BOEM

Bureau of Ocean Energy Management

Environmental Studies Program

Studies Development Plan
FY 2015–2017

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ABBREVIATIONS AND ACRONYMS

AAHU	Average Annual Habitat Units
AB	Assembly Bill
ABMP	Avian and Bat Monitoring Plan
ACES	Alaska Coastal Ecosystem Survey
ADCP	Acoustic Doppler Current Profiler
ADF&G	Alaska Department of Fish and Game
AEWC	Alaska Eskimo Whaling Commission
AHW	Advanced Hurricane WRF (weather research and forecasting)
AIS	Automatic Identification System
ALB	Airborne lidar bathymetry
AMAPPS	Atlantic Marine Assessment Program for Protected Species
ANIMIDA	Arctic Nearshore Impact Monitoring in Development Area
AOOS	Alaska Ocean Observing System
Apex	Apex Hawaii Offshore Wind, LLC
Approx.	Approximate
AQ	air quality
ArcSEES	Arctic Science, Engineering and Education for Sustainability
ASP	Alaska Annual Studies Plan
ATN	Animal Telemetry Network
AUV	Autonomous Underwater Vehicle
AWC	Atlantic Wind Connection
AWH	AW Hawaii Wind, LLC
AWOIS	Automated Wreck and Obstruction Information System
BACI	Before-After-Control-Impact
BASS	Bayesian Analysis for Spatial Siting
bbls	barrels
BLM	Bureau of Land Management
BO	Biological opinions
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BON	Biodiversity Observation Network
BOWFEST	Bowhead Whale Feeding Ecology Study
BPXA	BP Exploration Alaska
BRD	Biological Resources Division, U.S. Geological Survey
BRI	Biodiversity Research Institute
BRS	behavioral response study
BSEE	Bureau of Safety and Environmental Enforcement
BSMP	Beaufort Sea Monitoring Program
BWASP	Bowhead Whale Aerial Survey Project
CAA	Clean Air Act
CAB	Chemistry and Benthos
Cal Poly SLO	California Polytechnic State University, San Luis Obispo
Call	Call for Information and Nominations
cANIMIDA	Continuation of Arctic Nearshore Impact Monitoring in Development Area

CCE	California Current Ecosystem
CCS	California Current System
CESU	Cooperative Ecosystem Studies Unit
cf	cubic feet
CFR	Code of Federal Regulations
CHAOZ	Chukchi Acoustics, Oceanography and Zooplankton study
CIAP	Coastal Impact Assistance Program
CICESE	Centro de Investigación Científica y Educación Superior de Ensenada
CIRCAC	Cook Inlet Regional Citizens Advisory Council
CMAQ	Community Multipurpose Air Quality model
CMI	Coastal Marine Institute
CMSP	Coastal and Marine Spatial Planning
COMIDA	Chukchi Offshore Monitoring in Drilling Area
COP	construction and operations plan
CPUE	catch per unit effort
CSAS	Core Science, Analysis and Synthesis
CTD	Conductivity, Temperature, Depth sensor
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
DFO	Department of Fisheries and Oceans Canada
DO	dissolved oxygen
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOI STEM Ed	DOI STEM Education and Employment Pathways Strategic Plan
DPP	Development and Production Plan
DQM	Dredge Quality Management
DRAA	Disaster Relief Appropriations Act
DWH	Deepwater Horizon
DWM	Department of Wildlife Management (North Slope Borough)
EA	Environmental Assessment
eDNA	Environmental DNA
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	environmental impact statement
EMF	Electromagnetic Field
EP	Exploration Plan
EPA	Environmental Protection Agency
EPAct	Energy Policy Act of 2005
EPIRB	Emergency Position-Indicating Radio Beacon
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
ESID	EcoSpatial Information Database
ESP	Environmental Studies Program (BOEM)
ESPIS	Environmental Studies Program Information System
ESP-PAT	Environmental Studies Program - Performance Assessment Tool
FACT	Florida Atlantic Telemetry Group
FAU	Florida Atlantic University

FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FMC	Fishery Management Council
FWS	Fish and Wildlife Service
FY	Fiscal Year
G&G	Geological and Geophysical
GBIF	Global Biodiversity Information Facility
GCCESU	Gulf Coast Cooperative Ecosystem Studies Unit
GIS	Geographic Information System
GMU	George Mason University
GODEX	Gulf Oxygen Deepwater Experiment
GOM	Gulf of Mexico
GoM	Gulf of Maine
GOMR	Gulf of Mexico Region
GPS	Global Positioning System
HAPC	Habitat areas of particular concern
HECO	Hawaiian Electric Company
HF	High frequency
HPPG	High Priority Performance Goal
HRG	High Resolution Geophysical
HSDRRS	Hurricane Storm Damage Risk Reduction System
HTML	Hyper Text Markup Language
IA	Interagency Agreement
IARPC	Interagency Research and Policy Committee
IOOS	Integrated Ocean Observing System
IOPTF	Interagency Ocean Policy Task Force
IPC	Interagency Policy Committee
IPCC	Intergovernmental Panel on Climate Change
IT	Information Technology
ITM	Information Transfer Meeting
IUM	Information Update Meeting
IWG-OE	Interagency Working Group-Ocean Education
IWG-OO	Interagency Working Group on Ocean Observations
IWG-OP	Interagency Working Group on Ocean Partnerships
IWG-OSS	Interagency Working Group on Ocean Social Science
JIP	Joint Industry Program
km	kilometer
LCA	Louisiana Coastal Area
LCC	Landscape Conservation Cooperative
LGS	Louisiana Geological Survey
LIDAR	Laser Imaging Detection and Ranging
LME	Large Marine Ecosystems
LSU	Louisiana State University
LTER	Long Term Ecological Research
MAFLA	Mississippi, Alabama, and Florida
MAMES	Mississippi-Alabama Marine Ecosystem
MARCO	Mid-Atlantic Regional Council on the Ocean

MARES	Marine Arctic Ecosystem Study
MARINe	Multi-Agency Rocky Intertidal Network
Marine BON	Marine Biodiversity Observation Network
MCDA	multi-criteria decision analysis
MHK	Marine Hydrokinetic
MMP	Marine Minerals Program
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MOCHA	Multi-study OCean acoustics Human effects Analysis
MOU	Memorandum of Understanding
MVUS	Merchant Vessels of the United States
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NCCOS	NOAA National Centers for Coastal Ocean Science
NEEH	NextEra Energy Hawaii, LLC
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIMA	National Imagery and Mapping Agency
NIS	non-indigenous species
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NMNH	National Museum of Natural History
NOAA	National Oceanic and Atmospheric Administration
NOAA OER	Ocean Exploration & Research
NOC	National Ocean Council
NODC	National Oceanographic Data Center
NOP	National Ocean Policy
NOPP	National Oceanographic Partnership Program
NOS	National Ocean Service
NOSB	National Ocean Sciences Bowl
NOx	nitrogen oxides
NPDES	National Pollution Discharge Elimination System
NPRB	North Pacific Research Board
NPS	National Park Service
NRC	National Research Council
NRDA	Natural Resource Damage Assessment
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NRL	Naval Research Laboratory
NROC	Northeast Regional Ocean Council
NSB	North Slope Borough
NSF	National Science Foundation
NSL	National Studies List
NSSI	North Slope Science Initiative
NWS	National Weather Service

O&G	oil and gas
OBIS-SEAMAP	Spatial Ecological Analysis of Megavertebrate Populations
OBIS-USA	Ocean Biogeographic Information System - USA
OCNWRC	Oregon Coast National Wildlife Refuge
OCS	Outer Continental Shelf
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OCSLA	Outer Continental Shelf Lands Act
OEP	Office of Environmental Programs
OM	organic matter
OMB	Office of Management and Budget
OMZ	oxygen minimum zone
ONR	Office of Naval Research
OOS	Ocean Observing Systems
OREP	Office of Renewable Energy Programs
OSAT-1	Operations Science Advisory Team 1
OSRA	Oil Spill Risk Analysis
OSRP	Oil Spill Response Plans
OSTP	Office of Science and Technology
OSU	Oregon State University
OYPS	Office of Youth, Partnerships, and Service
PAH	Polycyclic Aromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
PDF	portable document format
PI	principal investigator
PM	particulate matter
PMEC	Pacific Marine Energy Center
PMEL	Pacific Marine Environmental Laboratory
PRISM	Pacific Rocky Intertidal Survey and Monitoring
PSBF	Potentially Sensitive Biological Features
RESTORE Act	Resources and Ecosystems Sustainability, Tourist Opportunity and Revived Economics of the Gulf States Act of 2011
RODEO	Real-time Opportunity for the Development of Environmental Observations
ROMS	Regional Ocean Modeling System
ROV	Remotely Operated Vehicle
ROW	right-of-way
RPB	Regional Planning Bodies
SAP	site assessment plan
SCB	Southern California Bight
SDI	Satellite Drilling Island
SDP	Studies Development Plan
SIA	Social Impact Assessment
SIP	State Implementation Plan
SMWG	Sand Management Working Group
SOAR	Synthesis of Arctic Research
SPUE	sightings per unit effort
SSB	standing stock biomass

STEM	Science Technology Engineering Math
SWAPS	Sperm Whale Acoustic Prey Study
SWSS	Sperm Whale Seismic Study
TDR	Temperature/Depth Recorder
TK	Traditional Knowledge
TSHD	Trailing Suction Hopper Dredge
U.S.	United States
UAA	University of Alaska Anchorage
UAF	University of Alaska Fairbanks
UAS	Unmanned Aircraft System
UCSB	University of California Santa Barbara
UCSC	University of California Santa Cruz
UF	University of Florida
ULL	University of Louisiana at Lafayette
UNOLS	University-National Oceanographic Laboratory System
USACE	U.S. Army Corps of Engineers
USARC	U.S. Arctic Research Commission
USCG	U.S. Coast Guard
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UT	University of Texas
UW	University of Washington
VMS	Vessel Monitoring System
VOC	Volatile Organic Compounds
VSA	Value suitability analysis
WEA	Wind Energy Area
WHOI	Woods Hole Oceanographic Institution
WMNWRC	Washington Maritime National Wildlife Refuge Complex
WRF	weather research and forecasting
WVA	Wetland Volume Assessment

BOEM
Bureau of Ocean Energy Management

CHAPTER 1
HEADQUARTERS

U.S. Department of the Interior
Bureau of Ocean Energy Management
Herndon, VA
2014

SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction

1.1.1 BOEM's Responsibilities

The Bureau of Ocean Energy Management (BOEM) is responsible for managing development of the Nation's offshore resources in an environmentally and economically responsible manner. In addition to its Headquarters Office in Herndon, Virginia, BOEM is composed of three Regional Offices: New Orleans, Louisiana; Camarillo, California; and Anchorage, Alaska.

BOEM develops the Five-Year Outer Continental Shelf (OCS) Oil and Natural Gas Leasing Program; oversees assessments of the oil, gas, and other mineral resource potential of the OCS; inventories oil and gas reserves and develops their production projections; and conducts economic evaluations that ensure the receipt of fair market value by U.S. taxpayers for OCS leases. BOEM also conducts the Oil and Gas Lease Sales, Sand and Gravel negotiated agreements, and creates official maps and geographic information system (GIS) data.

BOEM's Office of Renewable Energy Programs (OREP), located in Herndon, Virginia, implements and manages the Agency's offshore renewable energy responsibilities. OREP grants leases, easements, and rights-of-way for orderly, safe, and environmentally responsible renewable energy development activities. BOEM's Office of Environmental Programs (OEP) conducts environmental reviews, including National Environmental Policy Act (NEPA) analyses, and produces compliance documents for each major stage of energy development planning. These analyses inform BOEM's decisions on the Five-Year Program, conventional and renewable energy leasing, marine mineral resources, and development activities.

The Environmental Studies Program (ESP) is overseen and administered by the OEP. Through the ESP, BOEM's scientists conduct and oversee environmental studies to inform program and policy decisions relating to the management of energy and marine mineral resources on the OCS. This Studies Development Plan (SDP) is a foundational document supporting the ESP's function. The SDP provides the majority of the information used to develop the National Studies List (NSL) for the upcoming fiscal year (FY), and it may be used to develop and defend budget requests as well.

BOEM is also responsible for non-energy mineral resources (primarily sand and gravel) excavated from the OCS, managed through the Marine Minerals Program (MMP). Erosion of beaches, dunes, barrier islands, and coastal wetlands is a serious problem that affects tourism, energy, defense, and public lands infrastructure, but it is also important to coastal ecosystem functions. Access to OCS sand resources is critical for the long-term success of many shore protection, beach nourishment, and wetlands restoration projects. Recently, the MMP has been involved in the recovery efforts after Superstorm Sandy. It is anticipated that additional projects related to the effects of this storm will be proposed as needs arise.

BOEM has close ties to its sister bureau, the Bureau of Safety and Environmental Enforcement (BSEE), and supports its environmental science needs. BSEE promotes safety, protects the environment, and conserves offshore resources through vigorous regulatory oversight and enforcement. BSEE has three main functions: 1) developing standards and regulations to enhance safety and environmental protection for the exploration and development of offshore oil and natural gas on the U.S. OCS; 2) reviewing industry Oil Spill Response Plans (OSRP) to ensure compliance with regulatory requirements; and 3) focusing on compliance by operators with all applicable environmental regulations, as well as ensuring that operators adhere to the stipulations of their approved leases, plans, and permits.

BSEE is also supported by three Regional Offices (New Orleans, Louisiana; Camarillo, California; and Anchorage, Alaska) that are responsible for reviewing Applications for Permit to Drill, which ensure that all of the recently-implemented enhanced safety requirements are met, and for conducting inspections of drilling rigs and production platforms by using multi-person, multi-discipline inspection teams. BSEE maintains the new National Offshore Training and Learning Center; operates Ohmsett, the National Oil Spill Response Research and Renewable Energy Test Facility, in Leonardo, N.J.; and manages the Technology Assessment and Research program to advance research in safety, engineering, and offshore standards (BSEE, 2011).

1.1.2 Resource Estimates and Production

The 1.7 billion-acre OCS is a significant source of oil and gas for the Nation's energy supply. In FY 2013, the approximately 34.5 million acres on active OCS leases (BOEM, 2013e) generally accounted for about 5 percent of America's domestic natural gas production and about 21 percent of America's domestic crude oil production (BOEM, 2013c). Together, BOEM and BSEE apply oversight and regulatory frameworks to ensure that exploration, installation, operations, and decommissioning proceed safely and in an environmentally responsible manner.

The offshore areas of the United States are estimated to contain significant quantities of resources in undiscovered fields. BOEM estimates of technically recoverable oil and gas resources in undiscovered fields on the OCS (2011, mean estimates) are 88.6 billion barrels of oil and 398.4 trillion cubic feet of gas (BOEM, 2012).

1.1.3 Development and Production Planning

The OCS Lands Act requires the Department of the Interior (DOI) to prepare a 5-year program specifying the size and location of areas for Federal offshore oil and natural gas leasing and assessing the timing when leases will be enacted. DOI has the role of ensuring that the U.S. government receives fair market value for acreage made available for leasing and that any oil and gas activities conserve resources, operate safely, and take maximum steps to protect the environment. OCS oil and gas lease sales are currently held on an area-wide basis, with annual sales in the Central and Western Gulf of Mexico (GOM). Less frequent sales are held in the Eastern GOM. Sales in Alaska are focused on the Beaufort and Chukchi Seas, with a special sale in Cook Inlet, dependent upon

industry interest. The program operates along all the coasts of the United States – with oil and gas production occurring on the GOM, Pacific, and Alaska OCS (BOEM, 2011).

Legal settlements against British Petroleum and Transocean, stemming from the Deepwater Horizon (DWH) oil spill, awarded $350 million to the National Academy of Sciences (NAS). NAS has established a research grant program to study environmental science and human health impacts in the wake of the oil spill in the Gulf of Mexico, and it is anticipated that BOEM will be coordinating with this program for future projects. BOEM is also participating in the DOI RESTORE (Resources and Ecosystems Sustainability, Tourist Opportunity and Revived Economics of the Gulf States Act of 2011) Science Team, the RESTORE Council Executive Team, and the Gulf Coast Ecosystem Restoration Science Program Advisory Working Group with the goal of leveraging funding opportunities for the ESP.

BOEM's planning process links its activities to the DOI's Strategic Plan (U.S. DOI, 2011) in the following mission component areas: Sustainably Manage Energy, Water and Natural Resources, and Provide a Scientific Foundation for Decision Making. Careful planning ensures that goals and strategies are cascaded throughout the organization. BOEM's strategies also guide the development of budget documents, which are used as input for planning, and performance documents in support of ongoing efforts to build a Department-wide strategic plan. BOEM's ongoing work to oversee offshore energy and marine mineral exploration and development on the OCS, from lease offerings to lease abandonment, also addresses multiple mandates to ensure safe and sound operations, minimize impact on the environment, and achieve fair market value. This work includes ongoing critical research on the environment and preparation of rigorous environmental assessments for proposed development-related activities. The environmental research component is conducted through the ESP.

1.1.4 Authorities

The ESP was initiated in 1973 as a means to gather and synthesize environmental science and socioeconomic information to support decision-making concerning the offshore oil and gas program. The Outer Continental Shelf Lands Act of 1953, (OCSLA), as amended in 1978, established policies for the management of the OCS oil and gas leasing program and for the protection of marine and coastal environments. Section 20 of the Act authorizes the ESP and establishes three general goals for the program:

- Provide information needed for the assessment and management of environmental impacts on the human, marine, and coastal environments of the OCS and potentially affected coastal areas;
- Predict impacts on marine biota that may result from chronic, low level pollution or large spills associated with OCS production activities, such as from drilling fluids and cuttings discharges, pipeline emplacement, or onshore facilities; and,
- Monitor human, marine, and coastal environments to provide time series and data trend information for identifying significant changes in the quality and productivity of these environments, and to ascertain the causes of these changes.

Early ESP efforts summarized and synthesized available information. Early field studies were designed to provide a statistically valid baseline of the biological, geological, chemical, and physical characteristics of proposed leasing areas. Over the years many changes have occurred. Leasing and development activities are now focused predominantly in the GOM with development and leasing activity in Alaska's Beaufort and Chukchi Seas, as well as some production in southern California. To address critical OCS information needs, studies conducted in these areas are focused on characterizing environmental processes, determining the presence and abundance of important species, and investigating how species use the habitats.

Additionally, the passage of the Energy Policy Act of 2005 gave BOEM responsibilities in not only new frontier "areas" but also in frontier "technologies." There is significant potential for renewable energy from wind, wave and ocean currents offshore, focused along the Atlantic and Pacific coasts. While these nascent technologies are not producing energy on the OCS yet, efforts to support current and future renewable energy activities are underway. BOEM also is responsible for other mineral production offshore, which currently includes using sand and gravel for coastal restoration projects.

1.1.5 Headquarters Emphasis

This component of the Studies Development Plan (SDP) provides the national "context" of the ESP and the linkages between BOEM's diverse Regional needs. In contrast to the research conducted through BOEM's Regional Offices, which focus on specific geographic areas or technologies, the Headquarters Office's issues (and sometimes specific studies) are more national in scope and have program-wide applications. The ESP at Headquarters provides leadership and general program support (such as quality assurance, peer review planning, information and data management and dissemination). The Headquarters Office also provides integration of BOEM's physical oceanographic studies to support oil spill risk assessment (OSRA).

The quality of the ESP's scientific information is ensured through internal and external reviews by partners and by the OCS Scientific Committee (a Federal Advisory Committee). Studies may incorporate external review boards comprised of experts in the field. Publication of ESP study results in the peer-reviewed literature is supported and encouraged strongly.

Research projects are identified and selected on an annual basis with an emphasis on relevance to the missions of the Bureau and Department and also the scientific merit of the study efforts. Studies must be technically feasible and timed appropriately both to use information from other efforts and to be delivered in time for relevant documents and decisions. The ESP is measured and documented to be effective and efficient in delivering relevant information in a timely fashion.

To ensure consistency and transparency, the ESP follows a robust set of procedures that include multiple levels of review and approval. The development of the SDP includes

opportunities for public input to the topics considered for study. The results and products of all studies are also made available to the public via the BOEM website.

The ESP seeks partnerships to leverage funds with other interested Federal, State, and private stakeholders, wherever possible, to maximize the utility of the results and extend limited budgets. Partnerships bring together expertise, equipment, and funds from various sources and allow related work to be conducted simultaneously, often expanding the scope and relevance of the work conducted.

The results of BOEM-funded research are presented both domestically and internationally to a variety of audiences, including professional and academic societies, industry forums, and governmental workshops. These events spread our scientific information to wide audiences. Many of our projects have opportunities for educational components as well; examples include taking a teacher to sea, developing curriculum materials or games for students, and producing videos and posters.

1.2 Map of the Planning Area

The OCS is divided into 26 planning areas across four geographic regions – Atlantic, Pacific, Gulf of Mexico (Figure 1) and Alaska (Figure 2).

Figure 1. Atlantic, Pacific and Gulf of Mexico Planning Areas

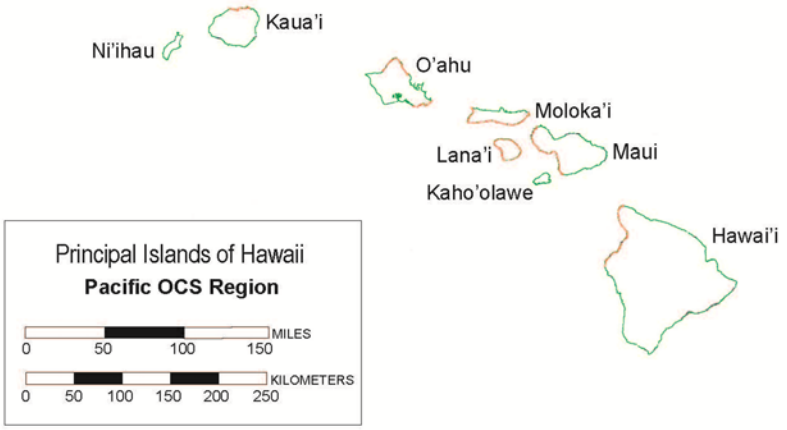
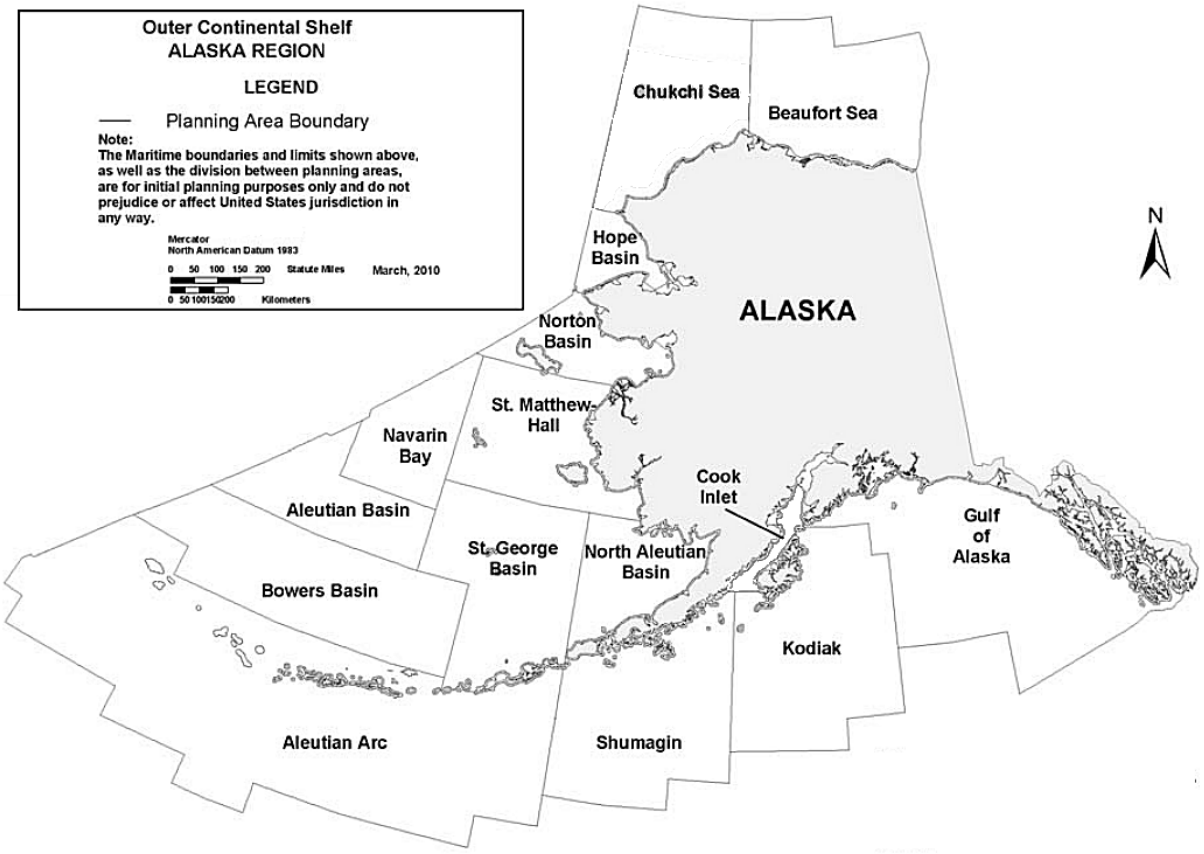


Figure 2. Alaska OCS Region Planning Areas



1.3 Projected OCS Activities

1.3.1 General Program Support

Annual support for the activities of the OCS Scientific Committee continues to be provided as a Headquarters Office function. The Scientific Committee was established to advise the Secretary of the Interior, through BOEM's Director, on the feasibility, appropriateness, and scientific value of the proposed studies.

In recognition of the benefits of peer-reviews and to enhance dissemination of environmental information as widely as possible, in addition to promoting the Bureau as a potential employer, BOEM routinely provides support to scientific conferences, workshops, and symposia. In some cases, symposia have a dedicated session on OCS research. BOEM-sponsored research is sometimes presented within the context of a wider scientific discipline. In other cases, BOEM supports meetings that have topics with strong relevance to mission-related information needs. The conferences to which funding is provided usually also receive financial support from other partners.

Another area of program support sponsored by the Headquarters Office is the archiving of biological specimens. The Smithsonian Institution's National Museum of Natural History (NMNH) is the Nation's most reliable and respected repository for biological collections. Since 1979, invertebrate specimens collected through BOEM's ESP have been carefully maintained through the NMNH's archiving standards and are made available to taxonomists around the world. Nearly 400 new species have been discovered due to BOEM's contributions.

