on a periodic basis. MARINE employs standardized field protocols and a shared database (www.MARINE.gov). In particular, this study provides funding to monitor 31 BOEM long-term monitoring sites adjacent to existing oil and gas OCS operations in southern California and adjacent to OCS wave energy activities off Oregon. BOEM continues to participate in the management and oversight of MARINE, to access data critical to our ongoing operations, and to fulfill our responsibility to monitor OCS platforms and pipeline operations and offshore renewable energy facilities. MARINE received the 2012 Partners in Conservation Award from the Secretary of Interior for its contribution to science through this unique partnership.

A significant change documented at MARINE sites is the finding of juvenile black abalone at selected sites on offshore islands. This finding, while encouraging, is not sufficient to offset the need to list the black abalone as endangered (see January 14, 2009, Federal Register Notice). Black abalone, affected by withering foot syndrome throughout the area, are still at low levels (5% of the original population in the late 1980s and early 1990s) along much of the coastline. While the areal extent of the disease has leveled off, new evidence of the disease is still found at BOEM sites in San Luis Obispo County. For many years, miles of coastline continued to be affected and the numbers of abalone fell drastically, apparently due to a combination of loss of animals from withering foot coupled with an absence of recruitment. Evidence of withering foot

syndrome was most recently observed in central California. It is unclear if the black abalone will recover; one of the problems limiting their recovery is the physical alteration of habitat that routinely occurs after the abalone leave. No impacts have been identified from oiling over the recent past, either from OCS or other operations.

Partnerships are fostered through MARINE with local, state, federal, and Tribal government agencies involved in monitoring research. This is an important cooperative agreement with the State of California, as its funding has been severely cut and BOEM-MARINE data are the key source of rocky intertidal information being used across California to determine changes in Marine Life Protected Areas and Areas of Special Biological Significance. MARINE also provides direct information about species shifts and other factors influenced by climate change, which is an important DOI objective. MARINE partners interact in technical conferences, government forums, and academic conferences to inform managers about the state of the rocky intertidal. This study will be procured through the California CESU program, which assures a conservative 17.5% overhead.

Objectives: This study will provide for the continued monitoring of 31 rocky intertidal sites on the mainland shore adjacent to OCS oil and gas facilities in California and potential wave energy facilities offshore Oregon. Information generated will provide the basis for evaluating impacts to the shoreline from OCS activities, especially accidental oil spills. Continued support of a web-based trend analysis of BOEM-funded sites in combination with other MARINE sites in the shared database, along with coordination of MARINE and database tasks, are included so that BOEM has access to the data needed for management decisions.

Methods: These 31 sites are monitored biannually by 5 teams of field biologists, including the BOEM Pacific Regional Intertidal Sampling and Monitoring (PRISM) in-house biology team. Barnacles, mussels, seastars, black abalone, surfgrass, limpets, turf weed, rock weed, and other algae are either photographed in fixed plots in the field, or measured and counted in irregular, circular, or band plots. Data are placed in a common database and are reviewed and published by the Science Panel.

The interactive database is hosted by the University of California through BOEM funding. (See <http://www.marine.gov/Findings/Data.html> “interactive database” link.) Broad-scale trend graphs put BOEM-monitored sites in context with all MARINE sites so that large-scale trends, such as El Niños, can be seen. This information allowed BOEM to determine potential shoreline effects from the 1997 Platform Irene oil spill in relation to El Niño-induced large storm events, which cause significant changes to sites all along the coast.

It is anticipated that continued work will be done to voucher new species and track species shifts through an ongoing BOEM program to archive specimens with the Smithsonian Institution. This information continues to provide valuable information for all MARINE partners and other scientists as they evaluate anthropogenic impacts against a changing environment influenced by climate change.

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): Southern California

Title: DOI Partnership II: Developing Improved Methods for Detecting Impacts from OCS Energy Activities Using Long-term Data from DOI Monitoring Programs

BOEM Information Need(s) to be Addressed: Monitoring and predicting the potential impacts of OCS oil and gas and renewable energy production on nearshore ecosystems requires an ability to distinguish between changes caused by natural processes versus those caused by human activities. This is often hampered by the lack of long-term data to describe natural variation. In southern California, two DOI monitoring programs that focus on kelp forest communities have the potential to provide considerable insight into the patterns and causes of change in kelp forest ecosystems. Analysis of these datasets (which span 30+ years) will enable scientists and managers to evaluate possible impacts from offshore oil and gas and renewable energy activities, and develop options to mitigate these impacts. This is especially important to BOEM in light of global climate change and the need to understand the cumulative impacts of multiple projects on the OCS.