1.3.2 Program Quality Assurance

National attention has been directed towards the ESP's performance measures and accountability. The Environmental Studies Program Performance Assessment Tool (ESP-PAT) was designed and implemented in 2005, and it is an internal, online system used to monitor the effectiveness of ESP products in fulfilling the Bureau's information needs. This tool also tracks the program's efficiency in delivering products on time. While designing performance measures for research programs has always been viewed as problematic, the ESP-PAT has accomplished this task, ensuring that the ESP fulfills its mission of providing the best possible scientific information for making decisions concerning our offshore resources. The ESP also reports on measures under the Renewable Energy High Priority Performance Goal (HPPG), and the ESP reports the percentage of environmental studies for renewable energy information needs awarded (including hybrid studies that benefit renewables) in a given fiscal year. The ESP typically meets or exceeds the established targets for ESP-PAT and HPPG metrics.

1.3.3 Scientific Integrity Policy

In January 2011, the Department of Interior was the first Federal agency to respond to the Presidential Memorandum on Scientific Integrity (March 9, 2009), and it acted on the guidance provided by the Office of Science and Technology Policy Memorandum on Scientific Integrity (December 17, 2010) by creating a department-wide Scientific Integrity Policy. The DOI Scientific and Scholarly Integrity Policy is now part of the DOI Departmental Manual (Part 305: Chapter 3) (U.S. DOI, 2011), and it replaces BOEM's 2009 Interim-policy and includes the designation of Departmental and Bureau level Science Integrity Officers. The purpose of the policy is to establish the expectations for how scientific and scholarly information considered in Departmental decision making is handled and used. The policy calls for the use of science and scholarship to inform management and public policy decisions and establishes scientific and scholarly ethical standards. In addition, the policy includes codes of conduct, a process for the initial handling of alleged violations, and clear guidance of how employees can participate as officers or members on the boards of directors of non-Federal organizations and professional societies. This policy applies to all Department employees, including political appointees, when they engage in, supervise, manage, or influence scientific and scholarly activities; communicate information about the Department's scientific and scholarly activities; or utilize scientific and scholarly information in making agency policy, management, or regulatory decisions. Further, it applies to all contractors, cooperators, partners, permittees, and volunteers who assist with developing or

applying the results of scientific and scholarly activities. The policy and supporting information can be found at: http://www.doi.gov/scientificintegrity/index.cfm.

1.3.4 General Peer Review Planning

Section V of the Office of Management and Budget's (OMB) Final Information Quality Bulletin for Peer Review (Executive Office of the President, Office of Management and Budget, 2004) requires that agencies have "a systematic process of peer review planning" and publish a "web-accessible listing of forthcoming influential scientific disseminations (i.e., an agenda) that is regularly updated by the agency." Numerous mechanisms within the ESP identify and fulfill the requirement for scientific peer review. These existing mechanisms include:

- Review and critical input by scientific advisory committees under the Federal Advisory Committee Act,
- Internal review of proposals by BOEM scientists,
- External review of proposals by other Federal and nongovernmental scientists,
- Review and critical input by Scientific Review Boards or Modeling Review Boards,
- Scientific peer review of final reports, and/or
- Publication in peer-reviewed technical and/or scientific journals.

Each project is evaluated for the appropriate level of peer review required for the particular effort. These measures begin early in the development stages, and continue during the course of projects. These components taken together ensure that the science produced by the ESP is of the highest quality and, thus, creates a sound basis for decision-making.

1.3.5 Information Management and Dissemination

While the goal of the ESP is to gather and synthesize environmental science and socioeconomic information to support decision-making concerning the offshore program, the information must be available in a usable form and distributed in a timely manner. The ESP follows codified, standard operating procedures for the distribution and use of study results to ensure that they are distributed quickly to all relevant parties and users of the information. This rapid information dissemination is a key management activity. An important resource for easy access to completed ESP products through BOEM's web is the Environmental Studies Program Information System (ESPIS) at http://www.boem.gov/Environmental-Stewardship/Data-and-Information-Systems.aspx (BOEM, 2013b). Full-text files, abstracts, and relational databases are searchable through the system, which allows users to easily search for, identify, and select sections of text or bibliographic citations that relate directly to the desired subject.

Planned enhancements of the ESPIS database will make all completed ESP reports and other deliverables available online as full electronic portable document format (PDF) documents. ESPIS will be linked to the Multipurpose Marine Cadastre (Multipurpose

Marine Cadastre, 2013) to create a tool to search geospatially for reports and data from completed environmental studies (http://www.marinecadastre.gov/default.aspx). It is envisioned that ESPIS will facilitate information sharing for National Environmental Policy Act (NEPA) assessment, oil and gas and alternative energy leasing, and inform Ocean Planning initiatives.

Information concerning ongoing research supported through the ESP is accessible at: http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Current-Research.aspx (BOEM, 2013a). The ongoing research is arranged by BOEM OCS Region and discipline (e.g., biology, socioeconomics, physical oceanography, fates and effects, etc.). Information provided for each study includes a complete description, status report, cost, and expected date of its final report. Affiliated web sites, presentation abstracts, and papers are provided where applicable.

In some cases, BOEM supports the archiving of data collected as part of a study, and archived data will be linked to Geo-ESPIS. Where appropriate, the data are required to be sent to the National Ocean Data Center. Another effort that BOEM supports is the Census for Marine Life. BOEM also continues to support the U.S. Geological Survey-hosted Ocean Biogeographic Information System (OBIS-USA), which is helping to fill the gap in the archiving of data for marine mammals and other marine life and implements standardized procedures for processing marine biological data collected by Federal, state, and university research efforts. BOEM will also promote the establishment of a national Animal Telemetry Network (ATN), which will be under the U.S. Integrated Ocean Observing System (U.S. IOOS). This network will implement a range of operational telemetry technologies so that a multitude of aquatic life may be monitored over temporal and spatial time-scales.

1.3.6 Physical Sciences, Oil Spill Risk Analysis and Air Quality

The Headquarters Office's role in coordinating regional physical oceanographic studies focuses on understanding and verifying general processes and features common to the OCS. The mechanisms of these processes and features in the ocean and atmosphere control the transport of materials and cause the mixing and redistribution of pollutants. The knowledge and information obtained from the physical oceanography and meteorology studies are used in assessing: 1) the transport of spilled oil, 2) the dispersion of discharge fluids and produced water, 3) the movement and spread of air pollutants, and 4) the effects of ocean conditions on the migration of marine mammals, the distribution of fishes, and other biological resources. BOEM is committed to the continuous improvement of its OSRA estimations and is using the results of field and modeling studies of ocean circulation to fulfill that commitment. As part of this effort, the additional capability to present results in a geographical format is being implemented.

The fate of spilled oil is another area of focus. Laboratory analyses are conducted on various types of oil, and computer models predict the behavior of an oil spill in the ocean environment. Furthermore, Headquarters staff members actively seek cooperative efforts with other agencies and private industries in such matters, and these efforts leverage BOEM's resources and provide additional needed information.

1.3.7 OCS Renewable Energy

The Energy Policy Act of 2005 delegated to BOEM the responsibility for offshore renewable energy development, including energy derived from offshore wind, waves, and ocean currents. Under Section 20 of the OCSLA, the ESP conducts studies to predict, assess, and manage environmental impacts and to monitor environments for renewable energy activities, as is done for oil and gas activities. Regulations to govern leasing for these energy types and operations were promulgated in 2009. To ensure that development occurs while concurrently protecting the environment, the ESP is funding projects to evaluate the potential effects on the environment including interactions between birds and wind turbines, space/use conflicts, visual effects, and effects of electromagnetic fields (EMFs) from high voltage direct currents (HVDCs). RODEO (Real-time Opportunity for the Development of Environmental Observations) is also partnership between BOEM and the Department of Energy (DOE) to examine ecological and socio-economic impacts during and after the installation of proposed offshore wind power demonstration projects. Additional staff support is provided from the Headquarters Office to support renewable energy study procurements as needed.

1.3.8 Global Climate Change

Recognized changes in global climate are of concern to BOEM, and the changing natural environment has resulted in shifts in the distribution of some marine species. These shifts, in turn, change the baseline conditions that are used to evaluate potential impacts from offshore energy-related activities. Of particular concern are the changes in ice conditions in Alaska and the resulting implications for oil spill projection and response. Ice also provides habitat, and fluctuating conditions will alter the distribution of some species. Along the Gulf and Atlantic Coasts, sea level rise and the implications for changing patterns of storm activity are concerns. BOEM is incorporating these effects and their implications in NEPA documents, and its many monitoring efforts provide excellent time series data that are useful to the understanding of climate change. While direct research on climate change is outside the purview of the ESP, many studies that evaluate marine ecosystems assist in the understanding of climate effects and changes that are occurring. Regional examples of long-term monitoring efforts are:

- For nearly 20 years, BOEM has collaborated with colleagues in the National Oceanic and Atmospheric Administration (NOAA) to monitor the health of the coral reefs of the East and West Flower Garden Banks, in the Gulf of Mexico.
- For more than 15 years, BOEM has collaborated with 38 partners to monitor the rocky intertidal systems along the entire Pacific coast and part of the New England coast.
- Beginning in 1979, BOEM has collaborated with partners to conduct aerial surveys of endangered whales in the Beaufort and Chukchi Seas off Alaska.

1.3.9 Partnerships

The ESP actively coordinates efforts with programs such as the National Oceanographic Partnership Program (NOPP). NOPP is a collaboration of Federal agencies that provides leadership and coordination of national oceanographic research and education initiatives. As a charter member of NOPP, the ESP continues to explore options to increase its participation, and its investments have grown dramatically in recent years. The ESP has funded research through NOPP focused on chemosynthetic communities, biological habitats supported by shipwrecks, surface circulation radar mapping in Alaska, improving cetacean electronic data loggers, and a variety of renewable energy projects. Several studies have received the NOPP Excellence in Partnering Award and also the U.S. Department of the Interior's Partners in Conservation Award. The Partners in Conservation Award, in particular, recognizes outstanding projects that address complex stewardship challenges in a collaborative and innovative manner. Two recent BOEM studies, "Atlantic Canyons—Pathways to the Abyss" and "Ocean Renewable Energy Stewardship Partnership," received this award in January 2014.

As just one of many examples of partnership, BOEM participates in the Interagency Working Group on Ocean Observations (IWG-OO), which is currently supported by the Consortium for Ocean Leadership. The IWG-OO promotes interagency activities and is a mechanism for partnership opportunities. The current focus is on developing a comprehensive ocean observation plan that addresses technical, scientific, and management components for the coming decade. As part of the support for this effort, BOEM contributes to a fund that is used to provide services for supporting the working group.

BOEM also participates as a co-chair on the Interagency Working Group on Ocean Partnerships (IWG-OP). The scope of the IWG-OP addresses the full range of ocean science, technology, and resource management priorities. This includes oceans and their interactions with the atmosphere, land, and living resources and with human influences; use, stewardship, and sustainability of living and non-living resources; and science, technology, and societal issues that are not clearly the domain of a single agency, program, or discipline.

BOEM also participates in the Interagency Working Group on Ocean Social Science (IWG-OSS). This group is tasked with assisting two Interagency Policy Committees (IPCs) under the National Ocean Council (NOC), the Ocean Science and Technology IPC and the Ocean Resource Management IPC, in integrating social science into ocean, coastal, and Great Lakes governance structures; agency functions; policies; and decision-making. The group's current focus is on supporting the implementation of the President's National Ocean Policy. In doing so, the IWG-OSS is coordinating reviews of current work on social indicators and social science data management and is also collaborating with partners to identify, develop, and employ valuation frameworks for ecosystem services.

1.3.10 Ecosystem-Based Management

BOEM continues its efforts to support ecosystem-based management through the studies planning process. Early ESP planning, which started in the Gulf of Mexico Region, was primarily ecosystem-based. The coastal habitats were studied via the U.S. Fish and Wildlife Service's (FWS's) ecologically defined "coastal characterization" studies, and each included a standard suite of reports, such as habitat descriptions, species profiles, socioeconomics, mapping, and GIS information. The marine study areas reflected physiographic units that were either generally distinct, with boundaries where habitats changed (e.g., South Texas Shelf, Texas-Louisiana Shelf, Mississippi-Alabama Shelf, West Florida Shelf, South West Florida Shelf) or were isolated (Topographic Features, Deepwater). For each of these areas, a standard suite of studies was planned as baseline or benchmark projects (later, "marine ecosystem studies"), including some marine ecosystem modeling, to better understand marine ecosystem processes and to clarify information needs for subsequent studies. More recent studies include marine ecosystem modeling efforts and highly integrated interdisciplinary studies, and these continue today. In light of changing environmental conditions, efforts are also focused on reassessing baselines and expanding monitoring efforts. The ESP is preparing for the upcoming influx of RESTORE Act funding to support environmental and sociocultural research Gulf of Mexico by engaging with the Department and other Federal agencies to discuss potential inter-agency efforts that would be supported by these funds, as well as working closely with NOAA to work towards coordinated long-term monitoring sites and projects in the Gulf of Mexico.

The assessments of prospective adverse effects that may impact marine ecosystems, as a result of offshore energy development, enable researchers to differentiate natural variables from those that are human-induced. In order to more precisely assess environmental risks and to better assess the most effective mitigation strategies, BOEM will support the establishment and demonstration of an operation marine biodiversity observation network (Marine BON). In order to further understand the distribution and abundance of marine animals and to analyze human use in the marine environment, BOEM will also be supporting the utilization of high-resolution aerial surveys, which will provide information on a large scale.

1.3.11 Ocean Planning

On July 19, 2010, President Obama signed Executive Order 13547 establishing a National Policy for the Stewardship of the Ocean, Coasts, and Great Lakes (Executive Office of the President, 2010). The Executive Order strengthens ocean governance and coordination, establishes guiding principles for ocean management, and adopts a flexible framework for effective coastal and marine spatial planning to address conservation, economic activity, user conflict, and sustainable use of the offshore areas. The National Ocean Policy (NOP) outlines nine priority objectives, including Marine Planning. It also creates the National Ocean Council (NOC), a two-tiered institutional framework to implement the NOP.

Marine Planning is an ecosystem-based planning process for analyzing current and anticipated ocean uses and identifying areas most suitable for various types or classes of activities. Marine plans will be prepared through stakeholder input and implemented using a regional approach to allow for variability of economic, environmental, and social aspects among different areas of the U.S. The planning scale for the nine regions proposed in the NOP framework document is the Large Marine Ecosystems (LMEs). This includes regions with an active BOEM presence such as the Gulf of Mexico, West Coast, Alaska, Mid-Atlantic, and the Northeast. BOEM is a Federal co-lead in the Mid-Atlantic region and a designated Federal representative in Alaska, Gulf of Mexico, Northeast, and the West Coast. It is important to note that the process is intended to provide a better framework for the application of existing laws and agency authorities but not intended to supersede them. As of January 2014, four Regional Planning Bodies (RPBs) have been stood up - Northeast, Mid-Atlantic, Caribbean and Pacific Islands. RPBs consist of representatives from Federal agencies, states, Federal recognized tribes, and Fishery Management Councils (FMCs) and are charged with implementing marine planning at the regional level.

1.3.12 Marine Minerals Program

Erosion and storm damage severely impact the Nation's beaches, dunes, barrier islands, and wetlands and affect the sustainability and value of coastal ecosystems and economies. The extent and magnitude of erosion and storm damage are also increasing along the U.S. coastline as climate variability drives changes in sea level and storm characteristics. Beach nourishment and ecosystem restoration continue to be preferred, however temporary, solutions to curb land loss, protect infrastructure, maintain coastal economies, and stall barrier island and wetland ecosystem collapse. As the availability of beach-compatible sand from proximal upland or environmentally-suitable borrow areas in state waters continues to decline, an increasing number of project proponents, ranging from other Federal agencies to local governments, rely on OCS sand to construct their beach nourishment and coastal restoration projects. OCS sand introduces new sediment into coastal budgets and is critical for the longer-term success of many shore protection, beach nourishment, and wetlands restoration projects along the Gulf and Atlantic coasts. This makes the role of OCS sand very important and contrasts with alternative sediment sources that are closer to shore and are already part of the active coastal transport system.

BOEM's Marine Minerals Program is the sole steward of OCS sand, gravel, and shell resources, so it plays a unique role and has responsibilities in many beach nourishment and coastal restoration projects. As of January 2014, the Bureau has conveyed rights to more than 77 million cubic yards of OCS sand for 42 coastal restoration projects in five states (BOEM, 2014). These projects have resulted in the nourishment or restoration of more than 230 miles of the Nation's coastline (approximate distance from New York City to Washington, D.C.), protecting billions of dollars of federal, state, local, and private infrastructure, as well as important ecological habitats (BOEM, 2013d).

BOEM has authorized use of OCS sand resources in an unprecedented number of projects over the past two years, more than a dozen projects in Louisiana, Florida, North

Carolina, South Carolina, and Virginia alone. BOEM has also begun to address the need for sand resources in other coastal states for the first time, such as New Jersey and Mississippi. In FY 2013-2014, BOEM played an integral role in the government's response to Superstorm Sandy. By the end of FY 2014, BOEM will have authorized the use of OCS in five different states related to Sandy's erosion and storm damage.

A large number of regional-scale resiliency projects are expected to flow from the North Atlantic Comprehensive Study currently being led by the U.S. Army Corps of Engineers (USACE). BOEM anticipates that many of these projects along the Mid-Atlantic Bight will require access to OCS sand resources. In the interim, BOEM is undertaking new sand resource evaluation work along the Atlantic coast, with more than $10 million in disaster relief Appropriations Act funding directly to the bureau. Similarly, funds were directed to BOEM to support environmental assessment and environmental monitoring work. BOEM is also currently sponsoring a two-year collaborative effort with the U.S. Navy, the National Aeronautics and Space Administration (NASA), the University of Florida, and the USACE to investigate the long-term recovery of benthic and fish communities following the dredging of a borrow area offshore central Florida. Major RESTORE Act refurbishment efforts are expected to require the use of OCS sand resources in order to restore coastal wetlands and barrier islands along the fragile Gulf Coast.

The sand bodies often targeted for dredging include shoals, sand ridges, cape associated features, and sand-rich buried channels. These sedimentary features are home to many different biological species, from federally managed fish species to foraging sea turtles, and some may even harbor submerged archaeological resources. As the demand for OCS sand increases, sand management issues and potential environmental conflicts have also become more complex and deserving of rigorous study, monitoring, and management. To this end, BOEM carries out environmental studies in support of the Marine Minerals Program to address three main requirements:

1. to comply with environmental laws and regulations;
2. to maintain its responsibility to manage public sand resources in an environmentally-sound and responsible manner; and
3. to identify long-term, cumulative impacts when making management decisions.

Since 1993, over 60 environmental studies have been funded along three primary themes of research:

1. biological studies, which address the potential for adverse impacts on marine life as a consequence of dredging sand on the OCS;
2. physical process studies, which examine the potential for changes in hydrodynamics and sediment transport processes in the vicinity of borrow areas and in the adjacent coastal zone; and
3. impact studies, which evaluate the potential for systemic effects on focused aspects of physical, chemical, biological, cultural, and human environments and

are then used to develop appropriate mitigation methods to minimize or prevent adverse impacts.

Recent Marine Minerals Program studies have addressed potential effects to essential fish habitats, measured noise levels in the marine environmental due to the operation of dredge engines and pumps, synthesized biological impacts from dredging, and identified topical areas requiring additional study. These types of studies are also being used to identify those areas that may feature prehistoric cultural resources and shipwrecks, which will then be avoided if future dredging activity occurs.

1.3.13 Acoustic Studies

An issue of ongoing concern to BOEM is the impacts of anthropogenic noise generated during offshore activities. Some examples include seismic exploration, pile driving during construction, ship self-noise from vessel traffic during operation, and explosions during structure decommissioning and removal. The ESP has completed several recent studies in all of these areas, which continue to expand the knowledge base on the effects of these sounds on aquatic life.

Another aspect of anthropogenic sound is its employment as a means of gathering information about the organisms themselves. Studies are underway to use acoustic detection systems to identify and quantify birds by their calls. This research will expand existing information about the distribution and abundance of birds, especially during low light conditions and in poor weather. These types of data are particularly useful in the siting of offshore wind farms. Similarly, BOEM is funding work to acoustically detect, classify, localize, and study marine mammals with our partners through NOPP, and a planned study will involve a synthesis of the cumulative impacts that repeated and varied stresses from anthropogenic sources have on these animals.

BOEM continues to conduct and participate in workshops and conferences with themes focused on sound issues. Recently, BOEM conducted a workshop to identify gaps in our understanding of the effects of noise on marine fish, fisheries, and invertebrates with a focus on the Atlantic and Arctic coasts. BOEM is also collaborating with the U.S. Navy to obtain and analyze declassified data, which have the potential to provide significant insights into marine mammal abundance and distribution and also on behavioral reactions to several types of anthropogenic noise.

1.3.14 Education and Youth Initiatives

BOEM, like many other Federal agencies, has an aging workforce and will need to replace many of its marine scientists and engineers as they retire. The agency must be able to attract well-qualified marine scientists and engineers to meet expanding and changing workforce needs. Since there is a shortage of marine scientists in general, BOEM faces competition from other employers in and out of government. At the same time, the Environmental Studies Program needs and will continue to need well-qualified marine scientists to conduct program-funded research. The ESP undertakes a number of activities to encourage students in their academic training and provide young professionals with opportunities to succeed in their careers. These activities are in

support of the ESP's education goals of 1) an ocean literate public, 2) a pipeline of marine scientists to meet ESP needs either through employment at BOEM or at universities, and 3) an ocean literate marine workforce. To achieve these goals, the ESP undertakes a number of activities aimed at increasing ocean literacy and building a strong marine workforce.

The ESP is engaged with other Federal agencies in addressing ocean literacy and marine workforce needs through the Interagency Working Group on Ocean Education (IWG-OE). The group has implementation responsibilities related to ocean literacy and building a skilled marine workforce under the National Ocean Policy Implementation Plan. The ESP is a member of the Department of the Interior's STEM (Science Technology Engineering Math) Education Working Group that prepared the DOI STEM Education and Employment Pathways Strategic Plan (DOI STEM Ed). The plan addresses four strategic areas: facilitate access to coordinated DOI resources, engage students and citizens, support educators, and strengthen career training and workforce development. The DOI STEM Ed plan supports the work of the DOI Office of Youth, Partnerships, and Service (OYPS), which was established in 2009 to bring the DOI bureaus together to implement policies and programs which increase youth involvement and engagement. The ESP is a member of the Youth Alliance; the working group of DOI bureaus that helps the OYPS meet its mission.

The ESP aligns its education efforts with the objectives and implementation strategies of the National Ocean Policy Plan and the DOI STEM Ed Plan. The ESP strategy primarily addresses students and educators from middle school through graduate school and is accomplished through the development of education materials based on ESP study results, involvement of undergraduate and graduate students through their universities on research teams conducting ESP-funded science, and through partnerships with programs and professional organizations focused on the marine sciences and marine education.

The ESP views teachers as our partners in preparing both an ocean-literate public and the next generation of marine scientists and engineers. The ESP also supports middle school and high school teachers and informal educators through co-sponsorship of the annual conference of the National Marine Educators Association, and participation in some of their committees, and through development of education materials based on ESP project results. The ESP has sponsored "teachers-at-sea" through formal teacher-at-sea programs and by incorporating a teacher in the research team on some ESP-funded studies. The ESP study project managers are encouraged to incorporate an education component into their study plans, and a respective study's education products are prepared through a collaborative effort between scientists and educators. These education resources are shared with students and educators at science education conferences and eventually through the re-designed BOEM website.

To encourage high school students interested in the marine sciences, the ESP provides financial support to the National Ocean Sciences Bowl (NOSB), which is a high school competition. The NOSB provides BOEM with the opportunity to develop links to the pre-college community and allow students to be aware of career opportunities in the marine sciences and in the Federal government, and BOEM is profiled in the NOSB

career booklet, “An Ocean of Possibilities! Careers Related to the Ocean and Aquatic Sciences.” The NOSB reaches out to students and communities to increase participation by minorities, women, and disadvantages students, which supports BOEM’s goal of a diverse workforce.

ESP studies using cooperative agreements with universities often use undergraduate and graduate students as part of the research team, and these students sometimes use the research results for their master thesis or doctoral dissertation. Some of those students enter an academic career and occasionally continue to conduct ESP research through their university. At some point in their career, these students may enter government service, which might include employment at BOEM. Either way, research teams on ESP-funded projects using undergraduate and graduate students contribute to the training and career development of the next generation of marine scientists.

1.4 Identification of Information Needs

The ESP plans to support several efforts to improve the dissemination of information and products resulting from its studies. BOEM will continue to maintain and expand tools to make collated samples, data, reports, and literature more accessible to internal scientists and the academic and general communities. The ESP proposes to continue archiving invertebrate specimens collected through BOEM-sponsored projects. This archiving effort supports the credibility of the ESP by ensuring that specimens are properly identified and preserved, and they must be accessible to researchers. BOEM has recently begun to incorporate contract requirements for the submission of tissue samples to the Smithsonian, and with the creation of a new state-of-the-art tissue/DNA archival facility at the Smithsonian's Museum Support Center, the archival of tissue/DNA from BOEM studies will allow researchers to have permanent access, similar to the continued availability of archived marine invertebrate specimen collections. DNA barcoding may also be conducted on BOEM-submitted specimens, providing valuable additions to DNA database information.

The ESP also continues to support the development of a portal for social science information, which will connect studies documents and reports to original data and data products geographically. In coordination with Federal partners, the ESP intends to improve the collection, mapping and, analysis of data on protected species, using observation programs in Alaska to demonstrate the expanded capability of the Ocean Biogeographic Information System - Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP).

BOEM’s commitment to understanding the fate of spilled oil will be furthered by the proposed study to develop environmentally benign oil simulants. This project supports our goals to use environmentally sound practices and to assess environmental effects. An oil simulant will allow *in situ* testing without damage to the environment and enable direct measurement of the behavior of particles in specific situations and locations.

The persistence of and scalability of certain effects on biological and physical systems from dredging remain poorly understood and need to be studied to ensure proper management of the Nation’s natural resources. This necessitates longer-term and

comparative study to be able to describe the inherent variability in ecosystem and biophysical function and resiliency let alone an ecosystem's response to short-term and chronic disturbance of potentially important benthic and demersal fish habitat and the impact on trophic transfer and bioenergetics from such perturbations. By studying and monitoring biological and physical effects within and adjacent to borrow areas at a local and regional scale, BOEM and other agencies such as National Marine Fisheries Service (NMFS) can better manage and protect resources by defining appropriate mitigation measures, environmental windows, or dredging practices. In parallel BOEM must also more accurately measure the actual disturbance and track the short-term and cumulative intensity of dredging in areas and document in greater detail a system's physical response. Only with this information can BOEM differentiate and compare pre-disturbance condition with the recovered or dynamic state of biological resources. The end goal is to incorporate this new information and improved understanding about the biological and physical system into systematic planning and resource management strategies, at both the local and regional scale.

In the interests of understanding the impacts of noise generated during offshore activities and in capitalizing on partnerships, the ESP proposes to support an ongoing effort that is pooling information from several behavioral response studies on humpback whales. This multi-study collection of data will provide more robust information for analysts to use and therefore lead to more scientifically supportable decisions.

1.5 New Starts for FY 2014 and Ongoing Studies Table

This section enumerates the new starts for FY 2014 and ongoing studies in Headquarters. Detailed information about the ongoing Headquarters studies can be found at our website here: http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Current-Research.aspx (BOEM, 2014a). As always, reports and technical summaries from completed studies in all Regions can be found through ESPIS here: http://www.boem.gov/Environmental-Stewardship/Data-and-Information-Systems.aspx (BOEM, 2014b).

Table 1. New Starts for FY 2014 and Ongoing Studies

NSL #	Study Title	Planning Area(s)	Start FY	Partners
New Starts				
Habitat & Ecology				
NT-13-05	Marine Arctic Ecosystems Study: A Multi-Agency NOPP Partnership (also appears under Physical Oceanography)	AK	2014	ONR, NOAA, US ARC, NSF, USCG, USGS, US IOOS, Shell
Information Management				
NT-14-01	Continued Archiving of Outer Continental Shelf Invertebrates by the Smithsonian Institution National Museum of Natural History	All	2014	NMNH
Marine Mammals and Protected Species				
NT-14-02	Developing BOEM's Access to Protected Species Occurrence Data for Impact Analysis and Rule-making	All	2014	
Physical Oceanography				
NT-13-05	Marine Arctic Ecosystems Study: A Multi-Agency NOPP Partnership (also appears under Habitat & Ecology)	AK	2013	ONR, NOAA, US ARC, NSF, USCG, USGS, US IOOS, Shell
NT-14-03	Propagation Characteristics of High-Frequency Sounds Emitted During High-Resolution Geophysical Surveys	All	2014	Navy, USACE

*Note: The procurement of any study is contingent upon availability of funding				
Ongoing Studies				
Air Quality				
NT-12-04	Testing and Evaluation of AERMOD Using AERCOARE and MMIF Meteorological Outputs Representative of the OCS	All	2012	
Fates & Effects				
NT-10-x31	Best Practices for Physical Process and Impact Assessment in Support of Beach Nourishment and Coastal Restoration Activities	All	2010	
NT-10-x32	Sub-Seabed Geologic Carbon Dioxide Sequestration Best Management Practices	All	2010	
NT-11-01	Evaluation of the Relative Environmental Sensitivity and Marine Productivity of the Outer Continental Shelf (OCS)	All	2011	
NT-11-07	Workshop on Alternative Technologies to Airguns for Use During Seismic Surveying of Offshore Energy Resources	All	2012	
NT-11-x22	Responding to Oil Spills in Arctic Environments	AK	2011	NAS
NT-12-x12	Characterization of Underwater Sound Produced by a Trailing Suction Hopper Dredge During Dredging, Pump-Out, and Placement Operations	All	2012	USACE
Habitat & Ecology				
NT-09-01	Archiving of Outer Continental Shelf Invertebrates by the Smithsonian Institution	All	2012	NMNH
NT-09-03	Surveying for Marine Birds in the Northwest Atlantic	AT	2009	FWS, NOAA
NT-11-x24	Compendium of Avian Information: Part 2	AT	2011	USGS
NT-12-06	Working Group and Research Planning to Identify the Habitat Value and Function of Shoal/Ridge/ Trough Complexes on the OCS	All	2012	
NT-13-01	Expanded Nation-Wide Scope for Archiving of Outer Continental Shelf Invertebrates by the Smithsonian National Museum of	All	2013	NMNH

	Natural History			
Information Management				
NT-10-x22	Support for Ocean Studies Board Activities	All	2010	NAS
NT-11-02	ESP Education and Outreach Initiative	All	2012	
NT-11-05	Support to the National Marine Educators Association Annual Conference	All	2012	
NT-11-12	Continued Support for the Development and Maintenance of a Marine Biological Data Archive	All	2011	USGS
NT-12-01	Enhancement of the Environmental Studies Program Information System and the MMC to Provide Environmental Studies Program Data	All	2012	
NT-13-02	Support for the National Ocean Sciences Bowl (NOPP)	All	2013	
Marine Mammals and Protected Species				
NT-10-03	Support for NOPP Project on Improving Cetacean Electronic Data Loggers	All	2010	ONR
NT-10-08	Support for JIP Controlled Exposure Experiments with Humpback Whales and Seismic Air Gun Arrays and Testing of Effectiveness of Ramp-Up	All	2011	
NT-11-08	Development of Software and Hardware to Acoustically Detect, Classify, and Locate Marine Mammals	All	2011	ONR
NT-13-x11	Arctic Science, Engineering, and Education for Sustainability (ArcSEES) (also appears under Social & Economic Sciences)	AK	2013	NSF
Physical Oceanography				
NT-08-02	Adaptation of Arctic Circulation Model	AK	2010	
NT-09-x15	Improving Wind Wave Predictions: Global to Regional Scales		2009	NAVY
NT-09-x19	University-National Oceanographic Laboratory System (UNOLS) Support	All	2009	NSF
NT-11-04	Update to the BOEM Oil Spill Risk Analysis (OSRA) Model: Applying Lagrangian Stochastic Model to	All	2011	

	Track Oil Spills			
NT-11-06	Shelf-Slope Sediment Exchange in the Northern Gulf of Mexico: Application of Numerical Models for Extreme Events	GM	2011	
NT-12-03a	Improving Oil-Spill Risk Analysis in the Gulf of Mexico: A Multi-Model Approach - Part A -Data Assimilative Ocean Hindcast for Oil Spill Risk Analysis in the Gulf of Mexico	GM	2012	
NT-12-03b	Improving Oil-Spill Risk Analysis in the Gulf of Mexico: A Multi-Model Approach - Part B	GM	2012	
Social & Economic Sciences				
NT-11-13	Commercial Fishing Hang Data as a Proxy for Locating Shipwreck Sites off the Mid-Atlantic Coast	AT	2011	
NT-13-x11	Arctic Science, Engineering, and Education for Sustainability (ArcSEES) (also appears under Marine Mammals & Protected Species)	AK	2013	NSF

Planning Area Codes

AT = Atlantic
AK = Alaska
GM = Gulf of Mexico
NT = National
PC = Pacific

Partner Codes

USACE = U.S. Army Corps of Engineers
FWS = U.S. Fish and Wildlife Service
NAS = National Academy of Sciences
NAVY = Department of the Navy
NMFS = National Marine Fisheries Service
NMNH = Smithsonian Institution's National Museum of Natural History
NOAA = National Oceanic and Atmospheric Administration
NOPP = National Ocean Partnership Program
NSF = National Science Foundation
ONR = Office of Naval Research
Shell = Shell Oil Company
US ARC = U.S. Arctic Research Commission
US IOOS = U.S. Interagency Ocean Observing System
US MMC = U.S. Marine Mammal Commission
USCG = U.S. Coast Guard
USGS = U.S. Geological Survey

SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

Headquarters proposes five new studies for FY 2015.

2.2 FY 2015 Table

Table 2. Headquarters Studies Proposed for the Fiscal Year 2015 NSL

SDP Page Number	Discipline	Regional Ranking	Study Title
29	HE	1	High Resolution Aerial Imaging for Surveying of Ocean Use by Humans and Marine Animals
31	HE	2	A Demonstration Marine Biodiversity Observation Network (BON) for Ecosystem Monitoring
35	MM	3	Assessment of the Cumulative Effects of Anthropogenic Stressors on Marine Mammals
37	IM	4	Continued Support for the Development and Maintenance of a Marine Biological Data Archive
39	IM	5	Workshop on Establishing a National Animal Telemetry Network (ATN)
Discipline Codes			
AQ = Air Quality		FE = Fates & Effects	HE = Habitat & Ecology
IM = Information Management		MM = Marine Mammals & Protected Species	
PO = Physical Oceanography		SE= Social & Economic Sciences	

Region: National

Planning Area(s): All

Title: High Resolution Aerial Imaging for Surveying of Ocean Use by Humans and Marine Animals

BOEM Information Need(s) to be Addressed:

This study will provide large scale, synoptic data that will provide foundational information for environmental analysis by BOEM. By implementing new technology, already tested by BOEM, information needs will be met for understanding the distribution and abundance of marine animals as well as human use in the marine environment. Products resulting from this study will be used for NEPA analysis, region specific environmental assessments, review of applications for permits, and development of the Five Year Plan for Oil and Gas Development.

Cost Range: (in thousands) $4000 **Period of Performance:** FY 2015-2019

Description:

Background: High resolution aerial imaging has been demonstrated to be a valuable tool in Europe for environmental monitoring of both marine animals as well as human uses. BOEM funded a pilot study in 2009 to determine the feasibility of deploying this technology on the U.S. Outer Continental Shelf (Normandeau 2013). This study found that high resolution aerial imagery was a safe cost effective method that can provide scientifically robust information on the distribution of birds, mammals, and sea turtles in the marine environment. Although not the focus of this previous study, it is apparent from the imagery collected that this technology can also captures human uses of the marine environment.

High-resolution aerial surveys can cost less than conventional aerial and vessel based surveys, however there real value is safety and accuracy. This new technology allows for a flying at higher altitudes, and thus facilitates safer flights. Just as important, this technology allows for more accurate density calculations due to: 1) higher flights that tend not to disturb marine fauna 2) the creation of a high quality, durable record allowing for repeated examination over a long period of time (e.g., decades) and 3) the ability to precisely calculate survey boundaries.

The purpose of this project is to operationalize this technology at a large scale, perhaps three BOEM planning areas, to test the feasibility of implementing repeated long term surveys across the outer continental shelf. There is interest among other government agencies to begin utilizing this technology and the recent BOEM study has documented the methods needed to equip USFWS and NOAA aircraft with the necessary equipment.

Objectives: The objective of this study is to gather large-scale geographic information on the distribution and abundance of marine organisms including, birds, sea turtles and marine mammals as well as the spatial patterns of human uses of the ocean.

Methods: High-resolution aerial imaging will be used to sample three BOEM planning areas multiple times during a single year. Example of data that products that can be developed include patterns and distribution of human uses such as fishing, boating, kayaking, surfing and potentially other recreational uses, as well as the density and distribution of marine animals.

It is estimated that these surveys will be conducted at a regional scale with a study area of approximately 25,000 km2, a 10% sampling area, and quarterly sampling. Observations will be identified, categorized and converted into a geographic data layer. Software may be used to identify "targets", however it is anticipated that identification, such as species, will be made by manual visual interpretation. Initial planning areas will be chosen based on information needs and the ability to complement existing research.

Revised Date: April 7, 2014

Reference: Normandeau Associates, Inc. 2012. High-resolution Aerial Imaging Surveys of Marine Birds, Mammals, and Turtles on the US Atlantic Outer Continental Shelf—Utility Assessment, Methodology Recommendations, and Implementation Tools for the US Dept. of the Interior, Bureau of Ocean Energy Management. Contract # M10PC00099. 378 pp. web link: http://www.data.boem.gov/PI/PDFImages/ESPIS/5/5272.pdf

Region: National

Planning Area(s): All

Title: A Demonstration Marine Biodiversity Observation Network (BON) for Ecosystem Monitoring

BOEM Information Need(s) to be Addressed: BOEM needs biodiversity information in all areas of the OCS acquired through a well-accepted, systematic methodology through abroad-scale, comprehensive, ecosystem-based monitoring of the marine environment. This information will enhance BOEM's environmental impact assessments and rule making for mitigation efforts.

Approximate Cost: (in thousands) $1,000 **Period of Performance:** FY 2015-2018

Description:

Background: Biological diversity, or biodiversity, is defined as the variety of life, encompassing variation at all levels of complexity – genetic, species, ecosystems, and biomes – and including functional diversity and diversity across ecosystems. A growing body of research demonstrates that: (1) the maintenance of marine biodiversity (including coastal biodiversity) is critical to sustained ecosystem and human health and resilience in a globally changing environment; and (2) the condition of marine biodiversity offers a proxy for the status of ocean and coastal ecosystem health and ability to provide ecosystem services. Thus, managing our marine resources in a way that conserves existing marine biodiversity would help address other ocean management objectives (Palumbi et al. 2009). For example, it would provide information to enhance biosecurity against threats such as invasive species and infectious agents, enable predictive modeling, better inform decision making, and allow for adaptive monitoring and Ecosystem-Based Management.

As stated in the final recommendations of the Interagency Ocean Policy Task Force, it is the policy of the United States to protect, maintain, and restore the health and biological diversity of ocean, coastal, and Great Lakes ecosystems and resources (http://www.whitehouse.gov/files/documents/OPTF_FinalRecs.pdf). The Census of Marine Life, which concluded in 2010, greatly enhanced our understanding of the status of marine biodiversity. It also made clear the importance of clear-cut, systematic and sustainable approaches to observing and monitoring biodiversity across different levels and at a national scale.

In May 2010, the Biodiversity Ad Hoc Group under the Interagency Working Group on Ocean Partnerships convened a workshop of experts to develop a plan and recommendations for attaining an operational marine biodiversity observation network (Marine BON) for the nation. The full workshop report can be found online at http://www.nopp.org/wp-content/uploads/2010/03/BON_SynthesisReport.pdf. In May 2013, workshop steering committee members published a paper in BioScience on

the feasibility of establishing a Marine BON (http://www.jstor.org/stable/pdfplus/10.1525/bio.2013.63.5.8.pdf).

Through the National Oceanographic Partnership Program (NOPP), NOAA, NASA, BOEM, and the USGS (with other federal bureaus likely joining later) sent-out a request for proposals to address the recommendation from the 2010 workshop to initiate an integrated Marine BON demonstration project. The bureaus are requesting proposals for one or more broadly coordinated demonstration projects in U.S. coastal waters, the Great Lakes, and the exclusive economic zone (EEZ) that demonstrate how an end-to-end marine BON can be developed. "End-to-end" refers to integration of observations and historical data across multiple scales of diversity (genetic to ecosystem, microbes to whales), time (instants to centuries), and space (in situ to satellite remote sensing). Special consideration will be given to proposals that demonstrate potential for establishing long-term, sustainable monitoring through partnerships.

The assessment of possible adverse risk from offshore energy development hinges critically on being able to differentiate human-induced effects from natural variability. Given the complexity of marine ecosystems and the possible effects of global climate change, this often requires making observations over large ocean areas, seasonally, and over multiple years and even decades to acquire reasonable statistical confidence. Towards that end, BOEM conducts long-term monitoring in selected areas and has plans for expanded monitoring in the Beaufort Sea (Marine Arctic Ecosystem Study (MARES)) and in the Atlantic (Atlantic Marine Assessment Program for Protected Species (AMAPPS II)).

These and earlier monitoring efforts range from single-species surveys (e. g. Bowhead Whale Aerial Survey Project (BWASP)) to more integrated ecological monitoring (e. g. Flower Garden Banks monitoring). The BON approach is to be highly ecological. The advantage of that to BOEM is the possibility of identifying which species in a given area are more vulnerable than others and which are more critical for the functioning of the ecosystem as a whole. Knowing that, BOEM can more precisely assess environmental risk and better decide on which mitigation efforts would be most beneficial overall.

Objective: The objective of this study is to develop a prototype ecosystem-based marine biodiversity network, across a range of habitats, looking at multiple trophic levels and species, and informed by historical data and past modeling efforts to the extent possible. Such a network will include one or more of the following:

(1.) integration of and building upon existing monitoring and management programs with new approaches;

(2.) assembly and synthesis of existing programs and data to identify trends and gaps in taxonomic, spatial, and temporal coverage;

(3.) expand upon planned and recently-launched observing sites, systems, and programs;

(4.) employ innovative techniques for data discovery and methods that dynamically interrelate data sets and add value to existing monitoring data;

(5.) coordinate with or utilize Smithsonian Institution resources for lab space and lab time, data and observations, and taxonomic or other expertise;

(6.) collaborate with the U. S. Integrated Ocean Observing System (U.S. IOOS) participants including the U. S. IOOS Regional Associations for coastal, ocean and Great Lakes observations, infrastructure, data management and modeling capabilities; and

(7.) engage NOAA's National Oceanographic Data Center, U. S. IOOS, and/or USGS's Ocean Biogeographic Information System (OBIS-USA) for biological data and metadata management, archiving, discovery, and access.

Methods: Through the National Oceanographic Partnership Program (NOPP), requests for proposals were broadly distributed. In response, research proposals have been submitted and will be evaluated by a panel of scientists with relevant research experience. BOEM and other co-funding agencies will be able to select which of the better-evaluated proposed projects they want to fund based upon their value to the agencies' missions.

Revised Date: April 7, 2014

Reference: Palumbi, S. R., P. A. Sandifer, J. D. Allan, M. W. Beck, D. G. Fautin, M. J. Fogarty, B. S. Halpern, L. S. Incze, J. A. Leong, E. Norse, J. J. Stachowicz, and D. H. Wall. 2009. Managing for ocean biodiversity to sustain marine ecosystem services. Frontiers in Ecology and the Environment 7:204- 211.

Environmental Studies Program: Studies Development Plan FY 2015–2017

Region: National

Planning Area(s): All

Title: Assessment of the Cumulative Effects of Anthropogenic Stressors on Marine Mammals

BOEM Information Need(s) to be Addressed: Whereas many investigations on the adverse effects of offshore activities on marine mammals address the immediate, acute impacts, less is known about the cumulative effects due to repeated and / or varied stress on these animals. A comprehensive review and synthesis of the scientific understanding to date of cumulative impacts and the methods used to evaluate them will give BOEM the ability to make more comprehensive impact assessments than has been done previously. BOEM's NEPA analyses and compliance with the Marine Mammals Protection Act (MMPA) and Endangered Species Act will be improved.

Approximate Cost: (in thousands) $300 **Period of Performance:** FY 2015-2016

Description:

Background: Potential interactions between marine mammals and anthropogenic sound are of concern to regulatory agencies, the environmental community, and the general public. There are many sources of anthropogenic sound in the ocean, from activities such as shipping, dredging and construction, oil drilling and production, geophysical surveys, and sonar from both civilian and military applications. In addition to sound, marine mammals may be exposed to a range of anthropogenic stressors and environmental changes. Other potential stressors include: toxicants, decreased prey abundance, and reduction in the quality or availability of habitat. The effect of a behavioral response on an individual animal's probability of survival or reproduction depend upon the animal's activities during the time of exposure (e.g., feeding, diving), attributes of the individual (e.g., age class, sex), physical condition, and its history of exposure to anthropogenic and natural stressors. And, of course the effect of a single stressor may be compounded by exposure to other stressors.

A promising approach to estimate cumulative effects of a given stressor is to link behavioral and/or physiological responses to vital rates (e.g., birth rates, juvenile survival, and adult mortality) by measuring body condition as a function of foraging success and energetics. Body condition is a state variable that responds to stressors and affects vital rates in both the short term and long term. Changes in behavior and/or physiology that reduce food intake or increase energy use can affect body condition. Over time, body condition will reflect the accumulated response to stressors. In many species, the reproductive success of females is limited by their energy stores, so variation in body condition can affect reproductive rate and survival of offspring. Changes in body condition can also affect survival via effects on the immune system.

A few years ago, the Office of Naval Research's (ONR's) Marine Mammals and Biology Program took the lead in an informal group of governmental and academic researchers

attempting to understand and model cumulative effects. Theirs was one of several such efforts, and there was not enough interaction among these groups to afford any one of them mutual benefit from the work done by the others. Consequently, ONR has proposed conducting a review and synthesis study on cumulative effects by the National Research Council's (NRC's) Ocean Studies Board, Division on Earth and Life Studies. The BOEM study proposed herein will co-fund the NRC review and synthesis.

Objectives: The objectives of this study are:

(1.) obtain a better understanding of the contribution of any one anthropogenic stressor to the cumulative impact of multiple stressors on individual marine mammals and marine mammal populations. (This is a fundamental problem in ecology that has not been solved and that is of direct relevance to environmental management.);

(2.) discover ways to quantify exposure-related changes in the behavior, health, or body condition of individual marine mammals;

(3.) assess the potential to use indicators of health or body condition to estimate changes in vital rates and, in turn, estimate the potential population-level effects; and

(4.) identify new approaches that could improve the assessment of cumulative effects.

Methods: A committee of approximately 8-9 subject matter experts will be recruited to review the present scientific understanding of cumulative effects of anthropogenic stressors on marine mammals and assess current methodologies used for evaluating cumulative effects. The committee will examine theoretical (modeling) and field methods used to assess the effect of anthropogenic stressors for:

(1.) short or infrequent exposure in the context of other known stressors (i.e. multiple stressors, both natural and anthropogenic); and

(2.) chronic exposure in the context of other known stressors.

This would include both direct and indirect effects from anthropogenic stressors and other environmental stressors.

The committee will meet 3 times over a span of 18 months to plan, gather information, deliberate, and prepare a final report. One of the meetings will include a public workshop as part of the data-gathering activities. The report will be subject to NRC review procedures prior to release. The committee will subsequently disseminate the report through briefings and presentations at scientific conferences.

Cost Justification: The total cost of the NRC review is approximately $600,000 . BOEM would be sharing half the cost. If other agencies are willing to co-fund this effort, BOEM's share of the cost would be reduced.

Revised Date: April 7, 2014

Environmental Studies Program: Studies Development Plan FY 2015–2017

Region: National

Planning Area(s): All

Title: Continued Support for the Development and Maintenance of a Marine Biological Data Archive

BOEM Information Need(s) to be Addressed: This study will enhance all of BOEM's environmental impact assessments and consultations involving living marine organisms as well as marine spatial planning efforts by significantly improving the accessibility to a great many marine biological observations now widely distributed among many organizations and existing in a variety of different formats. BOEM will benefit by having access to its considerable collection of data, integrated with many other, similar data sets in a uniform format (or a few standardized formats) with metadata documentation in a permanent archive. In addition, BOME will have user tools for data display and analysis that will be, or have been, developed. Finally, to the extent possible, BOEM's particular data access needs will be accommodated. (The soon-to-be completed geo-ESPIS will contain little data and mostly reference data available at various archives.)

Approximate Cost: (in thousands) $180 **Period of Performance:** FY 2015-2017

Description:

Background: Based upon considerable input from various federal agencies coordinated by the presidential Office of Science and Technology Policy and other formal and informal groups of data users and data generators, a federal data infrastructure for marine biological observations and similar data is being developed. The Ocean Biogeographic Information System-USA (OBIS-USA), brings together marine biological occurrence data –- recorded observations of identifiable marine species at a known time and place, collected primarily from U. S. waters or with U. S. funding. Coordinated by the Core Science, Analysis and Synthesis (CSAS) program of the United States Geological Survey (USGS), OBIS-USA, strives to meet national needs for access to marine data about organisms and ecosystems. OBIS-USA is part of an international data sharing network (OBIS) coordinated by the Intergovernmental Oceanographic Commission, of UNESCO.

BOEM has provided funding to OBIS-USA over the past four years in cooperation with other federal agencies, including USGS (CSAS), Navy (Living Marine Resources Program) and NOAA (Integrated Ocean Observing System, and Marine Fisheries). In addition, NOAA's National Ocean Data Center, and USGS have established a memorandum of understanding to ensure the marine biological data are well managed, available for use and archived to meet federal agency needs and mandates. The memorandum, together with informal agreements for a coordinated effort among National Oceanographic Data Center (NODC), USGS, and Duke University (hosting

OBIS-Seamap) have significantly furthered the development of OBIS-USA and the ongoing, evolving relationship among these three institutions to develop and maintain a federal marine biological data infrastructure for permanent data archiving, quick and easy access to the archived data by later users of the data, and the development of user tools for data display and analysis.

Objectives: The objectives of this study are:

(1.) (1.) continue the development and maintenance of a marine biological data archive within OBIS-USA at the USGS, in close collaboration with NODC and OBIS-Seamap;

(2.) assist in the formation of common data formats for various types of marine biological data and descriptive metadata;

(3.) gather, organize, and assimilate BOEM marine biological data into the OBIS-USA-OBIS-Seamap-NODC collaborative archive; and

(4.) realize opportunities to use the data collected by various federal, state, and university research projects to support BOEM's science and decision-making.

Methods: Building upon the existing OBIS-USA data archiving and data dissemination infrastructure, new procedures for processing marine biological data collected by various federal, state, and university research efforts will be developed and implemented. This will include continual improvement of internet-based access to the OBIS-USA collection. In addition, OBIS-USA will continue its collaboration with the scientific community to adopt standardization of data and meta-data formats. Finally, OBIS-USA will maintain and enhance its working relationship with NODC and OBIS-Seamap to avoid duplication of effort and to make accessing data and analysis tools residing at one or more of these three entities as seamless as possible for scientists and mangers using their services.

This study also has a data collection (data rescue) component, whereby USGS personnel will be working with BOEM regional personnel and scientists from several other federal research groups to move their data into the NODC-OBIS-USA-OBIS-Seamap archival infrastructure.

Revised Date: April 7, 2014

Environmental Studies Program: Studies Development Plan FY 2015–2017

Region: National

Planning Area(s): All

Title: Workshop on Establishing a National Animal Telemetry Network (ATN)

BOEM Information Need(s) to be Addressed: This study will enhance BOEM's environmental impact assessments and rule-making for mitigation through the expansion of the use of instrumented animal tags for broad-scale, comprehensive, ecosystem-based monitoring of the marine environment and the creation of an information collection and distribution process for the acquired data. In particular, it will help BOEM compliance with NEPA, MMPA, Endangered Species Act (ESA) and the Magnuson-Stevens Fishery Conservation Act. Additionally, the eventual successful development of the Animal Telemetry Network will offer BOEM and outside researchers the opportunity to do data synthesis and further analyses on the telemetry data to be accumulated and archived by the lead agency, the U. S. Integrated Ocean Observing System. Presently, these data are widely dispersed, held by many individual researchers.