Approx. Cost: (in thousands) \$225

Period of Performance: FY 2015-2017

Description:

Background: BOEM is charged with predicting, detecting, and interpreting the effects of activities associated with OCS oil, gas, and renewable energy production on nearshore habitats. This task is complicated by the high natural variability in nearshore systems as well as shifting baselines due to long-term environmental and anthropogenic effects unrelated to OCS activities (e.g., fishing). The giant kelp forests in southern California pose particular challenges for these environmental analyses, as they undergo large and abrupt fluctuations in size and species composition in response to a variety of predictable (e.g., seasonal) and unpredictable (e.g., large waves, altered fishing) events. These iconic habitats are of special interest to managers, having been designated Habitat Areas of Particular Concern (a subset of Essential Fish Habitat) for groundfish by the Pacific Fishery Management Council and as environmentally sensitive habitats by the State of California.

To improve BOEM's ability to predict, detect, and interpret impacts within this dynamic environment, a better understanding of the natural dynamics of nearshore systems and the giant kelp forests they support is necessary. Such an understanding requires comprehensive long-term data that span a wide range of environmental conditions in areas potentially impacted by OCS energy activities. BOEM also requires improved analytical frameworks that incorporate information about the stability and recovery rates of kelp forest communities.

In 2011 BOEM identified an opportunity to leverage kelp forest monitoring data collected by two DOI bureaus, USGS and NPS, to create a dataset with enhanced power for detecting impacts. BOEM worked to establish a partnership among the DOI bureaus and the Marine Science Institute at University of California Santa Barbara (UCSB), and provided funding for the partnership to assimilate, combine, and analyze the data from these two DOI projects, with the goal of creating an integrated 30+ year dataset of community dynamics at 40 kelp forest sites in the Southern California Bight. Substantial work has gone into producing this combined dataset, and preliminary analyses have shown that it has enhanced power to detect impacts at both local and regional scales. These analyses have tapped only a fraction of the potential of this unified dataset, which captures a wide range of biological and environmental conditions that provide a rich opportunity for improved mechanistic understanding of kelp forest dynamics. Such an understanding is needed to inform better methods for detecting and evaluating possible impacts from OCS energy activities in this dynamic region.

Objectives: The objective of this study is to continue detailed community analyses using long-term data to improve our understanding of the causes and consequences of change in giant kelp forest ecosystems so that managers may detect and evaluate possible impacts from offshore oil and gas and renewable energy activities, and develop options to mitigate these impacts. In addition, identification of patterns in these datasets will aid in predicting potential ecosystem impacts due to climate change and advancing adaptive management, both of which are goals central to DOI stewardship responsibilities.

Methods: This study will expand the spatial scope of the current dataset to include mainland reefs, by incorporating 11 reefs monitored by the Santa Barbara Coastal Long Term Ecological Research (LTER) site, a UCSB project that is part of a network of 26 sites funded by National Science Foundation to address ecological issues on multi-decade time scales. The LTER will also provide a new 28-year regional dataset of giant kelp biomass developed from Landsat satellite imagery made publically available by USGS. The quantitative description of how environmental factors affect kelp forest community structure, stability, and recovery that result from our analyses of the expanded dataset will be incorporated into improved methods for assigning causation to observed changes in reef communities in the region.

This study will build upon the integrated dataset obtained by combining USGS and NPS data and by integrating it with diver-collected data from mainland reefs, regional data of giant kelp biomass obtained from satellites, and data on key drivers such as waves, temperature, and fishing. The resulting dataset will be analyzed to determine (1) which environmental factors are the most important determinants of kelp forest community structure, (2) what aspects of kelp forest communities are most predictable, (3) what factors affect the stability of a kelp forest, and (4) how long kelp forests take to recover from disturbances of various magnitudes. These measured characteristics of kelp forest dynamics will be incorporated into methods for detecting impacts on reefs in the region.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

Title: West Coast Physical Oceanographic Assessment

BOEM Information Need(s) to be Addressed: BOEM analysts in the Pacific Region must obtain baseline oceanographic information, including variation in baseline and how the baseline is changing, to inform NEPA analyses for conventional and renewable energy along the West Coast. Teasing apart impacts to the environment from multiple stressors, including climate change, vs. ongoing and future operations is important to NEPA analysis and requires access to historic and up-to-date physical measurements. Currently along the Pacific Coast, this data collection and analysis is being conducted by different researchers along the West Coast and needs to be located in one place that is accessible to analysts.