Approximate Cost: (in thousands) $23 **Period of Performance:** FY 2015-2016

Description:

Background: Animal telemetry is the science of elucidating the movements and behavior of animals as they move through the world's oceans, coastal rivers, estuaries and great lakes. Animal telemetry devices ("tags") yield detailed data regarding animal responses to the changing physical environment through which they are moving. This can be done in near-real time, or by use of archival tags in which the data are stored or later transmitted to an array of sensors or satellites. Animal species tagged have ranged from 6-gram salmon smolts to 150-ton whales. Detailed observations of animal movements and behavior in relation to critical habitats in their aquatic environment have significantly improved our understanding of ecosystem function and dynamics. These observations are critical for sustaining populations, conserving biodiversity and developing the kinds of data required to implement ecosystem-based management. Sensors carried by animals have recently come of age and deliver ancillary, high resolution physical oceanographic data at relatively low costs. Animals are particularly adept at helping scientists identify critical habitats, spawning locations, and important oceanographic features (e.g., fronts, eddies and upwelling areas). They also provide important insights into regions of the oceans that are difficult and expensive to monitor (e. g., offshore environments, Arctic).

Animal telemetry observations can inform federal and state resource managers through improved spatial models of animal dynamics, and improve the basis of conservation and sustainable-use fishery management policies. A national Animal Telemetry Network (ATN) under the U. S. Integrated Ocean Observing System (U. S. IOOS) will implement a range of operational telemetry technologies that enable monitoring of a host of aquatic

life over multiple temporal and spatial scales. A national ATN will provide exciting and important short and long-term benefits, including enhancing fisheries and ecosystem-based management, filling oceanographic knowledge gaps and improving ocean modeling and forecasting, and advancing many of the National Ocean Policy (NOP) Implementation Plan priority objectives.

In the past several years, BOEM-funded research projects have made use of satellite-tracked tags to establish the migratory behavior of Arctic marine mammals and the behavioral response of Australian humpback whales and sperm whales in the Gulf of Mexico. These observations have significantly expanded our knowledge about these animals and, in turn, have improved BOEM's environmental impact assessments. Much more can be learned about habit use, reproductive behavior, and interactions with offshore infrastructure and support vessels with a more extensive use of animal tags and the use of the more advanced tags, which measure several relevant parameters like diving depths and durations, sound intensity, ambient temperature, salinity, and pH, etc. The establishment of an ATN offers the opportunity for more extensive monitoring of species of concern and to do it collaboratively with other parties of similar environmental concerns for cost savings.

Animal telemetry is currently at a grassroots level and the U. S. IOOS is poised to take a leadership role nationally and internationally. Similar telemetry organizations already exist in several other national ocean observing programs (such as the Integrated Marine Observing System (IMOS), http://www.imos.org.au/ , in Australia and the Ocean Tracking Network (OTN), http://oceantrackingnetwork.org/ , in Canada). By developing, maintaining and disseminating an integrated data display and storage of animal and telemetry data gathered by private, academic, local, state and federal institutions, U. S. IOOS has the capacity to lead and strengthen our national ocean observing capabilities in this area. Stronger ATN ocean observing capabilities will augment our knowledge and understanding of ocean ecosystems and our ability to engage in science-based decision-making and ecosystem-based management.

Objectives: The objective of this study is to conduct a workshop to launch the establishment of an integrated national ATN under the direction of U. S. IOOS program office. The workshop will be a forum to continue past discussions on the structure and functions of the envisioned ATN. Specifically, the workshop will address how the ATN will:

(1.) provide the scientific basis for marine fisheries and protected-endangered species management;

(2.) define essential or critical habitats for species protected under the ESA and MMPA;

(3.) provide real-time monitoring of marine fish, turtles, birds, and mammals;

(4.) evaluate the potential effects of anthropogenic disturbances;

(5.) improve coupled ocean-atmosphere observation and forecasting models (employing tags with conductivity and temperature sensors); and

(6.) develop and maintain an integrated data archive and data visualization system for animal telemetry data gathered by private, academic, local, and state and federal governmental institutions.

Methods: Invitations to attend the workshop will be sent to the group of university and governmental scientists who have had extensive past experience with animal tags and who have already been engaged with each other in developing the concept of an ATN. They have produced a mission statement with defined goals and the rationale for creating a national ATN. The workshop will facilitate the next step in creating the ATN.

The workshop will be conducted in a federal office building in the Washington, D.C. area to accommodate most of the federal scientists in this group. Travel expenses for 6 to 8 university scientists in the group will be paid by this study.

After the workshop, the two co-chairpersons will produce an executive summary of the conclusions reached and suggestions made by the committee members and a list of near-term future next steps for the steering committee to undertake.

Revised Date: April 7, 2014

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Costa, D., Block, B., Bograd, S. (2009). "TOPP: Using Electronic tags to monitor the movements, behavior and habitats of marine vertebrates" in Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2), Venice, Italy, 21-25 September 2009, Hall, J., Harrison D.E. & Stammer, D., Eds., ESA Publication WPP-306.

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SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2017

3.1 Long-Term Monitoring of Ecosystem Changes

The primary function of the ESP is to provide the scientific environmental information necessary to inform Bureau decisions. Because baselines shift over time with changing climate and with punctuated events such as oil spills or hurricanes, long-term ecosystem-based monitoring becomes essential. Long-term continuous monitoring extends the baseline against which relative impacts from natural and anthropogenic causes can be measured. With continuously collected environmental information and associated analyses, proper mitigations can be identified and special stipulations issued to alleviate potential impacts. Such information also further strengthens the quality of scientific information available for leasing decisions and supports marine spatial planning. The marine ecosystem modeling and highly integrated interdisciplinary studies undertaken by the ESP will be direct beneficiaries of long-term monitoring study results.

Such long-term monitoring projects may collect oceanographic, atmospheric, sociological and biological information. Depending on the parameters to be monitored, projects may use remotely placed sensors on existing or yet-to-be-built infrastructure, unmanned autonomous vehicles, or data from satellites for passive measurements; manned ships, aircraft, or site visits to actively collect information; or a combination of these methods. Some infrastructure exists in every region, and more is likely to be built in the next few years, providing sites for widespread data collections that can be used both for site-specific and (eventually) regional-scale analyses.

A notable portion of the scientific information required by BOEM is provided by the United States Geological Survey (USGS), some directly through intra-agency agreements and some indirectly through USGS's Ecosystems OCS Fund. Most recently, the ESP requested an amount of $1,500,000 from the OCS Fund, specifically to support studies conducted by the U.S. Geological Survey (USGS) that directly relate to the ESP's identified research priorities needed to inform important, ecosystem-based management decisions. Examples of previous studies funded by ESP and conducted by USGS include investigations of polar bears, rockfish, natural seeps, chemosynthetic communities, and a compendium of avian information. Typical OCS Fund studies have conducted modeling of avian populations, studies of the abundance and distribution of birds and marine mammals, and seafloor mapping work.

Historically, BOEM identified information needs that could be filled by USGS scientists, and USGS has determined which of those needs could be undertaken within the OCS Fund budget. This budget has lessened over time, resulting in additional funds being required from the ESP budget to support the studies or the cancellation or deferral of studies critical to BOEM. Another complication is that BOEM has had little oversight or control of study planning, conduct, financial management of studies conducted through the OCS Fund. Ensuring that BOEM receives the required information, results and deliverables in the necessary time frame has been difficult.

Having funds specifically targeted towards studies conducted by USGS in direct support of BOEM's identified priority research will create a formal coordination and oversight role in the work undertaken for BOEM. This BOEM-controlled funding source both encourages joint planning on research direction and provides BOEM with greater control over OCS Fund-supported research by ensuring that BOEM priority needs are financially supported. A similar parallel request by USGS for $3 million serves the same purpose by augmenting the USGS Ecosystems Outer Continental Shelf Fund budget line item.

The research conducted with these funds will be selected through the established ESP studies development process in coordination with USGS to inform important, ecosystem-based management decisions. This process uses multi-stage identification of information needs and reviews of requirements, and projects are tied specifically to BOEM needs and actions to ensure they provide the necessary information. The ESP's procedures ensure that the budget is allocated carefully to studies providing the most needed results and that partnership with USGS is established to leverage resources and extend the utilization of results to the maximum degree possible. The ESP has a long history of fully executing the entire budget allocated to the program in an efficient and transparent manner.

3.2 Monitoring

In conjunction with the research on changing baselines, increased emphasis will be needed on monitoring environment in areas where development is either occurring or may occur. This monitoring will be needed across all seasons and will need to extend across many years to account for natural variability. Monitoring will also address changes in the biological, oceanographic and atmospheric regimes. Data collected during monitoring efforts will be subsequently used to support NEPA analyses, OSRA and air quality modeling efforts, and inform assessments of climate change. Data will also be useful in evaluating the efficacy of established mitigations and stipulations. In the Gulf of Mexico Region, particularly, increased monitoring efforts will focus on social and economic impacts and also on the movements of and contaminants in affected wildlife. Efforts in this region will be coordinated with activities under the National Resource Damage Assessment to ensure there are no conflicts.

3.3 Partnering in Arctic Research

Research needs in the Arctic Ocean have increasingly been populating the agendas of state, national and international decision makers in recent years. These needs range from energy development and national security to climate change and social issues, and they involve agencies with different missions, capabilities and budgets. To make an efficient use of all available resources, several Federal assessments have called for increased interagency collaborations in Arctic research. In particular, President Obama recently signed Executive Order 13580 (Executive Office of the President, 2011), which mandates that Federal agencies responsible for overseeing the development of onshore and offshore energy resources in Alaska, and the associated infrastructure, do so in a safe and responsible manner and to help reduce the country's dependence on foreign oil

The ESP is engaged at many levels (e.g., strategic planning, policy, research) with other Federal agencies and countries in order to deliver coordinated and integrated environmental and scientific information to its managers. BOEM'S participation on the Interagency Arctic Research and Policy Committee (IARPC), which is led by the White House's Office of Science and Technology (OSTP), will continue. BOEM's ESP recently (April 18, 2012) partnered with the National Science Foundation (NSF) and a consortium of French agencies to address sustainability issues in the Arctic.

From a more technical perspective, BOEM is leading an interagency (NSF, NOAA, ONR, USGS, USCG, U.S. Arctic Research Commission [USARC], US IOOS, and Shell) planning effort to use state-of-the-art technology in the Beaufort Sea to answer a number of questions across several disciplines (e.g. marine biology, physical oceanography, and marine archaeology) and from different perspectives (e.g., ecosystem dynamics, climate change, and oil spill risk analysis). This program is being coordinated with a similar program, led by the North Pacific Research Board (NPRB), in the neighboring Chukchi Sea. This planning includes consultations with the IARPC to ensure coordination at higher levels and within the framework set forth in the National Ocean Policy (NOP).

3.4 Real Project Monitoring

With the imminent prospect of the placement of wind turbines and marine hydrokinetic devices offshore, an excellent opportunity for real-time environmental assessment and monitoring will become available. The ESP, in cooperation with partners at the Department of Energy, is pursuing initiatives to conduct environmental impact analysis on in-situ projects. While much of the coordination effort with our partners is managed through the Headquarters office, Regional leadership and participation in working groups and with managing the actual studies is a critical component to bring these efforts to fruition.

3.5 Understanding Effects

As activities increase, two areas are likely to receive increased focus: 1) the effects of seismic surveying activity on marine mammals and fish, and 2) the effects of dredging for marine minerals on biological and physical systems. Information in these areas is needed to support robust NEPA analyses, bolster consultations, and aid in the development of mitigations and best practices. The understanding of anthropogenic acoustic effects has long been an issue of concern for the ESP, and it will continue to be explored. Work in marine minerals may focus on the long-term monitoring of dredge sites and comparative studies.

3.6 Ocean Planning

Regional ocean plans in the long-run could inform the Bureau's regulatory and leasing functions. It is anticipated that these plans would reduce multi-use conflicts, facilitate environmental stewardship and enhance regulatory certainty. The Bureau's environmental science and assessment functions are supporting the planning exercise in

multiple ways. Many ongoing scientific studies are providing important anthropogenic and environmental baseline data, thereby enhancing the quality of regional plans. As the planning process evolves and new data needs are identified, the ESP could design studies to serve the programmatic needs and also inform marine planning. The Bureau's stakeholder engagement process for conventional and renewable energy leasing in many ways imitates the stakeholder process that is at the heart of ocean planning. These outreach efforts could provide valuable input to the regional ocean planning process.

BOEM
Bureau of Ocean Energy Management

CHAPTER 2

PACIFIC OCS REGION

U.S. Department of the Interior
Bureau of Ocean Energy Management
Camarillo, CA
2014

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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 Bureau of Ocean Energy Management (BOEM) 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 OCS Renewable Energy Task Forces with the States of Oregon and Hawaii.

For the Fiscal Years 2015-2017 Studies Development Plan (SDP), BOEM Pacific Region reached out to 27 major stakeholders for input. They included federal and state agencies, Tribal governments, and representatives of Native Hawaiian interests. The Pacific Region received eight study ideas from stakeholders, including the National Oceanic and Atmospheric Administration (NOAA), National Park Service (NPS), Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS), and the States of California, Oregon, Washington, and Hawaii.

Existing production and development activities on 43 producing oil and gas leases offshore southern California will continue (Figure 1). Annual production from these leases is currently 18 million barrels (bbls) of oil and 27 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 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 (Figures 2 and 3). BOEM has asked the Department of Defense (DOD) to review their use of the OCS and provide the bureau with potential zones that, due to military needs, would be excluded from renewable energy leasing off Hawaii and Oregon. DOD responded in 2013 that there are no off-limit areas on the Oregon OCS. BOEM expects DOD's response for

Hawaii some time in FY 2014. DOD has indicated that there could be off-limit areas around Oahu, a major market for renewable energy.

The interest for renewable energy is wave energy conversion and deepwater floating wind off Oregon and Hawaii. BOEM has received full applications for a wave energy research lease off Newport, Oregon, a deepwater floating wind energy commercial lease off Coos Bay Oregon (Figure 4), and is holding proposals for floating deepwater wind off Oahu. Interest for siting renewable energy is spreading to potential areas off California as well. The Department of Energy (DOE) chose California Polytechnic State University, San Luis Obispo (Cal Poly SLO) as a grant recipient to seek a renewable energy research lease off California. Cal Poly SLO and Oregon State University (OSU) are the two institutions on the West Coast to receive DOE grants to explore wave energy testing sites. BOEM met with researchers at Cal Poly SLO in the spring of 2014 and is in regular meetings with OSU as members of the Oregon Pacific Marine Energy Center (PMEC) working group. Several commercial companies have met with BOEM to discuss their concepts for both wave and wind energy projects off California, specifically off Vandenberg Air Force Base. Representatives from the State of Washington regularly communicate with BOEM; however, their major focus at this time is on state water tidal projects within Puget Sound and much of the Washington OCS lies within Olympic Coast National Marine Sanctuary, which is beyond the jurisdiction of BOEM.

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 decision making. 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. Additional information about the ESP and Pacific Region studies is available on the BOEM web site (BOEM 2014a, BOEM 2014b).

1.2 Maps of the Region

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

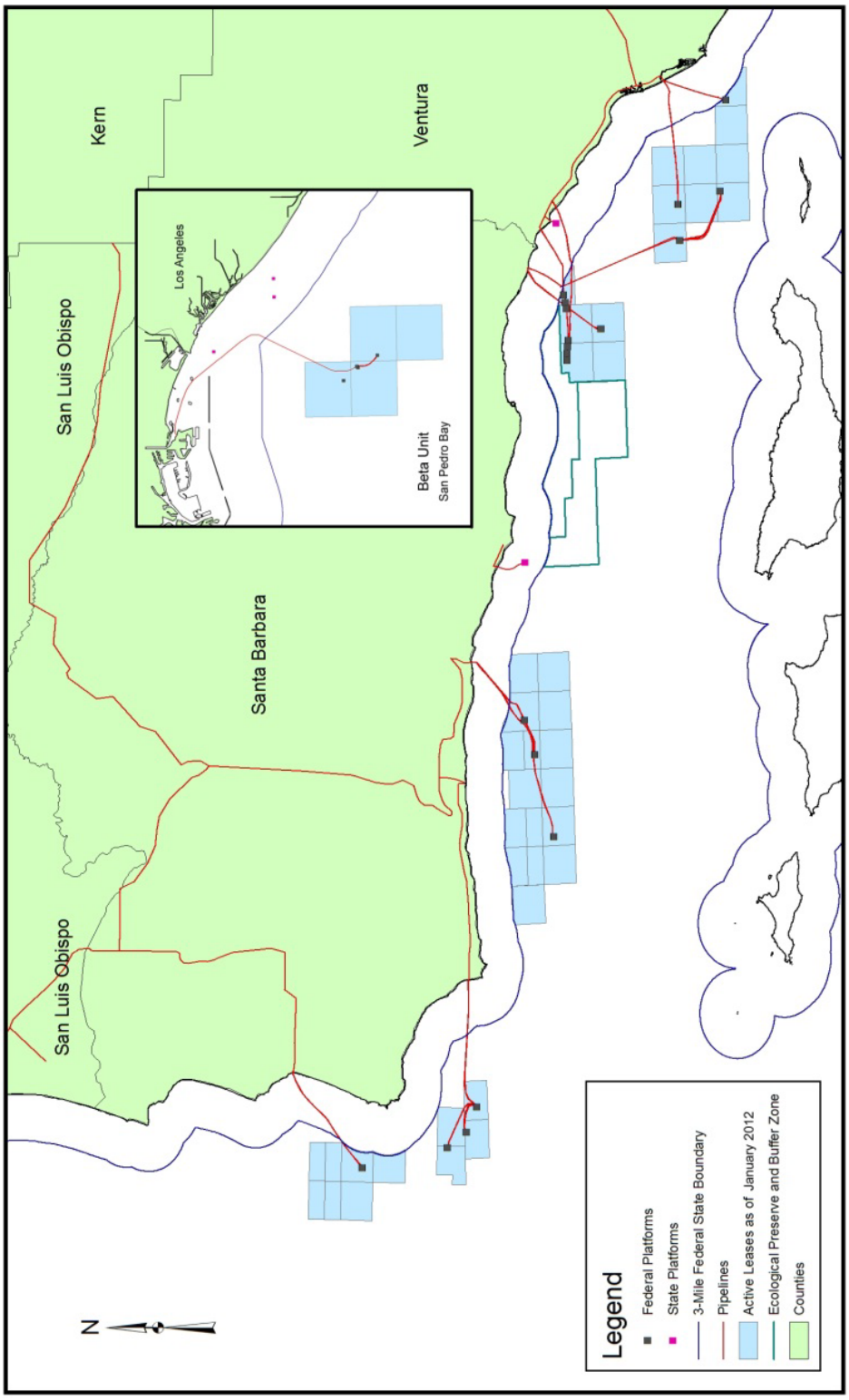


Figure 2. Wave Resource Potential for the U.S. West Coast and Hawaii (NREL n.d.)

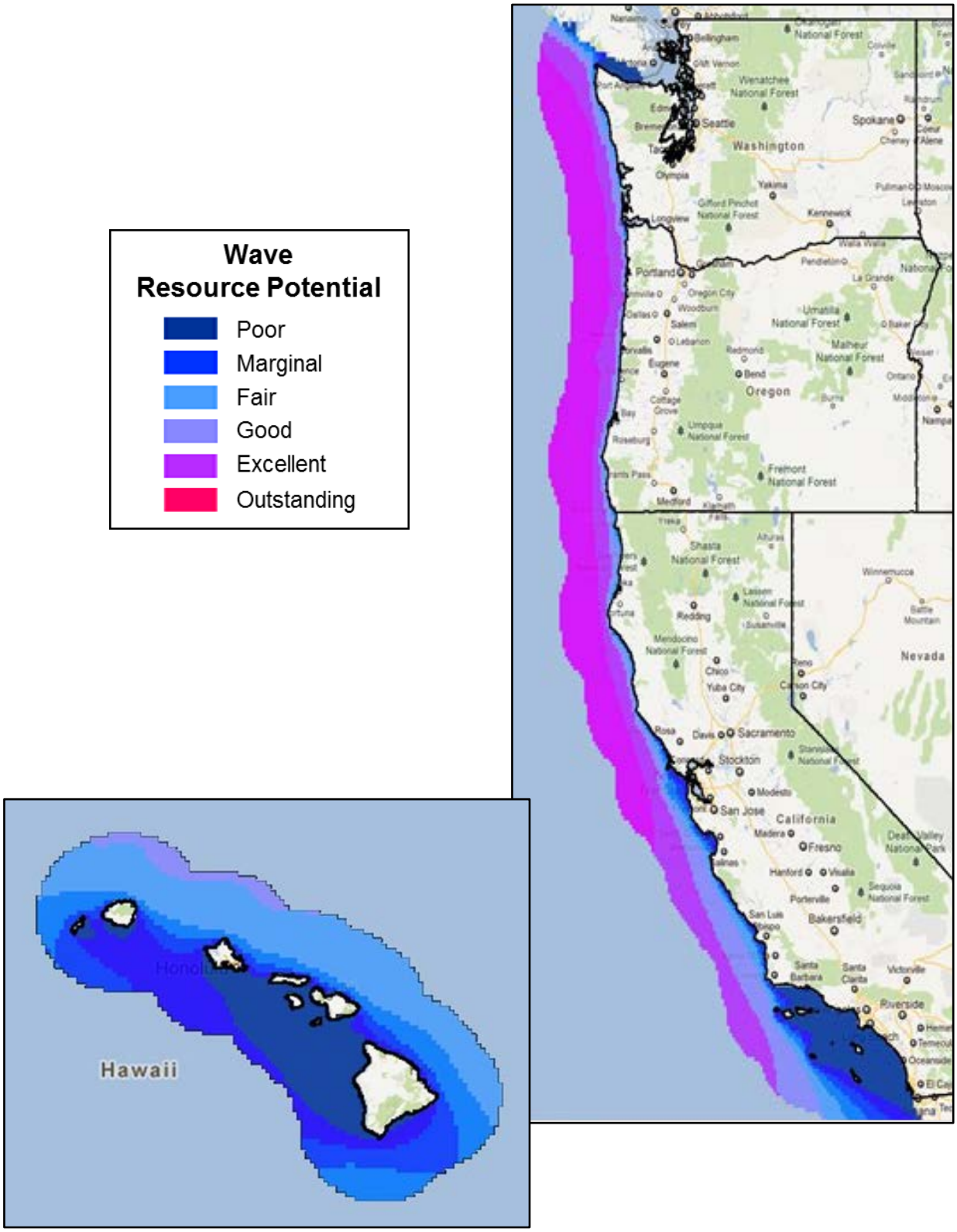


Figure 3. Wind Resource Potential for the U.S. West Coast and Hawaii (NREL 2009)

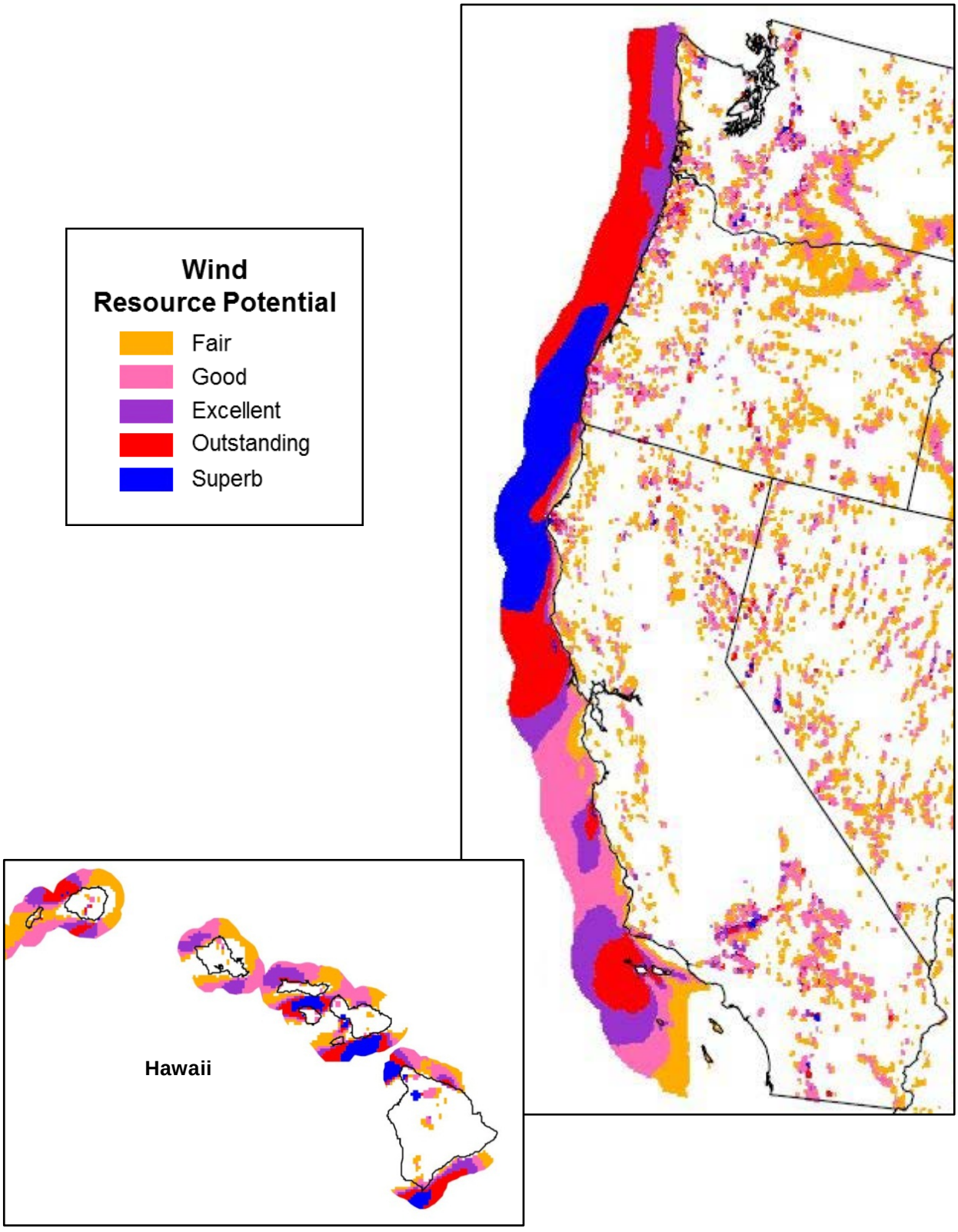
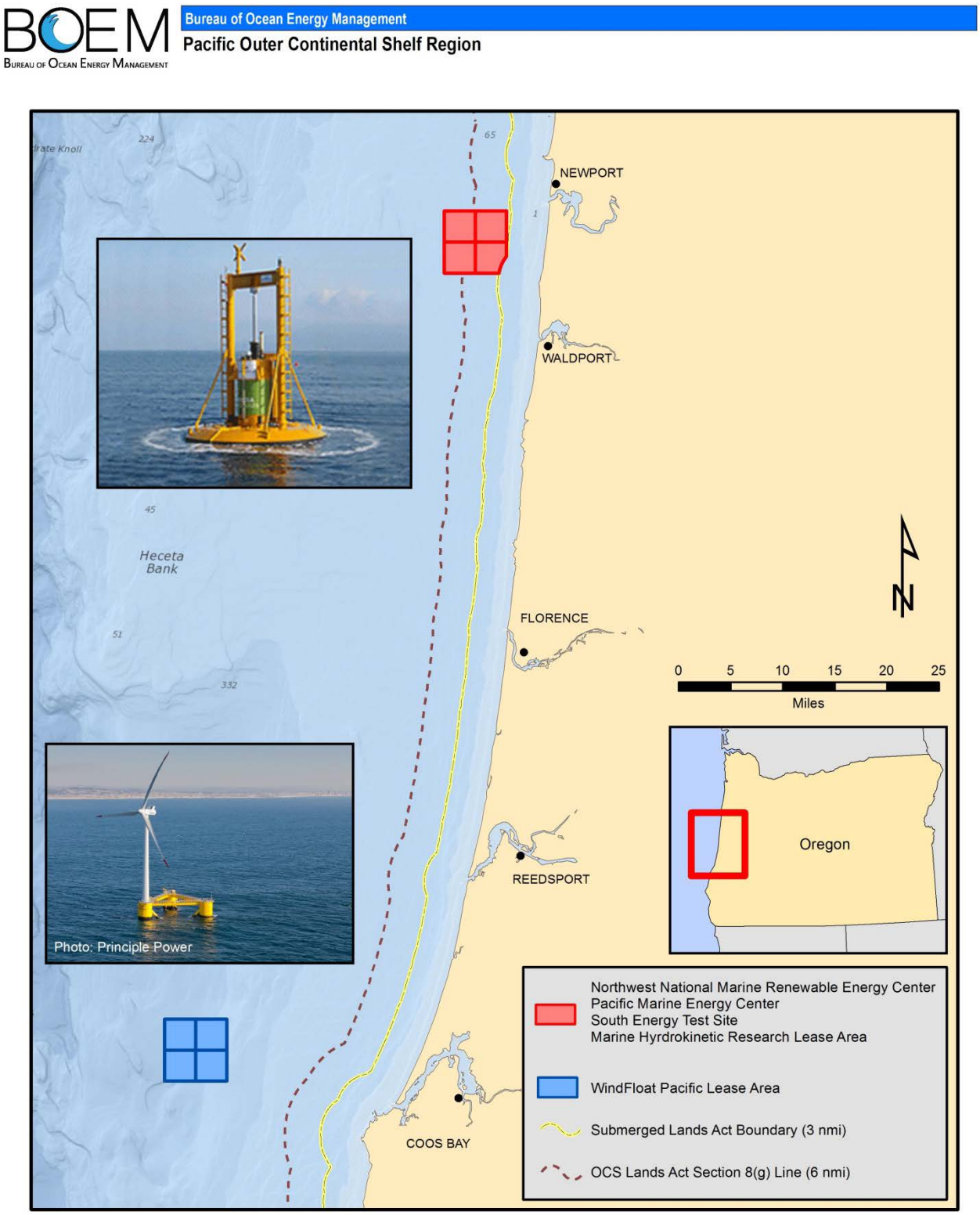


Figure 4. OCS Renewable Energy Projects in the Pacific Region



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.

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 18 million bbls of oil and 27 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 310 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 and revised oil and gas development plans as well as environmental review for the Pacific Region Bureau of Safety and Environmental Enforcement (BSEE) 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 and the installation of new pipelines offshore Los Angeles and Santa Barbara counties. Environmental studies information was crucial to completion of National Environmental Policy Act (NEPA) documents and creation of potential activity mitigation measures 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 EPAct. Regulations implementing EPAct

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.

Oregon OCS Renewable Energy

BOEM received complete renewable energy lease applications for two sites on the OCS off Oregon: one for a marine hydrokinetic (MHK) research lease and one for a deepwater floating wind commercial lease project (Figure 4). DOD has determined there are no national security or military operational constraints on the OCS off Oregon.

The Pacific Marine Energy Center (PMEC) on the OCS, five miles off Newport, Oregon, is the future site of the first utility-scale, grid-connected wave energy test site in the U.S. BOEM received a full application for a research lease to start this center for MHK investigations and has determined that there is no competitive interest for this site. PMEC will test energy generation potential and the environmental impacts of wave energy devices at the site. Subsea cables will transmit energy from the wave energy devices to the local power grid, and data to scientists and engineers at onshore facilities. The first installment of funding for PMEC was received in 2012 from DOE, along with a non-federal cost match, and DOE has chosen PMEC to receive continued funding. BOEM Pacific Region has been studying the site for baseline conditions of benthic regime, marine mammals, birds, human use, and cultural importance. BOEM Pacific Region has a modest amount of funds from the national ESP to monitor impacts at the site.

The WindFloat Pacific project on the OCS, 18 miles off Coos Bay, Oregon, is the future site of the first commercial, grid-connected, deepwater floating wind energy site in the U.S. The WindFloat facility, to be sited in about 1,400 feet of water, is the first offshore wind project proposed in federal waters off the West Coast and the first in the nation to use a floating structure to support offshore wind generation in the OCS. The innovative features of WindFloat dampen wave and turbine-induced motion, enabling wind turbines to be sited in previously inaccessible locations in deepwater, where wind resources are superior. WindFloat is not a monopile or gravity-based system; rather, it is secured to the seafloor through anchors and cables suitable to West Coast deepwater that is close to shore. The anchoring system mimics deepwater tension-leg, oil and gas platforms such as those in the Gulf of Mexico. Further economic efficiency is maximized by reducing the need for offshore heavy lift operations during final assembly deployment and commissioning. This is a fully tested technology that has the potential to significantly expand offshore renewable energy. The first installment of funding for WindFloat Pacific was received from DOE in 2012 and DOE has chosen Principal Power, the parent company for WindFloat Pacific, to receive continued funding. Secretary of the Interior Sally Jewell announced in her February 5, 2014, press conference that there is no competitive interest for the WindFloat Pacific deepwater wind lease. That determination paves the way for the WindFloat project and BOEM's environmental review, analyses, additional studies, and leasing decisions to proceed. BOEM Pacific

Region has been studying the site for baseline conditions of marine mammals, birds, human use, and cultural importance for several years. BOEM, in partnership with USGS, will study the area for baseline of the site-specific seafloor regime in the summer of 2014. BOEM Pacific Region has a modest amount of funds from the national ESP to monitor impacts at the site.

The Oregon OCS Renewable Energy Task Force has met five times to date. The immediate focus of the 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. This is an ongoing and developing process with the State of Oregon. The task force supports and enhances the regional planning that is taking place through the West Coast Governors Alliance on Ocean Health, a partnership between the three West Coast states and BOEM.

The State of Oregon undertook its own independent planning process for the Oregon Territorial Sea and adopted the final document in 2013. The Territorial Sea Plan is a package of policies and maps that will govern how and under what conditions ocean renewable energy will be allowed to develop in state waters. Four sites along the Oregon coast have been designated as areas suited for renewable energy development: two that can accommodate nearshore wave energy technologies and two that are better suited for deepwater wind technologies. Together, those sites comprise about 2% of the territorial sea and cover about 25 square nautical miles. Rather than designate Wind Energy Areas (WEAs), BOEM Pacific Region has chosen to be responsive to industry interests and feasible technology whenever and wherever lease applications arise. The State of Oregon has not requested that BOEM designate WEAs. BOEM Pacific Region, in partnership with DOE's Pacific Northwest National Laboratory, is funding a suitability study, due June 2014, that analyzes areas on the OCS off Oregon from an industry feasibility perspective. This study will provide information useful to BOEM for future decisions.

Hawaii OCS Renewable Energy

BOEM Pacific Region received two draft applications for commercial deepwater wind leases off Oahu, Hawaii: one unsolicited request from Apex Hawaii Offshore Wind, LLC (Apex) and another unsolicited request from AW Hawaii Wind, LLC (AWH). On January 13, 2014, DOD informed the Navy and Marine Corps about areas that are technically feasible for offshore wind development north and south of Oahu. Both the Navy and Marine Corps are now tasked with determining if and in which specific areas within lease blocks (lease aliquots) offshore wind development is compatible with national security and military operations. Through this DOD-driven process, BOEM, the State of Hawaii, and DOD may effectively delineate WEAs for Oahu, where the major Hawaiian grid use exists. The State of Hawaii has not requested that BOEM designate WEAs. Hawaii WEAs could potentially exist wherever there are no military operational constraints and there is technological capability and feasibility for the industry. Upon completion of the DOD assessment, both Apex and AWH plan to submit formal lease requests to BOEM.

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+ megawatt 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. NextEra Energy Hawaii, LLC (NEEH) met with BOEM on November 13 and December 4, 2013, to discuss a potential interisland cable from Maui to Oahu. NEEH and BOEM discussed the potential Right-of-Way request and path forward for the NEPA process. BOEM met with the Hawaiian Islands Humpback Whale National Marine Sanctuary on February 3, 2014, to discuss interisland power cables through the Sanctuary, where BOEM has no jurisdiction.

The Hawaii OCS Renewable Energy Task Force has met three times to date. Military constraints and both research and commercial leasing are significant topics for task force discussions.

California OCS Renewable Energy

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 (Freeport-McMoRan) to develop a proposal. Several meetings were held at and with Vandenberg Air Force Base in 2013 to discuss research lease requirements.

Cal Poly SLO was selected to receive a grant from DOE in late 2013 to assess the feasibility of locating a National Wave Energy Test Facility on the OCS off California. The awarded funds, combined with other matching funds, will be used to research and determine which location along California's coast has the best potential to accelerate the development of a commercial ocean renewable energy industry by serving as a National Wave Energy Testing Facility. BOEM Pacific Region is mentoring two students from Cal Poly SLO as they examine the potential to use whale acoustic deterrence devices from driftnet fishery practices in renewable energy applications. BOEM will meet with Cal Poly SLO in late May 2014 to further the relationship.

The State of California has not requested that BOEM establish an OCS Renewable Energy Task Force. Upon receipt of a request from the Governor of California, the Secretary of the Interior will instruct BOEM to establish the task force.

Washington OCS Renewable Energy

Regular ongoing communication between BOEM and the State of Washington pertains to scientific studies and information needs for the Washington OCS. Coordination with Washington includes regional planning through the West Coast Governors Alliance on Ocean Health.

Approximately 30-40% of the Washington OCS is under the jurisdiction of BOEM for renewable energy; the remainder is the Olympic Coast National Marine Sanctuary. At this time, the State of Washington's emphasis is on tidal projects within Puget Sound. The State of Washington has not requested that BOEM establish an OCS Renewable Energy Task Force. Upon receipt of a request from the Governor of Washington, the Secretary of the Interior will instruct BOEM to establish the task force.

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 2015-2017 fall into the following categories and support existing oil and gas production or potential renewable energy leasing activities.

1.4.1 Information Needs in Support of Existing Oil and Gas Production

Fates and Effects

BOEM needs to advance its knowledge on the biological connectivity of natural reefs and manmade structures in southern California, as well as understand the possible contribution of each platform to mainland and island marine communities. The proposed study *Watersipora II: Biological Oceanographic Connectivity of Southern California Reefs and Manmade Structures* would elucidate the role that offshore artificial structures may have in linking and affecting biological communities and provide a more complete body of information on the non-native bryozoan *Watersipora* and the native marine invertebrate communities, including commercially important species. This will enable BOEM to comply with the duties of federal agencies that are outlined in Section 2 of Executive Order 13112 (Invasive Species). BOEM will use study results for environmental reviews concerning existing operations and decommissioning alternatives of offshore platforms and potential marine renewable energy facilities.

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

Potential impacts to the shoreline are of particular concern in the Pacific Region because OCS operations are located very close to shore. Ongoing monitoring of rocky intertidal sites adjacent to OCS production facilities allows BOEM to directly assess potential and real impacts to the coastline from OCS operations. With these data, BOEM can evaluate impacts to shoreline resources from OCS activities by differentiating between naturally caused impacts and anthropogenic impacts, which may include impacts from OCS oil and gas production and accidental oil spills. It also provides the baseline for evaluation of future marine renewable energy projects off Oregon. The proposed study *BOEM-MARINe (Multi-Agency Rocky Intertidal Network)* implements BOEM's Outer Continental Shelf Lands Act mandate to monitor the marine and coastal environments adjacent to OCS operations.

After three decades of ESP-funded scientific research about the ecology and assemblages of platforms off California, BOEM needs to have the resulting reports and related literature material summarized and synthesized into a single professionally published reference that examines the influence of platform assemblages on the marine ecology of the Pacific coastal region and the implications of the artificial reef effect for renewable energy installations in any region. The proposed study *Synthesis of Pacific Platform Research* would synthesize completed and ongoing studies and peer-reviewed papers regarding the influence of Pacific platforms on regional marine ecology, and would be of value to inform BOEM decision makers and for NEPA analysis of the potential impacts of decommissioning oil and gas facilities and for NEPA analysis of the potential artificial reef effect for renewable energy project installations.

1.4.2 Information Needs in Support of Renewable Energy Leasing

Fates and Effects

BOEM requires information about the potential consequences of conventional and renewable energy activities (e.g., offshore infrastructure, oil spills, etc.) on the

productivity and trophic structure of sensitive habitats in the California Current Ecosystem (CCE), and ecosystem impacts have been identified by various documents (e.g., Boehlert, et al. 2013) as a high-priority need. The proposed study *Consequences of Ocean Energy Projects to Productivity and Trophic Structure in Marine and Coastal Habitats* would (1) synthesize available information to rank sensitivity of habitats likely to experience impacts from ocean energy projects to changes in productivity and trophic structure; (2) generate and parameterize simple models of the most sensitive habitats regarding how ocean energy projects may affect ecosystem dynamics; and (3) propose mitigation measures to preserve or enhance services and functions provided by the CCE. The ranking of habitat sensitivity will focus future studies and monitoring on where impacts (if any) may occur, and the sensitive-habitat modeling will assist a number of BOEM-related decisions on the OCS, including identifying appropriate areas for renewable energy development. The proposed mitigation measures may be employed as lease stipulations or conditions of approval for project-specific activities. BOEM will use results from this study for impact assessments, and Section 7 consultations under the Endangered Species Act and Essential Fish Habitat (EFH) consultations under the Magnuson-Stevens Fishery Conservation and Management Act.

Habitat and Ecology

Assessments of the potential ecological effects of renewable energy on benthic habitats along the West Coast of North America have only just begun, and the siting of renewable energy facilities in this region requires a knowledge base that can be applied over a regional scale. Improvement of existing habitat suitability models will provide a tool BOEM can use to extrapolate data from one area across to areas where less is known. Improved models have the potential to inform regional spatial planning processes for future consideration of renewable energy facilities and the necessary consultations associated with leasing (e.g., on EFH). Improved habitat suitability modeling could also improve site assessments needed for NEPA analysis and may reduce site survey requirements for lease holders. The proposed study *Cross-shelf Habitat Suitability Modeling* would help to standardize modeling efforts among different OCS Regions.

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.

Social and Economic Sciences

In order to properly consider other uses of the OCS in the vicinity of proposed renewable energy projects, BOEM has a need to provide greater detail on spatial patterns of the range of activities on the OCS, including commercial fishing, recreational fishing, vessel traffic, and others. The proposed study *Refining Maps of Ocean Use Compatibility and Cumulative Impacts for Ocean Energy Projects* would enhance ocean use maps specifically for decisions regarding ocean energy projects and develop a set of best mapping practices that should be applied to any future spatial data collection activities, particularly for industries that have complex use patterns such as commercial fishing. It would augment spatial data collected by BOEM-funded and other mapping efforts in the Pacific Region by (1) georeferencing critical metadata on use patterns, (2) defining the type of competition between stakeholder groups for ocean space (interference, exploitative, or apparent), and (3) delineating environmental consequences (context, intensity, and duration) of each type of use in relation to other uses.

1.5 New Starts for FY 2014 and Ongoing Studies

Table 1 lists FY 2014 New Starts and Ongoing Studies managed by the Pacific Region. Profiles of these "current" studies can be found on the BOEM web site (BOEM 2014c).

Table 1. BOEM Pacific Region New Starts for FY 2014 and Ongoing Studies

NSL #	Study Title	Planning Area(s)	Start FY	Partners
New Starts*				
Fates & Effects				
PC-14-05	Understanding and Mitigating the Effects of Marine Renewable Energy Technologies on the Coastal and Marine Environment in the Pacific OCS Region	All PAC	2014	
Habitat & Ecology				
PC-14-03	Year-round and Diel Patterns in Habitat-use of Seabirds off Oregon	WA-OR	2014	OSU (thru CESU)
Physical Oceanography				
PC-14-01	Expansion of West Coast Oceanographic Modeling Capability	SC, CC, NC	2014	UCLA (thru CESU)
Interdisciplinary				
PC-13-02	Using Ongoing Activities as Surrogates to Predict Potential Ecological Impacts from Marine Renewable Energy	All PAC	2014	DOE (thru NOPP)
PC-14-02	Potential Impacts of Submarine Power Cables on Crab Harvest	All PAC	2014	UCSB (thru CESU)
*Note: The procurement of any study is contingent upon availability of funding.				
Ongoing Studies				
Fates & Effects				
PC-11-03	Renewable Energy in situ 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	
PC-13-04	Understanding the Role of Offshore Structures in Managing Potential *Watersipora subtorquata* Invasions	All PAC	2013	UCSB (thru CESU)

NSL #	Study Title	Planning Area(s)	Start FY	Partners
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-12-03	Pacific Rocky Intertidal Survey and Monitoring (PRISM)	SC	2012	UCLA
PC-12-07	Analysis of Fish Populations at Platforms off Summerland, California	SC	2012	UCSB, OC (thru CESU)
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
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
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

NSL #	Study Title	Planning Area(s)	Start FY	Partners
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-10-08	Renewable Energy Visual Evaluations	WA-OR, NC, SC	2010	DOE (thru NOPP)
No NSL # (regional funds)	Pacific Regional Ocean Uses Atlas	WA-OR, HI	2012	NOAA
No NSL # (regional funds)	Characterizing Tribal Cultural Landscapes	WA-OR, NC, CC, SC	2012	NOAA
PC-13-01	Maritime Cultural Resources Site Assessment in the Main Hawaiian Islands	HI	2013	NOAA
Interdisciplinary				
No NSL # (regional funds)	Oregon OCS Seafloor Mapping: Selected Lease Blocks Relevant to Renewable Energy	WA-OR	2013	USGS
No NSL # (regional funds)	Industry Feasibility Mapping for the Outer Continental Shelf off the State of Oregon	WA-OR	2013	DOE

Planning Area Codes

SC = Southern California Planning Area
CC = Central California Planning Area
NC = Northern California Planning Area
WA-OR = Washington-Oregon Planning Area
HI = Hawaii OCS
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 Oceanic and Atmospheric Administration
NOPP = National Oceanic 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 2015 National Studies List (NSL) (section 2.2) and FY 2016 NSL (section 2.3).

Reference information about the Pacific Region ESP can be found on the BOEM website, including general information (BOEM 2014b), current Pacific studies (BOEM 2014c), and recently completed Pacific studies (BOEM 2014d).

2.2 Profiles of Studies Proposed for the Fiscal Year 2015 NSL

This Pacific Region FY 2015-2017 SDP includes study profiles that support conventional energy or renewable energy. The SDP includes profiles within the disciplines of fates and effects, habitat and ecology, marine mammals and protected species, 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.

Eight 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 2 and described in the succeeding profiles.

Table 2. BOEM Pacific Region Studies Proposed for the Fiscal Year 2015 NSL

SDP Page Number	Discipline	Regional Ranking	Study Title
69	MM	1	Data Synthesis and High-resolution Predictive Modeling of Marine Bird Spatial Distributions on the Pacific OCS
71	HE	2	BOEM-MARINe
73	HE	3	Synthesis of Pacific Platform Research
75	FE	4	Consequences of Ocean Energy Projects to Productivity and Trophic Structure in Marine and Coastal Habitats
77	FE	5	*Watersipora* II: Biological Oceanographic Connectivity of Southern California Reefs and Manmade Structures
79	SE	6	Refining Maps of Ocean Use Compatibility and Cumulative Impacts for Ocean Energy Projects
81	HE	7	Cross-shelf Habitat Suitability Modeling
83	FE	8	Predicting and Detecting the Effects of Climate Change and Ocean Acidification Using Long-term Ecological Data
Discipline Codes			
AQ = Air Quality HE = Habitat & Ecology IN = Interdisciplinary PO = Physical Oceanography			FE = Fates & Effects IM = Information Management MM = Marine Mammals & Protected Species SE = Social & Economic Sciences

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

Planning Area(s): Southern California, Central California, Northern 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 2015-2017

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, Santora and Sydeman 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, Menza and Huettmann 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 Marine Cadastre and similar BOEM datasets.

Revised Date: April 4, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

Planning Area(s): Southern California, Central California, Northern 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 evaluate impacts to shoreline resources from OCS activities by differentiating between naturally caused impacts and anthropogenic impacts, which may include impacts from OCS oil and gas production and accidental oil spills. It also provides the baseline for evaluation of future marine renewable energy projects (e.g., wave energy off Oregon). This 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) $2,120 **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 influence on planning and operations. BOEM and its 43 partners in MARINe (Multi-Agency Rocky Intertidal Network) biannually monitor over 130 established shoreline rocky intertidal sites from California to British Columbia using a targeted assemblage protocol. MARINe employs standardized field protocols and a shared publically available database (MARINe 2014a). BOEM makes up approximately one third of the MARINe partnership by funding 32 monitoring sites, which are spread across over 600 miles of coastline and are adjacent to existing oil and gas OCS operations in southern California or planned OCS wave energy activities off Oregon.

MARINe and BOEM's specific monitoring efforts have influenced decisions made within BOEM and other agencies. MARINe data have been essential for assessing damages and predicting recovery from one federal pipeline and two tanker oil spills offshore California. Declines in black abalone populations at MARINe sites near OCS facilities led to their listing as endangered (see January 14, 2009, Federal Register Notice). Analysis revealed that OCS operations were not responsible for this decline. In 2013, a fatal sea star disease has rapidly spread across the coastline to MARINe sites from Alaska to San Diego. Large numbers of animals from nearly a dozen species have been affected with this fatal disease. MARINe is in a unique position to assess the spread of the disease and is a source of information for the media and public.

Partnerships are fostered through MARINe with local, state, federal, and Tribal government agencies involved in monitoring research. MARINe is an important

cooperative effort with the State of California and is 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 Department of the Interior objective. MARINe received the 2012 Partners in Conservation Award from the Secretary of the Interior for its contribution to science through this unique effort.

Objectives: This study will provide for five years of (1) continued long-term monitoring of 32 rocky intertidal sites on the mainland shore adjacent to OCS activities in California and Oregon; (2) continued support of a shared database that is increasingly web-based and publically accessible; and (3) continued expansion of the DNA tissue and taxonomy vouchers of key species.

Methods: These 32 sites are monitored biannually by multiple teams of biologists, including the BOEM Pacific Rocky Intertidal Survey 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.

The interactive database is hosted by the University of California through BOEM funding (MARINe 2014b). 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 storm events. Continued work will be done to voucher new species and track species shifts through an ongoing BOEM program to archive specimens and preserve DNA tissue with the Smithsonian Institution. Vouchers provide valuable information for all MARINe partners and other scientists as they evaluate anthropogenic impacts against a changing environment influenced by climate change.

The current MARINe agreement is funded at $410,000 per year for data collection and database improvements. In a separate funding effort, $150,000 per year was added to establish and monitor sites in Oregon to support our renewable energy program. MARINe's value comes from being a long-term monitoring program and it therefore needs to be cost-effective. This proposal combines the oil and gas and renewable energy programs and all sites into one effort at an overall reduction in cost. Funding for the first year is proposed at $400,000 and includes a University of California-mandated 3% ($12,000) cost-of-living increase each subsequent year ($400,000, $412,000, $424,000, $436,000, $448,000 for FY 2015-2019). Cost savings are expected from streamlining sampling, reducing the number of sites in Oregon, and procurement through the Californian Cooperative Ecosystem Studies Unit at a conservative 17.5% overhead. An assessment is currently underway to statistically determine the effects of decreasing the frequency and/or locations of sampling. It is anticipated that reducing the sampling frequency from bi-annually to annually is feasible at many sites.

Revised Date: April 4, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

Planning Area(s): Southern California, Central California, Northern California

Title: Synthesis of Pacific Platform Research

BOEM Information Need(s) to be Addressed: After three decades of ESP-funded scientific research about the ecology and assemblages of platforms off California, BOEM needs to have the resulting reports and related literature material summarized and synthesized into a single professionally published reference that examines the influence of platform assemblages on the marine ecology of the Pacific coastal region and the implications of the artificial reef effect for renewable energy installations in any region. Given historic investment in interdisciplinary biological and oceanographic research of platforms, reefs, and shorelines in the region, a synthesis of completed and ongoing studies and peer-reviewed papers regarding the influence of Pacific platforms on regional marine ecology would be of value to inform BOEM decision makers and for NEPA analysis of the potential impacts of decommissioning oil and gas facilities and for NEPA analysis of the potential artificial reef effect for renewable energy project installations.