Approx. Cost: (in thousands) \$250

Period of Performance: FY 2015-2017

Description:

Background: This study will build on existing partnerships, coordinate data from existing monitoring, and make integrated data and information available to managers, policy makers, and the public. This study would proceed in coordination with the West Coast Ocean Observing Systems (OOS), Oregon State University, and the University of California, and utilize these existing partnerships as the backbone for this effort. On the west coast of the U.S. there are multiple research efforts collecting physical oceanographic parameters with instruments distributed in waters off Oregon, Washington, and California. Data are collected in similar manners, however there is no mechanism that can accept data from distinct research groups, or house, synthesize, and provide that data in one location. Connecting the multiple research efforts and creating a way to display and synthesize data in one location will provide the oceanographic baseline for the California Current along the West Coast of the U.S.

The need for physical oceanographic information was identified as one of the top priorities from the BOEM-sponsored Oregon Marine Renewable Energy Environmental Science Conference (held in the fall of 2012). This study would be a regional bridge for the West Coast, coordinating with the West Coast OOS programs and existing university research and monitoring programs. This study would enable the Pacific Region to obtain baseline oceanographic information for environmental analyses for both conventional and renewable energy development.

This study will foster coordination among federal and state agencies and academia, and aligns well with West Coast state priorities: West Coast Integrated Ocean Observing Systems programs, West Coast Governors Alliance on Ocean Health, California Ocean Protection Council, and California Natural Resources Agency. Study findings will directly benefit state government agencies that have key roles in coastal management, such as the California Department of Fish and Game, California State Lands

Commission, California Coastal Commission, California Ocean Protection Council, California State Water Resources Control Board, Oregon Department of State Lands, Oregon Department of Fish and Wildlife, Washington State Department of Natural Resources, Washington State Department of Ecology, and Washington Department of Fish and Wildlife. We expect this study to be awarded through a Cooperative Agreement with a state university or state entity.

Objectives: The overall objective of this study is to synthesize and improve the accessibility of existing oceanographic data.

Methods: The Pacific Region will work with existing partnerships to link in with current monitoring efforts, enhance those efforts, and obtain an understanding of baseline oceanographic information along the West Coast of the U.S. This will be accomplished in the following four areas:

(1) **Data Management:** Upgrade programming to allow new datasets to be incorporated from existing shore stations (initial computer programming was accomplished more than 10 years ago and needs to meet current standards).

(2) **Data Integration:** Program OOS system to accept data from disparate datasets. There are multiple research efforts occurring in California, Oregon, and Washington. Currently there is no one place to obtain these data. This study will create the ability to accept disparate datasets and make them available in one location.

(3) **Data Synthesis:** Create an online product, part of the OOS data dissemination, that synthesizes existing and newly collected parameters. Information will be in a format compatible with other BOEM analysis requirements (e.g., Multipurpose Marine Cadastre and ESPIS).

Revised Date: January 15, 2013

SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2016

This section presents a general discussion of topical issues and types of studies that the Pacific Region anticipates will be of interest in the future. The Pacific Region has a challenging and multifaceted mission, and must assess impacts from two vastly different types of offshore energy development (conventional and renewable) and three different technologies (oil and gas production, MHK wave energy conversion, and wind energy conversion) over a broad geographic area that includes the OCS off four states (California, Oregon, Washington, and Hawaii). Information needs vary greatly between the different energy programs, technologies, and geographic areas, necessitating foresight to maximize the benefits of future studies. Additionally, the offshore energy sector, both conventional and renewable, is volatile in the Pacific Region, and circumstances will likely require flexibility to quickly change the scientific endeavor and/or location of the needed information.

3.1 Multipurpose Studies – All Areas

As this SDP demonstrates, some studies can provide information that supports both continuation of the oil and gas program and the development of the renewable energy program in the Region. In light of diverse information needs and limited ESP resources, it will be crucial for the Region to capitalize whenever possible on studies that can inform both programs, although studies unique to only one program will continue to be seriously considered.

3.2 Oil and Gas Studies – Southern California

Ongoing activities related to oil and gas production, and the potential for oil spills close to the coast, will continue to be important for Pacific studies, and this interest will only increase as industry inevitably moves toward decommissioning OCS facilities. Consideration will be given to the review of oil and gas-related studies, some of which are several decades old, and to determining the need for updating that information. At present, there appears to be sufficient completed and ongoing studies specific to southern California fish, fisheries, birds, toxicology, physical oceanography, and marine mammals; however, the need for updated information will be periodically assessed.

3.3 Renewable Energy Studies – Hawaii and Oregon

Major subject topics, such as socioeconomic considerations and potential impacts to benthos, seabirds, or fisheries vary greatly between renewable energy technologies and between geographic areas, especially between Hawaii and Oregon, where wind and wave energy development is actively proposed. The Pacific Region's immediate information needs focus on information exchange, baseline and impact studies, and data management, integration, and synthesis for renewable energy, in support of both wave and wind energy off Hawaii and Oregon. Since no single federal, state, or academic institution will be able to provide all of the needed information, it will be important for BOEM to foster partnerships, where possible.