Approx. Cost: (in thousands) $400 **Period of Performance:** FY 2015-2017

Description:

Background: Since 1985, federal agencies have invested nearly $30 million to conduct research on fishes and mega-invertebrates that live around the platforms and on natural reefs off central and southern California. This present effort proposes a synthesis of research from the past and ongoing studies and journal literature in the Pacific Region that have focused on ecology of the platforms within the larger context of the Pacific coastal region. A brief survey of the peer-reviewed literature has found over 25 major relevant articles, and there are at least an equal number of agency reports. The federal studies include but are not limited to:

- ✓ Fisheries Species and Oil/Gas Platforms Offshore California
- ✓ Assessing the Fate of Juvenile Rockfish
- ✓ Santa Maria Shelf Oceanographic Circulation
- ✓ Inner-shelf Surface Currents and Characteristic Flow Patterns in Santa Barbara Channel
- ✓ Site-Fidelity and Transplantation Studies of Platform Fish
- ✓ The Ecological Role of Oil/Gas Production Platforms and Natural Outcrops on Fishes in Southern and Central California
- ✓ Effect of Offshore Oil Platform Structures on the Distribution Patterns of Commercially Important Benthic Crustaceans
- ✓ Survey of Invertebrate and Algal Communities on Oil/Gas Platforms in Southern California
- ✓ Ecological Performance of OCS Platforms as Fish Habitat off California
- ✓ Reproductive Ecology and Body Burden of Platform Resident Fish

- ✓ Habitat Value of Shell Mounds to Ecologically and Commercially Important Benthic Species
- ✓ Trophic Links: Comparisons Among Platforms and Natural Reefs
- ✓ Role of Food Subsidies and Habitat Structure in Influencing Benthic Communities of Shell Mounds at Platform Sites

The 2012 BOEM-funded studies, *Biological Productivity of Offshore Oil and Gas Structures in the Pacific OCS* and *Analysis of Fish Populations at Platforms off Summerland, California*, will be completed with journal submittals, well within time to be included in this present effort. The goal is to publish a hardcopy and e-journal release, special issue of a scientific journal regarding the influence of Pacific offshore platforms on regional ecology and the implications for renewable energy based on information obtained through these studies and published papers. Potential chapters could include but are not limited to:

- ✓ Origin and Fate of Pacific Offshore Platforms
- ✓ Platform Assemblages
- ✓ Inter- and Intra-relationships of Oceanographic Circulation and Larval Dispersion to/from Pacific Platforms
- ✓ Distribution Patterns of Important Benthic Crustaceans
- ✓ Site-Fidelity and Movement of Platform Fish
- ✓ Productivity of Pacific Platforms
- ✓ De facto Marine Preserves and the Artificial Reef Effect
- ✓ Influence of Pacific Platforms on Pacific Coast Marine Ecology
- ✓ Implications for Renewable Energy Installations

Objectives:

- Increase scientific understanding of the inter- and intra-relationships of assemblages at offshore petroleum platforms and the Pacific coastal ecosystem
- Determine the extent of influence of platform assemblages on Pacific coast populations of fish and invertebrates

Methods: Methods include forming a small oversight principal investigator (PI) team to inventory available reports and papers and determine their relevancy to the objectives. Next would be to acquire a professional editor specializing in scientific publication and journal-specific formatting and to establish a review board of Chapter leads from a broad range of West Coast universities and agencies. The leads would digest, reanalyze data, if needed, and as directed by the PI, summarize, and reach overarching conclusions and findings to meet the objectives. The PI team would work with a publisher, such as the Bulletin of Marine Science or a similar journal, to publish a stand-alone journal issue and e-journal release.

Revised Date: April 4, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

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

Title: Consequences of Ocean Energy Projects to Productivity and Trophic Structure in Marine and Coastal Habitats

BOEM Information Need(s) to be Addressed: The overall objective of this study is to assess potential consequences of conventional and renewable energy activities (e.g., offshore infrastructure, oil spills, etc.) on the productivity and trophic structure of sensitive habitats in the California Current Ecosystem (CCE). Ecosystem impacts have been identified by various documents (e.g., Boehlert, et al. 2013) as a high information need. The purpose of this study is to (1) synthesize available information to rank sensitivity of habitats likely to experience impacts from ocean energy projects to changes in productivity and trophic structure; (2) generate and parameterize simple models of the most sensitive habitats regarding how ocean energy projects may affect ecosystem dynamics; and (3) propose mitigation measures to preserve or enhance services and functions provided by the CCE. The ranking of habitat sensitivity will focus future studies and monitoring on where impacts (if any) may occur, and the sensitive-habitat modeling will assist a number of BOEM-related decisions on the OCS, including identifying appropriate areas for renewable energy development. The proposed mitigation measures may be employed as lease stipulations or conditions of approval for project-specific activities. BOEM will use results from this study for impact assessments, and Section 7 consultations under the Endangered Species Act and Essential Fish Habitat consultations under the Magnuson-Stevens Fishery Conservation and Management Act.

Approx. Cost: (in thousands) $900 **Period of Performance:** FY 2015-2019

Description:

Background: Section 18 of the Outer Continental Shelf Lands Act (43 U.S.C. § 1344) mandates that decision making consider maintaining ecosystem productivity. Primary production in the Pacific Region is fairly well understood and results largely from phytoplankton and macroalgae. Other sources, such as marine plants and bacteria found in association with seeps, contribute smaller amounts to overall production, although they may be locally important. In contrast, an understanding of what drives secondary productivity is lacking for many marine and coastal habitats. The transfer of organic material between trophic levels governs secondary production and often is dependent upon the flow of biomass or nutrients (subsidies) from other, highly productive areas. A habitat may be very sensitive to alterations of this subsidy flow and respond quickly to either natural or anthropogenic impacts. For example, drift macrophytes, including kelp, other algae, and seagrasses, provide important trophic support and habitat for shorebirds and fishes on sandy beaches and the surf zone. If this subsidy is altered (via oil spills or reduction of wave energy), to what extent would consequences in production and trophic structure of communities be observed?

In other habitats productivity dynamics may be more complex. Deep, soft-sediment habitat, which is the dominate seafloor environment on the OCS, benefits from at least three sources of primary production that arrive as subsidies: phytoplankton (as marine snow), kelp detritus, and bacteria associated with natural seeps. A process that would help to identify subsidy hotspots (and thus productivity/biodiversity hotspots) that may be generated either by oceanographic or geomorphological conditions would be helpful in identifying areas unsuitable for certain kinds of development.

In addition to integrating all seafloor mapping efforts within the Pacific Region, this study builds upon at least three completed or ongoing studies funded by BOEM: *Role of Food Subsidies and Habitat Structure in Influencing Benthic Communities of Shell Mounds at Sites of Existing and Former Offshore Oil Platforms, Predicting the Consequences of Wave Energy Absorption from Marine Renewable Energy Facilities on Nearshore Ecosystems,* and *Archaeological and Biological Assessment of Submerged Landforms on the Pacific Outer Continental Shelf.*

Objectives: The overall objective of this study is to assess potential consequences of conventional and renewable energy activities (e.g., offshore infrastructure, oil spills, etc.) on the productivity and trophic structure of sensitive habitats in the CCE.

Methods: To meet the study objective, four tasks will be performed.

(1) *Synthesize information.* Identify habitats in areas of ongoing or potential offshore energy projects that may experience environmental impacts; summarize information regarding productivity and biomass/nutrient/habitat subsidies and the ecosystem services (supportive, regulating, provisioning, and cultural) and functions (e.g., support for managed, threatened or endangered species) that these habitats provide.

(2) *Rank habitats by vulnerability*. Using the synthesis of information, build simple models that integrate potential sources of production/subsidies and the sensitivity of these sources to offshore energy activities. Rank the vulnerability of these habitats by considering the intensity and likelihood of experiencing an impact.

(3) *Analyze case studies.* Select two or more vulnerable habitats as case studies to groundtruth/parameterize estimates using isotope analyses (which show clear signals in C, N, and S that identify sources of primary production) and other techniques. For critical information gaps, perform experiments that elucidate potential consequences of offshore activities to ecosystem services and functions provided by the CCE.

(4) *Write final report.* Suggest mitigation measures to preserve or enhance ecosystem services and functions potentially affected by offshore energy activities.

Revised Date: April 4, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

Planning Area(s): Southern California, Central California

Title: *Watersipora* II: Biological Oceanographic Connectivity of Southern California Reefs and Manmade Structures

BOEM Information Need(s) to be Addressed: BOEM needs to advance its knowledge on the biological connectivity of natural reefs and manmade structures in southern California, as well as understand the possible contribution of each platform to mainland and island marine communities. The need for this information is to elucidate the role that offshore artificial structures may have in linking and affecting biological communities and provide a more complete body of information on the non-native *Watersipora* and the native marine invertebrate communities, including commercially important species. This will enable BOEM to comply with the duties of federal agencies that are outlined in Section 2 of Executive Order 13112 (Invasive Species). BOEM will use study results for environmental reviews concerning existing operations and decommissioning alternatives of offshore platforms and potential marine renewable energy facilities.

Approx. Cost: (in thousands) $275 **Period of Performance:** FY 2015-2016

Description:

Background: Artificial substrate in the marine environment may facilitate the establishment and spread of non-indigenous species (NIS) by providing novel habitats where NIS have a competitive advantage over native species. Some of these NIS may subsequently invade natural habitats and displace or change native biological communities. In southern California, biologists documented the first appearance of the non-indigenous bryozoan *Watersipora subtorquata* in 1963 at an artificial oil island located in state waters. Under certain conditions and water depths, *Watersipora* covers virtually 100% of the available substrate and therefore experts recognize that this species has the potential to become quite destructive to native communities. Through BOEM's ongoing study *Understanding the Role of Offshore Structures in Managing Potential Watersipora subtorquata Invasions (Watersipora I),* we found that the distribution of *Watersipora* on offshore oil and gas platforms expanded from one to now four of the seven platforms previously surveyed in a BOEM-funded study in 2001, and it has been found on an additional platform not surveyed in 2001. In addition, the ongoing study provided the first reports of *Watersipora* on natural reefs (3 reefs to date) located in the Santa Barbara Channel. Because this bryozoan has been found on some oil and gas platforms in federal waters, a report released in 2010 by the California Ocean Science Trust identified this NIS as a priority information gap needed to evaluate future rigs-to-reefs proposals. Through this ongoing study, *Watersipora* I, we will continue to survey natural reefs and manmade structures as well as document the seasonality of *Watersipora* larval settlement, and model the potential vector pathways. The below objectives and tasks are additional work that will provide new information and enhance and build upon the ongoing study, *Watersipora I*.

Objectives: Evaluate the biological connectivity of marine communities in the Southern California Bight, determine the seasonality of larval settlement for native and non-native invertebrates, and describe the role that offshore structures may have in linking and affecting biological communities. This information is needed in order to include more accurate information into environmental reviews addressing ongoing operations, decommissioning of oil and gas platforms, and potential renewable energy facilities.

Methods: To meet the overall study objectives, four tasks will be performed.

(1) Quantify rates of colonization and growth of Watersipora subtorquata. Scuba divers will use underwater transects and photographic samples to document changes in the abundance and geographic and depth distribution of *Watersipora* and other prominent NIS on (a) oil and gas platforms and (b) nearby natural reefs in comparison to initial surveys taken during the first year of the ongoing study, *Watersipora I*. In addition, the rates of colonization and growth of *Watersipora* onto areas that have been experimentally cleaned will be measured over time to determine the effect of platform cleaning operations and season on the establishment of this species.

(2) Document the seasonality of marine invertebrate settlement at platforms. This study will utilize the recruitment data collected in the ongoing study, *Watersipora I*, to detail the reproductive seasonality of ecologically and economically important marine invertebrates, including mussels (e.g., native *Mytilus californianus* and introduced *M. galloprovincialis*), scallops, and commercially important crabs, in addition to *Watersipora*.

(3) Model biological connectivity. Information from tasks 1 and 2 will be used to generate a model of biological connectivity between manmade structures and natural reefs. Updated Regional Ocean Modeling System (ROMS) flow fields from the BOEM study *Expansion of West Coast Oceanographic Modeling Capability* will be used to drive a 3D particle model that will model invertebrate larval dispersal in southern California and examine connectivity between and among platforms and natural reefs on the mainland and islands.

(4) Recommend mitigation measures that would prevent establishment of Watersipora *in uncolonized habitats.* Obtaining a better understanding of the factors affecting the spread of *Watersipora* will assist BOEM in evaluating a number of simple mitigation measures that may be employed to manage NIS. Such measures may include (a) adjusting the schedule of either marine vessel hull cleaning or platform maintenance operations that remove biofouling on submerged portions of the jacket so that they coincide with seasons not sensitive to NIS establishment, (b) growth abatement devices (e.g., "wave-driven" marine growth preventer), and (c) vector management and other potential actions.

Revised Date: April 4, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

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

Title: Refining Maps of Ocean Use Compatibility and Cumulative Impacts for Ocean Energy Projects

BOEM Information Need(s) to be Addressed: In order to properly consider other uses of the OCS in the vicinity of proposed renewable energy projects, BOEM has a need to provide greater detail on spatial patterns of the range of activities on the OCS, including commercial fishing, recreational fishing, vessel traffic, and others. The overall objective of this study is to enhance ocean use maps specifically for decisions regarding ocean energy projects and develop a set of best mapping practices that should be applied to any future spatial data collection activities, particularly for industries that have complex use patterns such as commercial fishing. The purpose of this project is to augment spatial data collected by BOEM-funded and other mapping efforts in the Pacific Region by (1) georeferencing critical metadata on use patterns, (2) defining the type of competition between stakeholder groups for ocean space (interference, exploitative, or apparent), and (3) delineating environmental consequences (context, intensity, and duration) of each type of use in relation to other uses.

Approx. Cost: (in thousands) $600 **Period of Performance:** FY 2015-2018

Description:

Background: The final recommendations of the Interagency Ocean Policy Task Force (IOPTF) provided a framework for implementing coastal and marine spatial planning (CMSP), which is defined as a comprehensive, adaptive, integrated, ecosystem-based, and transparent spatial planning process, based on sound science, for analyzing current and anticipated uses of ocean, coastal, and Great Lakes areas (The White House Council on Environmental Quality 2010). The IOPTF further states that "CMSP identifies areas most suitable for various types or classes of activities in order to reduce conflicts among uses, reduce environmental impacts, facilitate compatible uses, and preserve critical ecosystem services to meet economic, environmental, security and social objectives."

Mapping current uses of ocean space is a critical first step of CMSP, and is an expensive and logistically intensive endeavor. The primary end result of these efforts is usually an ArcGIS product that depicts simple maps of general use patterns for various stakeholder groups, and notes clarifying or specific details that may be critical to proper interpretation of use patterns only in the metadata, if at all. Some early CMSP efforts have used these simple maps without the clarifying details to generate broad-reaching conclusions, including describing cumulative impacts of multiple uses (e.g., Halpern, et al. 2008) or ecosystem vulnerability (e.g., Teck, et al. 2010). The inferences drawn by these studies are highly sensitive to nonlinearities in use patterns, and the direction and intensity of conclusions would likely change substantially with the incorporation of additional information.

This proposed study builds upon the following BOEM-funded studies, *Identification of Outer Continental Shelf Renewable Energy Space-Use Conflicts and Analysis of Potential Mitigation Measures, Bayesian Integration for Marine Spatial Planning and Renewable Energy Siting,* and *Pacific Regional Ocean Uses Atlas,* as well as other efforts by the States of Oregon and California to map uses in state waters.

Objectives: The overall objective of this study is to enhance ocean use maps specifically for decisions regarding ocean energy projects and develop a set of best mapping practices that should be applied to any future spatial data collection activities, particularly for industries that have complex use patterns such as commercial fishing.

Methods: To meet the study objective, five tasks will be performed.

(1) Synthesize previously collected material (maps, metadata, interviews, published and grey literature) on OCS stakeholders in order to obtain a high-resolution depiction of compatibility among user groups and the relative environmental impacts.

(2) Identify information gaps and collect new information, if needed, on *use behavior* that describes the nature of interactions (e.g., interference, exploitative, or apparent competition for space) between stakeholder groups and combine the new information with the previous synthesis to update compatibility determinations. Special emphasis will be given to enhancing the information base regarding commercial fisheries. The update may entail creation of new or modification of old data layers.

(3) Identify information gaps and collect new information, if needed, on *environmental and cultural impacts* generated by each ocean use and combine the new information with the previous synthesis (including compatibility determinations) to update cumulative effects of multiple ocean uses. The update may entail creation of new or modification of old data layers.

(4) Create new scripts or formulae that link revised use and cumulative impact data layers with other georeferenced data. Using spatial statistics, multiple regression models, or other analysis tools, determine important correlates of use patterns with physical, biological, or economic variables.

(5) Review study products and use them as a case study to suggest new or refine existing best mapping practices that ensure that relevant details are collected and how to incorporate these details into a GIS product.

Revised Date: April 4, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

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

Title: Cross-shelf Habitat Suitability Modeling

BOEM Information Need(s) to be Addressed: The wave and wind climates along the West Coast of North America represent one of the best prospects for the development of offshore renewable energy, yet assessments of the potential ecological effects of renewable energy on benthic habitats have only just begun. The siting of renewable energy facilities on the OCS adjacent to California, Oregon, and Washington requires a knowledge base that can be applied over a regional scale. While it is costly to undertake a region-wide study, improvement of existing habitat suitability models will provide a tool BOEM can use to extrapolate data from one area across to areas where less is known. Improved models have the potential to inform regional spatial planning processes for future consideration of renewable energy facilities and the necessary consultations associated with leasing (e.g., on Essential Fish Habitat [EFH]). Improved habitat suitability modeling could also improve site assessments needed for NEPA analysis and may reduce site survey requirements for lease holders. This work would help to standardize modeling efforts among different OCS Regions.

Approx. Cost: (in thousands) $450 **Period of Performance:** FY 2015-2018

Description:

Background: In September 2014, Oregon State University (OSU) will complete the BOEM-funded study *Survey of Benthic Communities near Potential Renewable Energy Sites Offshore the Pacific Northwest,* in which geophysical seafloor conditions and benthic invertebrate communities are being surveyed and analyzed. One product of that study will be a habitat suitability model for selected species; the model will identify a number of habitat covariates that relate to specific invertebrate communities and use those relationships to predict other locations where those communities are likely to be found. Therefore, the model will be a tool to identify the key physical parameters that are more cost effective to sample than biological sampling; it will also support inferences about the biological communities in the area, including inferences that will be useful for identifying unique or rare habitats on the seafloor and/or prioritizing where applicants need to focus further survey efforts.

BOEM, NOAA (which conducts EFH consultations), and other regional stakeholders use modeling to incorporate regional data to inform decision making. Evaluating and improving the spatial extent and validating the BOEM/OSU habitat suitability model is necessary before it can be a useful tool. Currently, this model is limited to the inner and mid-shelf, but it is now clear that renewable energy developers are interested in areas farther offshore. By expanding the geographic scope, a cross-shelf sampling will also provide a high-resolution and seasonal understanding of cross-shelf dynamics. Such an understanding will improve the predictive capabilities of this model.

Models are only useful if they are accurate and used appropriately. The BOEM/OSU habitat suitability model was validated using portions of one infaunal dataset. An impartial analysis of the model using a completely separate dataset is needed to validate the accuracy and usefulness of the model. BOEM has previously funded efforts to model habitat associations of birds and mammals using different methods. Separate models also exist for fishes and invertebrates. BOEM needs to have a clearer understanding of the strengths and weaknesses of these different modeling approaches in order to ensure that the outputs are directly useful to non-modeling experts within BOEM.

Objectives: To improve the predictive capabilities of habitat suitability models by:

- Improving the applicability of the model to a wider depth range on the continental shelf and slope from northern California to southern Washington;
- Validating the model by collecting additional data;
- Providing a comparison among alternative modeling approaches.

Methods: To improve baseline understanding of benthic habitats and communities and improve the usefulness of an existing habitat suitability model, direct sampling is required. Seasonal infauna sampling over one year would provide an independent data set to validate the BOEM/OSU habitat suitability model. Box core sampling would focus on unconsolidated sediments in a transect across the continental shelf and slope. Species would be sorted, identified, and counted. There are two areas on the Oregon OCS where the lease-application process is underway; one of those areas will be selected for the location of the transect. Available data from other sources will be incorporated into this model, where applicable.

The BOEM/OSU habitat suitability model is based on a Bayesian belief network and GIS framework that is designed to be updated with new information. Bayesian belief networks, also called belief nets or influence diagrams, are graphical representations of mathematical models where each variable is presented as a node that can take on two or more possible values. The links between nodes describe the dependence or causal influences between variables. Existing outputs will be compared to infaunal samples from one new location (at a similar depth) to validate the accuracy of model outputs. New data from deeper areas of the continental shelf and slope will be incorporated into the model by reexamining the input variables developing appropriate binning of data inputs. Models will be output as GIS-based raster images.

This project intends to utilize NOAA's expertise to evaluate the BOEM/OSU habitat suitability model and compare it to similar modeling approaches developed with other biological datasets. Potential examples could include models for seabird occurrence and abundance developed for the Atlantic Region or predictive spatial models used for U.S. Pacific groundfish fisheries.

Revised Date: April 4, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

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

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 Department of the Interior (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 on Ocean Health, both of which have identified ocean acidification as a priority area.

Approx. Cost: (in thousands) $250 **Period of Performance:** FY 2015-2016

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 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: April 4, 2014

2.3 Profiles of Studies Proposed for the Fiscal Year 2016 NSL

Five new studies supporting ongoing and potential future activities in the Pacific Region are proposed for the FY 2016 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 2016 NSL

SDP Page Number	Discipline	Study Title
87	FE	DOI Partnership II: Developing Improved Methods for Detecting Impacts from OCS Energy Activities Using Long-term Data from DOI Monitoring Programs
89	PO	West Coast Physical Oceanographic Assessment
91	HE	The Contribution of Offshore Oil and Gas Structures on the Pacific OCS to Regional Fish Standing Stock Biomass and Production
93	HE	Analysis of Long-term Seabird Colony Legacy Data in the Pacific Northwest as a Regional Baseline
95	HE	Baseline Characterization of Unsurveyed Southern California Rocky Intertidal Communities
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 2015-2017

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 Department of the Interior (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) $250 **Period of Performance:** FY 2016-2018

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 the 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: April 4, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

Planning Area(s): Southern California, Central California, Northern 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 of the U.S. 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. Because West Coast data are being collected and analyzed by different researchers, there is a need to assemble it in one place that is accessible to analysts.

Approx. Cost: (in thousands) $250 **Period of Performance:** FY 2016-2018

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 there are multiple research efforts collecting physical oceanographic data with instruments distributed in waters off Oregon, Washington, and California. Although data are collected in similar manners, 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 the data in one location will provide the oceanographic baseline for the California Current along the West Coast.

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 (Boehlert, et al. 2013). This proposed study would be a regional bridge for the West Coast (coordinating with the West Coast OOS programs and existing university research and monitoring programs) and would enable BOEM 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 Wildlife, 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.

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

Methods: BOEM Pacific Region staff 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. This will be accomplished in three phases:

(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 does not meet current standards.)

(2) Data Integration: Program the OOS system to accept data from disparate datasets generated from multiple research efforts in California, Oregon, and Washington.

(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 analytical tools and information systems (e.g., Marine Cadastre and ESPIS).

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Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

Planning Area(s): Southern California

Title: The Contribution of Offshore Oil and Gas Structures on the Pacific OCS to Regional Fish Standing Stock Biomass and Production

BOEM Information Need(s) to be Addressed: This analysis will provide foundational information on the contribution of manmade structures to the regional standing stock biomass (SSB) and production of fishes so that specified criteria can be properly evaluated during the decommissioning process associated with the California Marine Resources Legacy Act. This will aid in the interpretation of local and regional consequences of different decommissioning options (e.g., complete removal or a topping option). Additionally, this study will provide further background from which to evaluate the potential of new manmade structures associated with wind and wave energy projects to contribute to local and regional fish standing stock and production.

Approx. Cost: (in thousands) $200 **Period of Performance:** FY 2016-2017

Description:

Background: California Assembly Bill (AB) 2503 enacted the California Marine Resources Legacy Act to establish a program to allow partial removal of offshore oil platforms if specified criteria are satisfied. Results from an ongoing BOEM-funded study awarded in FY 2012, *Biological Productivity of Fish Associated with Offshore Oil and Gas Structures on the Pacific OCS,* has demonstrated that the secondary production of fishes on these platform habitats is the highest of any marine habitat that has been studied (about an order of magnitude higher than fish communities from other marine ecosystems, when compared on a per-square-meter-of-seafloor basis). High rates of fish production on these oil platforms ultimately result from high levels of recruitment and subsequent growth of primarily rockfishes (genus *Sebastes*) to the substantial amount of complex hardscape habitat created by the platform structure distributed throughout the water column. However, the contribution of these habitats to regional estimates of standing stock and production has not yet been evaluated. Although platforms likely represent a relatively small proportion of the overall hard substratum in California, these structures may be providing a significant amount of the hard substrate below a depth of 50 meters, where habitats are predominately soft-bottom (Bernstein, et al. 2010). Understanding the relative fisheries and conservation value of these structures from a regional perspective will directly inform policy and management, specifically the evaluation of criteria related to the AB 2503 decommissioning options for existing platforms. Additionally, results will inform the implementation process for emerging renewable energy (e.g., wind and marine hydrokinetic) technologies.

Objectives: The goal of this research is to determine the contribution that platforms across the Southern California Bight (SCB) make to regional estimates of SSB and

production of fishes. We will first generate a GIS layer to quantify the current areal extent of hard-bottom habitat in the SCB and the proportion of this that the platforms represent. Then we will use existing fisheries-independent visual survey data to quantify the SSB and production of fishes on natural reefs in the region in order to estimate the proportion of these resources that currently reside on platforms.

Methods: In order to estimate the proportion of fish SSB and productivity (Pondella, Love and Fink 2011b; Claisse, Pondella, et al. 2012; Claisse, Pondella, et al. 2014) residing on platforms in the SCB we first will need to map and quantify the extent of natural habitat. Currently there is relatively complete data for the distribution of hard substrates in the marine environment throughout the SCB, which we will combine into a single GIS layer in order to map and quantify the extent of natural rocky reef habitat. This will be compared to existing estimates of the surface area of hard-substrate habitat on each platform (MBC Applied Environmental Sciences 1987). To estimate fish SSB and production, we will use existing data collected during scientific surveys by either submarines or scuba where the observers record the frequency and size class of fishes on platforms, deep natural rocky reefs (e.g., Love, Schroeder and Nishimoto 2003), and shallow nearshore reefs (e.g., Pondella, et al. 2011a). Observed fish lengths will be converted to a biomass using standard length-weight equations from the literature. Annual production for the observed fish community will be calculated using a model we developed and refined for a previous BOEM-funded project. This model (Pondella, Love and Fink 2011b; Claisse, Pondella, et al. 2014) calculates annual secondary production for fishes by subtracting current total biomass estimates from total biomass estimates predicted one year later using species-specific weight-length relationships and von Bertalanffy growth functions. Losses due to mortality are accounted for in the model by including a species- and size-specific natural survivorship function. Additionally, production due to recruitment (i.e., gains due to immigration, growth, and survival) of larval and juvenile fishes over the year time interval is also estimated. These factors will be critical to better describe the essential nursery habitat of these offshore platforms. Total SSB and secondary production for each sampled reef unit will be calculated (Claisse, Pondella, et al. 2012). To estimate region-wide metrics for natural reefs for comparison, metric density values for unsurveyed reefs will be estimated through linear interpolation and then multiplied by the unsurveyed reef area. More intensive analyses will be focused on SCB sub-regions where more survey data exists (e.g., Santa Barbara Channel).

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Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

Planning Area(s): Washington-Oregon

Title: Analysis of Long-term Seabird Colony Legacy Data in the Pacific Northwest as a Regional Baseline

BOEM Information Need(s) to be Addressed: Several offshore energy development projects are currently being planned off the coast of Oregon and tests of commercial-scale wave energy converters have already been installed. Some of these projects are near existing seabird colonies and could potentially affect seabirds breeding within the Oregon Coast National Wildlife Refuge Complex (OCNWRC) and Washington Maritime National Wildlife Refuge Complex (WMNWRC). The goal of this study is to process, analyze, and summarize long-term seabird colony abundance and distribution data collected by the U.S. Fish and Wildlife Service (USFWS). These products will be used to evaluate potential effects of region-wide offshore energy development projects, providing a baseline against which effects of future offshore energy projects on seabird breeding colonies can be compared.

This study would enable USFWS to archive, process, manage, analyze, and report 25 years of previously unprocessed photographic data in Oregon, the only long-term baseline data set of its kind for seabird colonies in the Pacific Northwest, and a less extensive data set from Washington. This project would add significant information to the North Pacific Seabird Colony Register, Avian Knowledge Network, or other online portals, and would assist with development of the California Current System Seabird Monitoring Plan. The study would address legally mandated priorities of BOEM identified in the Outer Continental Shelf Lands Act of 1953, as amended in 1978 (43 U.S.C. 1331 et seq.), which specifies that studies conducted by federal agencies of coastal areas which may be affected by energy sales and leases may be utilized in lieu of BOEM directly conducting such activities. USFWS would also assess opportunities to integrate these seabird data with other established monitoring programs (e.g., MARINe, PRISM) and new monitoring networks (e.g., Marine BON).

Approx. Cost: (in thousands) $350 **Period of Performance:** FY 2016-2018

Description:

Background: Since 1988, USFWS has conducted aerial photographic surveys of offshore islands and islets comprising the OCNWRC. Similar surveys have been conducted less consistently along much of the Washington coast, most of which is encompassed by the WMNWRC. Multiple species of breeding seabirds are surveyed, including Common Murre, Brandt's Cormorant, Pelagic Cormorant, Double-crested Cormorant, and gulls, representing a diverse array of life-histories and indicators of dynamic nearshore and offshore baseline conditions. Surveys are conducted annually on a single day in early to mid-June. Although the entire coast of Oregon is surveyed, only about 12% of the total 393 colonies are counted each year, because of a lack of funds to support the staff time required to process colony count images. OCNWRC staff recently began to archive and

process a small portion of the legacy colony count data. Approximately 50,000 film slides from aerial surveys remain to be scanned, archived, digitally counted, managed, analyzed, and summarized into tangible products such as reports or published papers.

Offshore energy development projects have implications for West Coast seabirds and their habitats, and BOEM has funded several studies to inform planning of these energy developments by documenting at-sea movements, flight behaviors, and distributions of seabirds along Oregon, including a study by Dr. Robert Suryan of year-round diel patterns of seabirds off Oregon. The proposed study would complement these ongoing studies by providing baseline data on seabirds at coastal breeding colonies. While energy projects may directly affect birds flying through the project area due to direct mortality from interactions with wave or wind energy devices, these projects may also indirectly affect seabird colonies by obstructing flight corridors to foraging areas and interrupting foraging and other behaviors.

Objectives: The objectives of this study are to (1) process, archive, and analyze USFWS's long-term seabird colony dataset to establish population trends and distributions of nesting seabirds, (2) maintain a database that will be readily accessible for use in impacts assessments, and (3) produce reports or scientific publications that will be readily available to BOEM, the scientific community, the general public, and other government agencies to provide a baseline against which the effects of global climate change, changing ocean conditions, and energy development can be assessed.

Methods: Methods for conducting colony counts of breeding seabirds from digital aerial photographs are well established. Images will be graded and digitized, and seabirds will be counted using the highest quality images of each colony with GIS. Counts by species will then be entered into a georeferenced database. Much of the legacy data for this study from OCNWRC remain unprocessed and are in the form of film slides. These slides must be cataloged, professionally scanned, managed, and archived before they can be digitized to facilitate counting of breeding seabirds. Once all counts are conducted, data will be analyzed to compare spatial and temporal variability of colony counts between seasons. These analyses could be used to evaluate relationships between colony count trends and changes in ocean conditions and fisheries impacts, as well as how colonies shift spatially.

Study results will include the following: (1) colony counts for Oregon seabird colonies from 1988 to the present and for Washington from the early 2000s and from 2010 to the present, and (2) analysis and summary of long-term seabird colony trends into unpublished reports, peer-reviewed scientific papers, and scientific presentations at conferences and meetings. Data will be readily accessible to BOEM, the science community, and the general public through the online North Pacific Seabird Colony Register database and other online portals, as appropriate. Considering the volume of legacy data to be archived and analyzed, this study will require three years of full-time work. The budget proposed would fund staff time to process, archive, and analyze the images, as well as the costs for professional scanning of slide images.

Revised Date: April 4, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Pacific

Planning Area(s): Southern California

Title: Baseline Characterization of Unsurveyed Southern California Rocky Intertidal Communities

BOEM Information Need(s) to be Addressed: This study builds on the BOEM-MARINe (Multi-Agency Rocky Intertidal Network) study by adding a tool that allows for a broader assessment of impacts to rocky intertidal communities in the event of an OCS oil spill. The data collected and products generated from this study will augment information for BOEM scientists and planners about locations of the rarest and most sensitive biological communities in rocky intertidal zones, provide greater detail to habitat maps used for spill response, and be used to assess injuries from OCS oil spills on Department of the Interior (DOI)-managed lands in southern California. This study will be leveraged with additional funding provided through the participation of two other DOI bureaus, the Bureau of Land Management (BLM) and the National Park Service (NPS).

Approx. Cost: (in thousands) $125 **Period of Performance:** FY 2016-2018

Description:

Background: BOEM has collected two decades of rocky intertidal data adjacent to Pacific OCS oil and gas operations. Through our coordination of the MARINe network of sites along the Pacific coast and offshore islands and the MARINe database, we have a wealth of information that allows us to extrapolate to other remote sections of the coastline, provided certain other information about the habitat has been collected.

The University of California Santa Cruz (UCSC) has developed a ground-based protocol (UCSC 2014), which, when used in conjunction with LIDAR (Laser Imaging Detection and Ranging) technology and MARINe data, can be used to classify rocky intertidal habitats along large sections of unsurveyed coastline. This integrated approach is especially valuable for characterizing shorelines that are hazardous and difficult to reach.

Another benefit of the study is validating existing habitat maps routinely used for spill response. In the areas where this protocol and remote imaging have been completed, significant errors have been discovered, which would have otherwise delayed deployment or caused deployment of the incorrect teams to an area. For example, sections of coastline identified as sandy were found actually to be rocky and largely inaccessible.

Objectives: The objective of this study is to characterize the rocky intertidal habitats of undocumented sections of the mainland coast and offshore islands to facilitate assessment of impacts from an OCS oil spill in the Santa Barbara Channel or San Pedro Bay.

Methods: Initially, researchers will research, collect, and integrate existing data from diverse sources to select appropriate shoreline sites for the study. The focus of this study will be on less-studied sections of the offshore islands in the Santa Barbara Channel and along the Palos Verde Peninsula near Long Beach. Work will be coordinated with managers at BLM (for sites in California Coastal National Monument) and NPS (for sites in Channel Islands National Park). Sites will be selected based on (1) their susceptibility to oiling from OCS oil and gas facilities and (2) the need for shoreline habitat characterization.

Following site selection, LIDAR imagery will be acquired and on-the-ground field work will be performed concurrently to collect critical physical and biological parameters (e.g., slope, aspect, and key species) at selected sites, and correlations between remotely sensed and ground-based field data sets will be identified. Access points will also be identified and mapped to assist with oil spill response. Using correlations between the LIDAR images and field data, researchers will develop a predictive model to characterize unsurveyed intertidal communities on the basis of their similarities to known communities already surveyed by MARINe.

This study will support BOEM's NEPA analyses and oil spill assessments, as well as decision-making by other federal and state agencies, including BLM (California Coastal National Monument), NPS (Channel Islands National Park), U.S. Coast Guard, California Department of Fish and Wildlife, and California Office of Spill Prevention and Response.

Revised Date: April 4, 2014

SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2017

This section presents a general discussion of topical issues 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 require flexibility to quickly change the scientific endeavor and/or location of the needed information. BOEM Pacific Region has chosen to be responsive to federal agencies, state, and industry interests whenever and wherever that interest in a task force or lease application arises for renewable energy. For conventional energy, California has the sole interest. For renewable energy, Oregon and Hawaii are the major interests.

3.1 Stakeholder Outreach and Partnerships

For the past several years, the Pacific Region has reached out to major stakeholders in all four states for their thoughts and ideas on the direction of Pacific renewable energy studies. This effort has been accomplished through formal letters. The process was successful for the first few years; however it needs to be improved if it is going to continue. The best ideas for needed information and consequent study design should come from the BOEM analysts and policy makers who are actually performing the environmental project reviews, writing the NEPA documents, and making the decisions. Stakeholders often have a refreshing outlook and may identify ecosystem resources or ecological connections that complement BOEM's ideas. The Pacific Region intends to work with other BOEM regions and BOEM headquarters to reinvent our approach to stakeholder inclusion. Rather than soliciting simply for any and all stakeholder ideas, BOEM Pacific Region may identify broad topics of interest to BOEM and ask for study ideas that specifically address those topics. In addition, the Pacific Region may accomplish the effort though email and appropriate social media.

BOEM Pacific Region intends to expand the number of and deepen our existing partnerships across all federal and state agencies, non-governmental organizations, and industry for both conventional and renewable energy programs. This effort should include sincerity in funds and/or in-kind matching of staff, equipment, supplies, or services, or transportation and access to industry facilities. The Pacific Region has met with California Sea Grant, Hawaiian Islands Humpback Whale National Marine Sanctuary, USFWS, and NOAA West Coast and Hawaii science centers, and scheduled dates for meetings with USGS, DOE, and others for the spring and summer of 2014. BOEM Pacific Region looks forward to expanding this effort in the future and possibly working toward regional ecosystem science conferences modeled after the Alaska Marine Science Symposium, especially for Hawaii.

3.2 Oil and Gas Studies

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, there is a pressing need for synthesis studies now and future periodic assessment to update information. A study in this SDP proposes a synthesis of Pacific platform research. Another proposed study seeks to examine biological and oceanographic connectivity between the platforms and Santa Barbara Channel ecosystem. Additional studies of this type will be pursued in the future.

3.3 Renewable Energy Studies

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 the Pacific West Coast, where wind and wave energy is developing offshore. The Pacific Region's immediate information needs focus on information exchange, baseline and impact studies, and data management, integration, and synthesis. 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 socioeconomist 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 cultural resources, patterns of human uses of the ocean, and implications of renewable energy development. Additionally, a new study underway this year seeks to identify the potential impact of submarine power cables on commercial crab harvest. The Region recognizes the importance of integrating natural and social sciences in planning and decision-making for offshore energy; nonetheless, the Region has limited staff and no specialist. It is unknown when the Region may be able to fill this staffing need.

The collection of baseline data prior to commercial development will turn toward site-specific assessment, which will rely 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 meters. As a result of this expanding interest, Pacific studies will need to address multiple and disparate ecosystems.

BOEM hosted the Oregon Marine Renewable Energy Environmental Science Conference and Experts Workshop on November 28-29, 2012, at OSU. The conference report (Boehlert, et al. 2013) is available in ESPIS and on the OSU web site (OSU 2014). 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 at the time of commercial build out, the existing acoustic environment and the consequence of change, the effect of electromagnetic fields on endangered and threated 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. Based on information from the conference, the Pacific Region considered the most immediate information needs when developing our proposed FY 2015 profiles.

BOEM
Bureau of Ocean Energy Management

CHAPTER 3

GULF OF MEXICO OCS REGION

U.S. Department of the Interior
Bureau of Ocean Energy Management
New Orleans, LA
2014

SECTION 1 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

In managing Outer Continental Shelf (OCS) activity, the Bureau of Ocean Energy Management (BOEM), formerly Minerals Management Service (MMS) then Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), has two core responsibilities: safe offshore operations and environmental protection. Our safety goal is to ensure incident free energy exploration and development on Federal offshore leases. Our environmental responsibilities are to ensure that all activities on the OCS are conducted with appropriate environmental protection.

The BOEM New Orleans Regional Office conducts all oil and gas, renewable energy, and marine minerals leasing and resource management functions on the OCS for the Gulf of Mexico Region (GOMR) and oil and gas-related activities (such as Geological & Geophysical (G&G)) in the Atlantic Region OCS areas, a total of 430 million acres in seven planning areas (see map in Section 1.2). Currently there are more than 5,600 active oil and gas leases in the Gulf of Mexico (GOM) and more than 2,600 active platforms making significant contributions to the Nation's energy supply.

BOEM's Environmental Studies Program (ESP) was established in 1973 as a means to gather information to support decision making for offshore oil and gas leasing. The program (then under the Bureau of Land Management (BLM)) evolved with changes in the geographic areas of concern, in environmental issues, and in study priorities and policies. In 1994, the MMS Atlantic OCS Regional Office was closed and its responsibilities transferred to the GOMR. In the GOMR, the ESP addresses issues from prelease through postlease operations. In the Atlantic Region, the ESP has been limited to prelease descriptive and process-type investigations since there has been no recent oil and gas production in that area.

The GOM is anticipated to remain the Nation's primary offshore source of oil and gas. Initiatives to emphasize the use of "environmentally friendly" natural gas further promote the production from the Gulf's gas fields. Advances in offshore technologies (e.g., directional drilling; deepwater structures such as sub-sea completions, spar, and tension-leg platforms; sub-salt prospecting; three-dimensional geophysical profiling; and down-hole instrumentation) ensure that exploration and development will continue in the Gulf for decades to come.

In 1992, MMS (now BOEM) entered into a partnership with the Louisiana State University (LSU) to establish the first Coastal Marine Institute (CMI). This partnership, which continues today between BOEM and LSU, was developed as part of an initiative to cultivate new State-Federal cooperative agreements on environmental and socioeconomic issues of mutual concern. These projects are designed to help answer questions regarding the potential impacts from oil and gas and marine minerals activities.

The establishment of the Biological Resources Division (BRD), a division of the U.S. Geological Survey (USGS), in 1996, provided new opportunities for partnership in biological research. The BRD has procured and conducted several studies for the GOMR in the past.

Because there has been an increase in deepwater oil and gas activity in the GOM, BOEM (then MMS) sponsored a deepwater workshop in April 1997. Conducted under a cooperative agreement with LSU, the workshop focused on physical oceanography and the environmental and social sciences. The recommendations and issues identified in the workshop proceedings (Carney, 1997) are being used to design the studies needed by BOEM for the preparation of environmental assessments (EA), environmental impact statements (EIS), other National Environmental Policy Act (NEPA) documents, and deepwater regulations to oversee oil and gas activities. A follow-up workshop to discuss the results of these studies was held in May of 2002 (Schroeder and Wood, 2003). The information that was gathered since the first workshop was presented in 2002.

In April 2010, the *Deepwater Horizon* (DWH) incident caused a massive oil spill that released millions of gallons of crude oil into the GOM. The degree and extent of offshore and onshore environmental impacts to natural and cultural resources as well as socioeconomic impacts from this spill are currently under investigation. Legal settlements against British Petroleum and Transocean, stemming from the DWH spill, awarded $350 million to the National Academy of Sciences (NAS). NAS has established a research grant program to study environmental science and human health impacts in the wake of the oil spill in the GOM. BOEM staff is involved in coordinating with NAS and other funding sources, including the Resources and Ecosystems Sustainability, Tourist Opportunity and Revived Economics of the Gulf States Act of 2011 (RESTORE Act), for future projects occurring over the next 30 years. BOEM is participating on the Department of the Interior (DOI) RESTORE Science Team, RESTORE Council Executive Team and the Gulf Coast Ecosystem Restoration Science Program Advisory Working Group with the goal of leveraging funding opportunities with the Environmental Studies Program.

In 2010, BOEM joined the Gulf Coast Cooperative Ecosystem Studies Unit (GCCESU) as a Federal partner. Membership in the GCCESU creates additional opportunities for interdisciplinary and multi-agency research, technical assistance, and education through collaborations within a network of member Federal and State agencies, universities, and research and environmental groups.

In 2011, the Bureau of Ocean Energy Management, Regulation and Enforcement was reorganized to form the Bureau of Ocean Energy Management and the Bureau of Safety and Environmental Enforcement (BSEE). BOEM's Environmental Studies Program supports environmental studies for both BOEM and BSEE information needs.

1.2 Map of the Planning Areas

Figure 1. **Map of the Planning Areas**

1.3 Projected OCS Activities

1.3.1 Gulf of Mexico Region

Since the GOMR is the most active U.S. OCS area, most activities associated with energy exploration and production occur here. These activities include leasing, exploration, development, removal of platforms, installation of pipelines, and marine minerals extraction. The 2012-2017 five-year program proposes 12 lease sales in the GOM. The Central Planning Area, Western Planning Area, and a portion of the Eastern Planning Area not under Congressional moratorium will continue to be considered for potential leasing before 2017. Large portions of the Eastern Planning Area are put off limits by the Energy Policy Act of 2005 and are not under consideration. The first lease sale of the new five year program, Western Planning Area Lease Sale 229, was held on November 28, 2012. The second lease sale, Central Planning Area Lease Sale 227, was held on March 20, 2013. Western Planning Area Lease Sale 233 was held on August 28, 2013, and a joint sale for Central Planning Area Sale 231 and Eastern Planning Area Sale 225 was held March 19, 2014.

1.4 Identification of Information Needs

With the extent of offshore oil and gas activities in the deepwater GOM and the DWH oil spill in 2010, environmental and socioeconomic information needs have increased. The GOMR has approximately 80 ongoing studies divided among all areas of interest. We are proposing studies in the following topics to meet our information needs to aid in future analysis within EIS's, EA's, mitigations, and other requirements from the NEPA. Several proposed studies intend to assess the recovery and long-term impacts of the oil spill on the GOM's coastal, marine, and human environments while other studies propose to fill information gaps not related to the DWH spill.

1.4.1 Physical Oceanography

The Region has funded numerous studies along the continental shelves of the northwest and northeast Gulf, which resulted in an improved understanding of the circulation in these coastal areas. The GOMR has focused its energies and efforts in the planning and acquisition of information in deepwaters of the Gulf, both in U.S. and Mexican territories. Continued expansion of industry deepwater development reinforces our need to gather additional deepwater current observations that when integrated with datasets in Mexican waters can be used to validate a basin wide numerical model. Such a model is needed to provide spatial and temporal current information to use in oil spill trajectory and dispersion modeling. After completing five deepwater studies, BOEM is conducting studies of the Loop Current, which include the dynamics of the Loop Current in U.S. waters and its complementary study in Mexican waters and the Lagrangian study of the deep circulation. Upon completion of these ongoing studies, BOEM will update the historical synthesis of oceanographic data in the Gulf. Physical oceanographic processes do not stop at the Exclusive Economic Zone (EEZ) and a full understanding requires inclusion of information from Mexican waters. We continue working with Mexican researchers to collect information in Mexican waters and coordinate as they

have embarked on a massive study of the Campeche region. In 2014, we are expecting the publication of the final report, *Analysis of Ocean Current Data from Gulf of Mexico Oil Platforms*. We are also expecting to complete two additional reports, the *Dynamics of the Loop Current in U.S. and Mexican Waters* and the *Current-Topography Interaction and Its Influence on Water Quality and Contaminant Transport Over Shelf-Edge Banks*. New needs include an updated and descriptive inventory of all chemicals used in the offshore oil and gas industry in the GOM, including hydraulic fracturing chemicals, to allow for assessments of risks should a spill involving one or more of these chemicals occur. Another need is to evaluate fresh groundwater reserves potential on the OCS. This non-renewable natural resource, if available on the OCS, could become BOEM's responsibility to manage.

1.4.2 Atmospheric Sciences

BOEM has several ongoing or recently completed air quality studies to determine if offshore OCS sources impact the air quality of GOM onshore coastal areas. For Fiscal Year (FY) 2013 two new studies were awarded: a Gulfwide emissions inventory for year 2014, and an adaptation of the weather research and forecasting (WRF) model to the GOM. A third study combining the update of the exemption level for post-lease reviews of plans and the cumulative impacts modeling and analysis of OCS emissions is expected to be awarded in 2014. The final report, *Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling*, was published in 2013, and the final report for Gulfwide emissions inventories is expected to be published in 2014.

1.4.3 Fates and Effects

There are numerous examples of BOEM studies that have collected baseline information or examined the fates and effects of oil and gas activities in the OCS of the GOM. In the mid-1970's, the first major offshore environmental survey in the GOM was conducted in response to questions about the effects of oil and gas activities on the continental shelf. This study, Mississippi, Alabama, and Florida (MAFLA) examined physical, chemical, and biological parameters along the MAFLA shelf. Portions of the study area were revisited in the late 1980's for similar analyses as part of Mississippi-Alabama Marine Ecosystem (MAMES). Several other baseline studies informed the DWH Oil Spill Response and were summarized in the Operational Science Advisory Team's (OSAT-1) Report, comparing measured hydrocarbon concentrations against reference locations. BOEM's ESP has conducted numerous studies over the years and the sum of past, current, and future studies forms a strong environmental monitoring framework that guides BOEM's management decisions.

BOEM has also begun to focus on new issues that have arisen since past studies, such as ocean acidification, and considering new methodologies and techniques for characterization. As part of its Cumulative Impacts analysis for NEPA documents, BOEM must take into consideration the multiple stressors that could impact Gulf habitat in addition to oil and gas activities, including for example climate change. Ocean acidification is a major issue facing the world's oceans as atmospheric CO2 concentrations rise, and it is expected to especially impact sensitive coral reef habitats.

In response to this potential threat, BOEM is currently initiating in FY 2014 the following new study: *Coral Reef Ocean Acidification Sentinel Site in the Flower Garden Banks National Marine Sanctuary* (GM-14-05). As well, since the DWH spill, revising baseline conditions and answering fundamental (bio) geochemical questions is more important than ever. The region should be recharacterized to collect baseline data and to employ new technologies. Collecting baseline data for areas where future oil and gas activities may occur should also be considered. Furthermore, any studies as a result of the oil spill should also be considered.

Several ongoing BOEM studies in GOM seek to better understand the fate and effects of oil spills, including the implications of various response activities. The DWH oil spill was the first of its kind in deepwater and the first time that dispersants have been injected near the seafloor for remediation purposes. Thus, more must be learned about the behavior of spilled oil, especially dispersed oil, under these specific conditions. Initiated in 2011, BOEM has an ongoing study titled *Simulation Modeling of Ocean Circulation and Oil Spills in the Gulf of Mexico* (GM-11-02), which will provide the agency with a next-generation, 3-D blowout model for the Gulf, including consideration of a variety of possible spill scenarios. As well, the following ongoing study initiated in 2012 will inform BOEM's Oil Spill Risk Analysis (OSRA) modeling, especially related to surface transport of oil spills: *Remote Sensing Assessment of Surface Oil Transport and Fate during Spills in the Gulf of Mexico* (GM-12-02). Another topic of particular interest is how oil and dispersed oil might interact with sediment particles or undergo sedimentation in deepwater environments. An ongoing BOEM study procured in 2012, *Oil/Dispersed Oil-Sediment Interactions in Deepwater Environments and Impacts of Dispersants on the Environmental Fate of Persistent Oil Components* (GM-11-13), is investigating these topics.

1.4.4 Biology

The management needs of BOEM continue to require new information on all aspects of ecology across a variety of habitat types in U.S. waters. In some cases, information is also required on a Gulf-wide basis due to the connectivity of ecosystems across federal boundaries. New and ongoing energy activities touch upon every ocean province from our coastal marshes to the abyss. New technology has ushered exploration into deeper waters down the continental slope and onto the abyssal plains. At the same time, new technology prompts renewed interest in hydrocarbon resources under the thick salt layers beneath the OCS, and there is considerable gas development activity in shallower shelf areas. Therefore, while BOEM needs to collect information in frontier areas where biological information is sparse, older data on shelf communities may also need to be updated.

Periodic review and updates of information on GOM habitats ensures that protective measures are adequate and that adaptive management practices are implemented. A long-range systematic monitoring program is needed to apply new technologies and methods to studies of shelf ecosystems and related topics. The program should cover a wide range of habitats and topical studies such as habitats the BOEM protects with stipulations, other shelf habitats, coastal studies, protected species, invasive species, and

climate effects. With continued BOEM funding provided in FY 2013 through the LSU CMI program, the Gulf SERPENT program will provide observations of both pelagic and benthic species on the OCS, using industry remotely operated vehicles (ROVs), into the future. In terms of decommissioning activities, both BOEM and BSEE need updated information on the effects of continued high numbers of explosive platform removals on current fish populations in GOM. The study *Explosive Removal of Structures: Fisheries Impact Assessment* proposed by BSEE for FY 2015 seeks to quantify these impacts. Coastal studies also continue to play an important role in the Studies program, with a study proposed for FY 2015 in partnership with USGS to better quantify coastal land loss along select areas of the Gulf Coast.