While there is no regional socioeconomic on staff, efforts to garner urgently needed information are underway through collaborations with other federal agencies, researchers, and stakeholders, including regionally and ESP-funded studies to project visual impacts of offshore renewable energy technologies and identify submerged and coastal Tribal cultural resources, patterns of human uses of the ocean, and implications of renewable energy development. Additionally, two FY 2014 studies proposed in this SDP would identify the potential impact of submarine power cables on crab harvest and locate and classify submerged prehistoric sites. The Region recognizes the importance of integrating natural and social sciences in planning and decisionmaking for offshore energy.

The collection of baseline data prior to commercial development will turn toward site-specific assessment, which will rely in part on industry interest and applications. Until recently, interest in wave energy development was limited to a few shallow-water sites off Oregon. However, interest in both wave and wind energy off Oregon and Hawaii has accelerated and expanded to include multiple OCS sites in water depths of 100-1000 m. As a result of this expanding interest, Pacific studies will need to address multiple and disparate ecosystems.

Responding to a request from the State of Oregon, BOEM held a marine renewable energy environmental science conference November 28-29, 2012, at OSU in Corvallis. This conference focused on existing and needed environmental information and did not include or address socioeconomic or technological aspects of renewable energy. BOEM's objectives for the conference were to showcase completed and ongoing research that addresses environmental questions associated with wave and wind energy development in the Pacific Northwest, to synthesize new research and existing information and distill it into products that agencies and resource managers can use, and to identify and prioritize study gaps of the technologies or potentially affected systems that can be used for scientists, managers, and funders to focus future research efforts.

The draft conference report is in the initial stages of review, with the final report due by the summer of 2013. Based on preliminary information from the conference, study priorities include acquisition of baseline information at potential sites, studies to anticipate direct impacts at potential sites, and monitoring of devices after installation. With regard to anticipating impacts, the invited experts concluded that federal and state agencies and industry should seek information regarding sediment transport, the existing acoustic environment and the consequence of change, the effect of electromagnetic fields on endangered and threatened marine species, the effect of noise on marine mammals, the potential for collision and redistribution of birds, bats, and marine mammals, and the artificial reef effect and the consequences to seafloor ecosystems. Reviewing existing information was also extremely useful. It is quite clear that many of the identified information needs are being addressed and funded by state agencies, BOEM, and industry. The Pacific Region will review the report in detail and, where appropriate, use it as a guide for future study plans.

SECTION 4.0 LITERATURE CITED

- Biological Survey of Canada. 2003. The role of voucher specimens in validating faunistic and ecological research. Biological Survey of Canada (Terrestrial Arthropods) Document Series No. 9. 21 pp.
- Kinlan, B.P., C. Menza, and F. Huettmann. 2012. Predictive modeling of seabird distribution patterns in the New York Bight. Chapter 6 *in* A biogeographic assessment of seabirds, deep sea corals and ocean habitats of the New York Bight: science to support offshore spatial planning, C. Menza, B.P. Kinlan, D.S. Dorfman, M. Poti, and C. Caldow, eds. NOAA Technical Memorandum NOS NCCOS 141. National Oceanic and Atmospheric Administration, Silver Spring, MD. 224 pp.
- Love, M.S., D.M. Schroeder, L. Snook, A. York, and G. Cochrane. 2008. All their eggs in one basket: a rocky reef nursery for the longnose skate (*Raja rhina* Jordan & Gilbert 1880) in the southern California Bight. *Fishery Bulletin* 106:471-475.
- NREL. 2009. United States - Wind Resource Map. U.S. Department of Energy, National Renewable Energy Laboratory. Retrieved January 2013 from <http://www.nrel.gov/gis/pdfs/windsmode14pub1-1-9base200904enh.pdf>
- NREL (undated). Wave Resource Atlas (from Renewable Energy Resource Atlas). U.S. Department of Energy, National Renewable Energy Laboratory. Retrieved January 2013 from http://maps.nrel.gov/re_atlas
- Nur, N., J. Jahncke, M.P. Herzog, J. Howar, K.D. Hyrenbach, J.E. Zamon, D.G. Ainley, J.A. Wiens, K. Morgan, L.T. Ballance, and D. Stralberg. 2011. Where the wild things are: predicting hotspots of seabird aggregations in the California Current System. *Ecological Applications* 21(6):2241-2257.
- Suryan, R.M., J.A. Santora, and W.J. Sydeman. 2012. New approach for using remotely sensed chlorophyll *a* to identify seabird hotspots. *Marine Ecology Progress Series* 451:213-225.

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