Long-term monitoring at the Flower Garden Banks continues to be a centerpiece of BOEM's Environmental Studies Program. Better understanding of cumulative stressors at the Flower Garden Banks is required, such as the impacts of variable temperature and acidification, the latter also indicators of climate change. New studies currently being procured for FY2014 will extend the Flower Garden Banks Long-Term Monitoring Program and collect a baseline of ocean acidification measurements at the coral reefs on these Banks. Partnerships with other agencies continue to play an important role in the environmental studies process, as highlighted by both these studies.

In addition to field research, BOEM also has an increasing need for ecosystem models which can both simulate the present state of habitat and populations, as well as predict future change under different perturbation scenarios. This predictive need for assessing the potential impacts to marine biota from oil and gas activities is identified in the Outer Continental Shelf Lands Act (OCSLA). For example, BOEM needs information on the spatio-temporal variability of planktonic distributions and related higher-trophic habitat to address the potential gulf-wide impacts of industry on these communities in the GOM. Modeling tools can be used to provide simulations of longer time spans and at higher spatial resolution than can be achieved with ship-based sampling alone. A new study for FY2015 proposes to use a gulf-wide ecosystem model and Intergovernmental Panel on Climate Change (IPCC) scenarios to provide projected habitat conditions in Gulf OCS habitats, with focus on habitats of special interest to BOEM.

1.4.5 Protected Species

BOEM has undertaken a variety of protected species research in the GOM region. Section 7 Endangered Species Act (ESA) consultations for protected species frequently identify information gaps and make recommendations for areas of research either as part of the "terms and conditions" or as part of the "conservation recommendations." These directives often dictate the types of research necessary to fill information gaps and allow BOEM to meet our protected species information needs for OCS activities.

The Endangered Species Act of 1973 (ESA) (16 U.S.C. §§ 1631 et seq.), as amended (43 U.S.C. §§ 1331 et seq.), establishes a national policy designed to protect and conserve threatened and endangered species and the ecosystems upon which they depend. BOEM and BSEE are currently in consultation with National Marine Fisheries Service (NMFS) and Fish and Wildlife Service (FWS) regarding the OCS oil and gas program in the GOM. BOEM is acting as the lead agency in the ongoing consultation, with BSEE's

assistance and involvement. The programmatic consultation was expanded in scope after the reinitiation of consultation by BOEM following the DWH explosion and oil spill, and it will include both existing and future OCS oil and gas leases in the GOM through 2022. This consultation also considers any changes in baseline environmental conditions following the DWH explosion, oil spill, and response. The programmatic consultation will also include postlease activities associated with OCS oil and gas activities in the GOM, including G&G and decommissioning activities.

With consultation ongoing, BOEM and BSEE will continue to comply with all reasonable and prudent measures and the terms and conditions under the existing consultations, along with implementing the current BOEM- and BSEE-required mitigation, monitoring, and reporting requirements. Based on the most recent and best available information at the time, BOEM and BSEE will also continue to closely evaluate and assess risks to listed species and designated critical habitat in upcoming environmental compliance documentation under NEPA and other statutes.

Following the success of the *Sperm Whale Seismic Study (SWSS)*, additional cetacean studies have followed. These include the *Sperm Whale Acoustic Prey Study (SWAPS)* (GM-09-05) and *Sperm Whales and Bottlenose Dolphins in the GOM* (GM-11-03). Sea turtles in the GOM are also the focus of BOEM research in *The Movement and Habitat Associations of Sea Turtles in the Northern Gulf of Mexico* (GM-10-04). A manatee study has now gotten underway in partnership with USGS titled *Florida Manatee Movement and Habitat Use in the Northern GOM* (GM-13-07). New potential protected species studies could include a Passive Acoustic Monitoring Program for the northern GOM, in order to provide more data on the ambient noise environment and a relative baseline with which to assess any BOEM/BSEE authorized activities.

1.4.6 Social Sciences and Economics

In the GOMR, normal operations of the offshore industry rather than accidental events have been, over the years, the primary driver of its social and economic consequences. Generally, social impact assessment (SIA) projects the effects of new actions on unaffected baselines. In the GOMR, SIA evaluates the effects of a "new" action on a baseline that has experienced 70 plus years of past and ongoing consequences of similar "new actions." Because the modern offshore petroleum industry was born and evolved in the Gulf, SIA faces unique challenges. On one hand, while much SIA is "what if" stories, any effects that offshore oil activity has had are likely to have actually occurred somewhere in the GOMR (National Research Council, 1992). On the other, finding them proves difficult since they must be disentangled from other social and economic changes and trends that are occurring that continue to affect the present. In addition, the offshore petroleum industry is a massive assemblage of many and varied enterprises, each with its own needs for capital, goods and services, its own labor conditions and community relationships, its own technological and organizational dynamics, and its own past, current and future impacts. The DWH oil spill and its aftermath have added an additional dimension to this situation, affecting environmental services, the operations of enterprises, people's attitudes, and the way State and Federal

governments manage and regulate. The DWH spill has changed the baseline and raised new concerns.

No single research strategy could address all these complexities, and the Gulf ESP approaches this puzzle from three basic directions and with multiple methodologies. First, the ESP emphasizes the industry itself. The industry's size, variability, and longevity mean that characteristics and distributions of its various sectors shape the socioeconomic baseline, and that data on these sectors is needed to calibrate the models used to estimate its consequences and future effects. Much ESP effort describes and measures key industry sectors (e.g., drilling, production, fabrication, transportation) and uses this information to assess local and regional impacts. The move into deepwater, growing interest in alternative energy and renewed interest in the Atlantic, and the push to address local-level effects are significant concerns in the Gulf. The second strategy focuses on developing a "dynamic baseline." All SIA begins with the baseline but, in the Gulf, the need to disentangle industry effects from other trends and events turns this into a substantial and iterative task. Much past ESP research aimed at developing this baseline and the growing State and stakeholder emphasis on local-level impacts has sharpened this focus. A third strategy focuses on standard SIA social and cultural issues. Many of the current issues relate to the DWH spill.

In terms of number, if not budget, the majority of ongoing Gulf socioeconomic studies are cooperative agreements conducted under the LSU CMI (see studies beginning with GM-92-42 at http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/GOMR-Ongoing-Social-Sciences-and-Economics-Studies.aspx). Under the CMI, the GOMR provides an annual announcement that identifies areas of particular interest. The GOMR then receives, selects, and negotiates CMI research proposals that may address some or all of these areas and others. This annual CMI planning cycle is now underway, and because its timing conflicts with that of Scientific Advisory Committee reviews, CMI proposals have not been provided in this document even though they address a wide range of critical information needs related to such topics as oil spill impacts, industry strategy, localized socioeconomic effects, infrastructure use, environmental justice, and assessment methodology. New information needs include an assessment of how coastal land loss and storm surges impact onshore industry and the analysis of changes that have occurred as the OCS industry has evolved. Examples include the recreational use of offshore structures, OCS-related transportation systems, and the industry's employment and demographic effects.

1.4.7 Submerged Cultural Resources

Submerged cultural resources are both non-adaptive and non-renewable and are protected by a well-established body of laws and regulations at both the Federal and State level. Shipwrecks, ship strandings and groundings, airplane wrecks, submerged terrestrial sites such as shell middens and coastal campsites, docks, wharves, and other maritime facilities are but a small sample of the types of cultural resources likely to be affected by offshore energy development and marine mineral extraction. BOEM, as a

Federal agency, is required to consider the effects of its permitted actions on sites listed or eligible for listing on the National Register of Historic Places (NRHP).

An ongoing information need is to understand the impacts of the 2010 oil spill in the GOM on archaeological resources within the coastal and marine environments. Impacts to archaeological resources are not addressed as part of the Natural Resource Damage Assessment (NRDA) process therefore a significant information gap exists. A new study procured in FY 2014 will examine the impacts of the oil spill and associated clean-up activities on coastal prehistoric sites in Louisiana. Information gathered during this study will also benefit the State of Louisiana. Another study procured in FY 2013, *A Comparative Analysis of an Oil Spill on the Biota Inhabiting Several Gulf of Mexico Shipwrecks* (GM-13-03), is analyzing and comparing the effects of oil and dispersant exposure on wooden and metal-hulled shipwrecks, their associated microbial communities, and resident biota within and outside of the spill area. This effort is being undertaken through a multi-agency Federal partnership between BOEM, BSEE, and the U.S. Naval Research Laboratory (NRL) (GM-13-03a), a competitive contract (GM-13-03b), and a cooperative agreement with George Mason University (GMU) (GM-13-03c).

Other studies continue to inform BOEM about impacts to submerged cultural resources from various offshore activities. One ongoing study procured in 2012, *Analyzing the Potential Impacts to Cultural Resources at Significant Sand Extraction Areas* (GM-12-04), is investigating potential impacts to offshore sand resources and shipwrecks associated with dredging activities to support coastal restoration and protection projects in Louisiana. BOEM continues to seek to understand the nature of submerged cultural resources to ensure they are not harmed as a result of the Bureau's permitted actions.

New studies proposed for FY 2015 include follow-up data collection at the Monterrey shipwrecks in Keathley Canyon, initially discovered in 2012 and investigated in 2013. Another study proposes to conduct NRHP eligibility determinations for several shipwrecks investigated in 2012 by the NOAA vessel *Okeanos Explorer*. For FY 2016 and beyond, we envision funding a study to conduct laboratory experiments to examine how shallow water wooden shipwreck remains and resident bacteria respond to crude oil and chemical dispersant exposure. Another study could examine selected post-WWII shipwrecks to determine their NRHP eligibility, conduct additional archival research, and identify potential environmental hazards from the degradation of these wrecks over time.

1.5 New Starts for FY 2014 and Ongoing Studies Table

Table 1 lists new studies planned to start in FY 2014 and ongoing studies categorized by discipline. Profiles for these studies can be found at: http://www.boem.gov/GMStudies/.

Table 1. BOEM Gulf of Mexico Region New Starts for FY 2014 and Ongoing Studies

NSL #	Study Title	Planning Area(s)	Start FY	Partners
New Starts				
Air Quality				
GM-14-01	Cumulative Impacts Modeling for the Gulf of Mexico Region	GW	2014	
Habitat & Ecology				
GM-14-06	Long-Term Monitoring at the East and West Flower Garden Banks: 2014-2017	C	2014	NOAA
Information Management				
GM-14-03	LSU CMI (2014-2018)	GW	2014	LSU
Physical Oceanography				
GM-14-05a	Coral Reef Ocean Acidification Sentinel Site in the Flower Garden Banks National Marine Sanctuary: Data Collection and Analysis	C&W	2014	TAMU Shell
GM-14-05b	Coral Reef Ocean Acidification Sentinel Site in the Flower Garden Banks National Marine Sanctuary: Field Support	C&W	2014	NOAA
Social & Economic Sciences (Marine Archaeology)				
GM-14-04	Testing and Assessment of the Effects of an Oil Spill on Coastal Archaeological Sites	C	2014	ULL
*Note: The procurement of any study is contingent upon availability of funding				
Ongoing Studies				
Air Quality				
GM-06-x14	Operations of the BOEM's Radar Wind Profiler /RASS at the Houston Coastal Center	C&W	2006	
GM-92-42-138	Deployment and Operation of Radar Profiler	C&W	2007	LSU
GM-10-02	Year 2011 Gulfwide Emissions Inventory Study	GW	2010	
GM-13-02	Year 2014 Gulfwide Emissions	C&W	2013	

	Inventory Study			
GM-13-04	Enhancing the Capability of a New Meteorological Model for Air Quality and Other BOEM Applications in the Gulf of Mexico	GW	2013	
Fates & Effects				
GM-09-11	Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the OCS	GW	2010	
GM-11-13	Oil/Dispersed Oil-Sediment Interactions in Deepwater Environments and Impacts of Dispersants on the Environmental Fate of Persistent Oil Components	GW	2012	
GM-12-02	Remote Sensing Assessment of Surface Oil Transport and Fate During Spills in the Gulf of Mexico	GW	2012	
Habitat & Ecology				
GM-92-42-118	Digital Conversion and Selected Analysis of Dive Video From Fifteen Dive Seasons	C&W	2004	LSU
GM-92-42-126	Deep-Water Coral Distribution and Abundance on Active Offshore Oil and Gas Platforms and Decommissioned “Rigs-to-Reefs” Platforms	C&W	2006	LSU
GM-92-42-133	Gulf SERPENT: Establishing a Deepwater Plankton Observation System Using Industrial ROVs	GW	2007	LSU
GM-92-42-140	Digitization and Reanalysis of Northern Gulf of Mexico Continental Slope Study Seafloor Photographs	GW	2008	LSU
GM-08-03	Exploration and Research of Northern Gulf of Mexico Deepwater Natural and Artificial Hard Bottom Habitats with Emphasis on Coral Communities: Reefs, Rigs and Wrecks	C&W	2008	
GM-09-01-07	New Invasive Marine Species Colonizing Oil/Gas Platforms in the Northern Gulf of Mexico: Verification and Examination of Spread	C	2010	LSU
GM-09-01-08	Biomass and Mass-Balance Isotope	C	2010	LSU

	Content of Seep Populations on the Upper Slope Gulf of Mexico Determined from Archived Samples			
GM-09-11	Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the OCS	GW	2010	
GM-10-01	Forcing Functions Governing Salt Transport Processes in OCS Navigation Canals and the Surrounding Wetland Landscape Utilizing Houma Navigation Canal (HNC) as a Surrogate Canal	C	2010	USGS
GM-11-01a	Deep-Water Reconnaissance of Potentially Sensitive Biological Features (PSBF's) Surrounding Shelf-Edge Topographic Banks in the Northern Gulf of Mexico	C&W	2011	NOAA
GM-11-01b	Deep-Water Reconnaissance of Potentially Sensitive Biological Features (PSBF's) Surrounding Shelf-Edge Topographic Banks in the Northern Gulf of Mexico	C&W	2011	LSU
GM-12-x10	Abundance and Distribution of Commercially Important Estuarine Dependent Species Populations within the Gulf of Mexico	C&E	2012	UNO
GM-12-03	Eastern Brown Pelicans: Dispersal, Seasonal Movements, and Monitoring of PAHs and Other Oil Contaminants among Breeding Colonies in the Northern Gulf of Mexico	GW	2012	USGS
GM-09-01-12	Evaluating the Importance of Shallow Water Rigs as Habitat for Newly Recruited Reef Associated Fishes in the OCS off Louisiana	C	2012	LSU
GM-09-01-13	Genetic Affinities in Populations of the Invasive Indo-Pacific Coral *Tubastraea Micranthus* on Northern Gulf of Mexico Platforms: Multiple Invasions?	C	2012	LSU
GM-09-01-11	Optimization of Non-Voucher Gulf of Mexico Benthic Fauna Specimen Archives: A Cooperative Effort with the U.S. National Museum of	GW	2012	LSU

	Natural History			
GM-09-01-16	Continuing and Expanding a Deepwater Biological Observation System in the Northern Gulf of Mexico		2013	LSU
Information Management				
GM-04-04	Literature Search and Data Synthesis of Biological Information for Use in Management Decisions Concerning Decommissioning	C&W	2005	
GM-08-x13	**E**co**S**patial **I**nformation **D**atabase – U.S. Atlantic Region	AW	2009	
GM-09-01-01	Administration of the LSU Coastal Marine Institute (2009-2013)	GW	2010	LSU
Marine Mammals & Protected Species				
GM-09-05	Sperm Whale Acoustic Prey Study (SWAPS)	GW	2009	NOAA
GM-10-04	The Movement and Habitat Associations of Sea Turtles in the Gulf of Mexico	GW	2010	NOAA
GM-11-03	Sperm Whales and Bottlenose Dolphins in the Gulf of Mexico	GW	2011	NOAA
GM-13-05	Pressure Wave and Acoustic Properties Generated by the Explosive Removal of Offshore Structures: Potential Effects on Protected Species	C&W	2013	BSEE
GM-13-07	Florida Manatee Movement and Habitat Use in the Northern Gulf of Mexico	GW	2013	
Physical Oceanography				
GM-92-42-94	Wave-Bottom Interaction and Bottom Boundary Layer Dynamics in Evaluating Sand Mining at Sabine Bank for Coastal Restoration, Southwest Louisiana	C&W	2002	LSU
GM-92-42-127	Effects of Loop Current and Loop Current Eddies – Analysis Using the Real-Time BOEM ADCPs from Oil Platforms	GW	2006	LSU
GM-08-01	Dynamics of the Loop Current in U.S. Waters	E	2008	
GM-09-07	Current Measurements in the Yucatan-Campeche Area in Support of Loop Current Dynamics Study	E	2009	CICESE

GM-10-03	Lagrangian Study of the Deep Circulation in the Gulf of Mexico	GW	2010	
GM-10-05	Current-Topography Interaction and Its Influence on Water Quality and Contaminant Transport Over Shelf-Edge Banks	W	2010	NRL
GM-11-02	Simulation Modeling of Ocean Circulation and Oil Spills in the Gulf of Mexico	GW	2011	
GM-09-01-14	Mass Wasting Processes and Products of the Mississippi Delta Front: Data Synthesis and Observation	C	2013	LSU
Social & Economic Sciences				
GM-92-42-80	The Relationship of Crime to Oil Development in the Coastal Regions of Louisiana	C	2000	LSU
GM-92-42-106	Environmental Justice: A Comparative Perspective in Louisiana	C	2003	LSU
GM-92-42-110	Social Capital and Offshore Oil Development in St. Mary Parish	GW	2004	LSU
GM-92-42-122	Factors Affecting Global Petroleum Exploration and Development and Impacts on the Attractiveness and Prospectivity of the U.S. Gulf of Mexico Deepwater	GW	2005	LSU
GM-06-03	Gulf Coast Communities and the Fabrication and Shipbuilding Industry: A Comparative Community Study	GW	2006	
GM-92-42-125	Spatial Restructuring and Fiscal Impacts in the Wake of Disaster: The Case of the Oil and Gas Industry Following Hurricanes Katrina and Rita	C&W	2006	LSU
GM-92-42-131	Gulf Coast Subsidence and Wetland Loss: A Synthesis of Recent Research	GW	2006	LSU
GM-07-08	State and Local-Level Fiscal Effects of the Offshore Petroleum Industry	GW	2007	
GM-07-x12	Assessing Impacts of OCS Activities on Public Infrastructure, Services, and Population in Coastal Communities Following Hurricanes Rita and Katrina	GW	2007	

GM-92-42-134	Forecasting Service Vessel and Helicopter Trips Related to OCS Development	GW	2007	LSU
GM-92-42-135	Structural Shifts and Concentration of Regional Economic Activity Supporting GOM Offshore Oil and Gas Activities	C&W	2007	LSU
GM-92-42-139	Understanding Current and Projected Gulf OCS Labor and Port Infrastructure Needs	GW	2007	LSU
GM-08-07	History of Gulf of Mexico Offshore Petroleum Industry, Phase III: Deepwater Developments	GW	2008	
GM-92-42-142	OCS Studies Review: (1) Geographical Units for Observing and Modeling Socioeconomic Impact of Offshore Activity; (2) LA and TX Oil and Gas Activity Review and Production Forecast: and (3) Pipeline Paper	C&W	2008	LSU
GM-09-01-02	Characteristics and Possible Impacts of the Aging Workforce Transition on the Outer Continental Shelf Oil and Gas Industry in the Gulf of Mexico Region	GW	2009	LSU
GM-09-01-03	Developing Indicators to Measure Socioeconomic Impacts of OCS Activities: A Temporal Analysis of Counties within the Gulf of Mexico Region	GW	2009	LSU
GM-09-01-04	Geographic Units for Socioeconomic Impact Analysis in the Gulf of Mexico Region	GW	2009	LSU
GM-09-01-05	Improving Capacity for Institutional Analysis of the Oil and Gas Industry for the Gulf of Mexico Region	GW	2009	LSU
GM-09-08	Oil and Gas Infrastructure in the Mid-Atlantic Region	M-ATL	2009	
GM-09-01-06	A Prospectus for Historical Social and Economic Analysis of the Oil and Gas Industry for the Gulf of Mexico Region	GW	2010	
GM-08-05	Ethnic Groups and Enclaves Affected by OCS Activities	GW	2010	

GM-11-06	Examination of the Relationship between Tourism and OCS Oil and Gas Activities in the Gulf of Mexico	GW	2011	
GM-09-01-09	Subsistence in Coastal Louisiana: An Exploratory Study	C	2011	LSU
GM-11-08	Assessing Vulnerability of Sectors and Regions to OCS Oil and Gas Industry Volatility	GW	2012	
GM-12-x11	Social Impacts of Deepwater Horizon Along the Gulf Coast	C	2012	
GM-09-01-15	The Economic Benefits of the Gulf of Mexico Coastal Ocean Observing System (GCOOS)	GW	2013	LSU
GM-13-06	An Analysis of the Impacts of the Deepwater Horizon on the Seafood Industry	GW	2013	
Social & Economic Sciences (Marine Archaeology)				
GM-09-01-10	Late Quaternary Stream and Estuarine Systems to Holocene Sea Level Rise on the Outer Continental Shelf Louisiana and Mississippi: Preservation Potential of Prehistoric Cultural Resources and Sand Resources	C&W	2012	LGS, LSU
GM-12-04	Analyzing the Potential Impacts to Cultural Resources at Significant Sand Extraction Areas	C	2012	
GM-92-42-136	Examining and Testing Potential Prehistoric Archaeological Features on the Gulf of Mexico, Offshore Continental Shelf	C&W	2007	LSU
GM-13-03a	A Comparative Analysis of an Oil Spill on Biota Inhabiting Several Gulf of Mexico Shipwrecks Spanning the 19th to 20th Centuries: Project Management: Project Management	C	2013	NRL
GM-13-03b	A Comparative Analysis of an Oil Spill on Biota Inhabiting Several Gulf of Mexico Shipwrecks Spanning the 19th to 20th Centuries: Archaeological Analysis	C	2013	
GM-13-03c	A Comparative Analysis of an Oil Spill on Biota Inhabiting Several Gulf of Mexico Shipwrecks Spanning the 19th to 20th	C	2013	GMU

	Centuries: Microbial Analysis			

Planning Area Codes	
AW = Atlantic Wide	GW = Gulf Wide
N-ATL = North Atlantic	C = Central Gulf
S-ATL = South Atlantic	E = Eastern Gulf
M-ATL = Mid Atlantic	W = Western Gulf

Partner Codes	
BSEE = Bureau of Safety and Environmental Enforcement	
CICESE = Centro de Investigación Científica y Educación Superior de Ensenada	
GMU = George Mason University	LGS = Louisiana Geological Survey
LSU = Louisiana State University	NRL = U.S. Naval Research Laboratory
NOAA = National Oceanic and Atmospheric Administration	
Shell = Shell Oil Company	TAMU = Texas A&M University
ULL = University of Louisiana Lafayette	UNO = University of New Orleans
USGS = U.S. Geological Survey	

SECTION 2 PROPOSED STUDY PROFILES

2.1 Introduction

Since the DWH oil spill of 2010, the GOMR Environmental Studies Program has continually modified its Studies Plan to reflect the agency's current information needs for studies that address impacts and recovery from the oil spill. The proposed oil spill-related studies attempt to avoid duplication of study efforts yet fill information gaps where NRDA studies may not address particular resources and their impacts from the oil spill.

The FY 2015-2017 Studies Development Plan includes profiles for new studies within the disciplines of air quality, 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 recovery of the physical and social environment over the long term as well as studies to fill information gaps that are not related to the DWH oil spill. Several studies represent multiyear, multidisciplinary efforts aimed at studying a variety of resources that may be impacted by an oil spill. Some studies are also envisioned as coordinated efforts through interagency agreements and cooperative agreements with other Federal and State agencies and universities.

The following section focuses on the proposed studies for FY 2015 and beyond. However, ongoing studies in the GOMR can be found on the web at: http://www.boem.gov/GMStudies/.

2.2 Profiles of Studies Proposed for the Fiscal Year 2015 NSL

Table 2. BOEM Gulf of Mexico Region Studies Proposed for the Fiscal Year 2015 NSL

SDP Page Number	Discipline	Regional Ranking	Study Title
125	HE	1	Explosive Removal of Structures: Fisheries Impact Assessment
127	SE	2	Coastal Land Loss and Oil & Gas Infrastructure
129	PO	3	Chemical Products Used in Gulf of Mexico Oil & Gas Operations: Inventory, Disposal, and Risks
131	SE	4	Interdisciplinary Research at the Site of Three 19th Century Deepwater Shipwrecks: the Monterrey Shipwrecks
133	AQ	5	Fugitive Emissions Update – Component Count and Amounts
135	HE	6	Forecasted Ecosystem Conditions in Gulf of Mexico OCS Habitats Using Coupled Modeling and Climate Scenarios
137	SE	7	Socioeconomic Impacts of OCS Infrastructure: Shifts in Recreational Behaviors
141	SE	8	National Register Evaluations of Deepwater Archaeological Sites in the Gulf of Mexico
143	SE	9	An Assessment of OCS-Related Onshore Transportation Industries and Operations in the Gulf of Mexico Region
147	HE	10	Gulf of Mexico Land Loss Change Assessment and Application to Louisiana Coastal Habitat Loss
149	HE	11	Deepwater Coral and Chemosynthetic Atlas and Modeling Program: Gulf of Mexico
151	PO	12	Evaluation of the Potential for Fresh Groundwater Reserves on the Gulf of Mexico OCS
Discipline Codes			
AQ = Air Quality		FE = Fates & Effects	HE = Habitat & Ecology
IM = Information Management		MM = Marine Mammals & Protected Species	
PO = Physical Oceanography		SE= Social & Economic Sciences	

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Western and Central

Title: Explosive Removal of Structures: Fisheries Impact Assessment

BOEM Information Need(s) to be Addressed: Despite BOEM's previous efforts, quantitative data on the impacts of explosive platform removals to fishes remains limited. It is known that many fishes are killed during decommissioning, but impact analysis is based on a small sampling effort (9 platforms) across a narrow depth range (14 -32 m). The increase in decommissioning activities combined with the understanding that fish assemblages vary greatly in space and time, suggests that extrapolation of results from previous work may not accurately predict impacts to fish populations or to fisheries (Gitschlag et al., 2000). An expanded evaluation of explosive removal impacts across a greater range of habitats would provide BOEM and BSEE more accurate information for understanding the broader impacts of OCS decommissioning activities. These data will provide for a more accurate analysis as required by NEPA and provide vital information that can be incorporated into regional fisheries management policies by other agencies.

Approx. Cost: (in thousands) $3,000 **Period of Performance:** FY 2015-2018

Description:

Background: Oil and gas platforms represent defacto artificial habitat for pelagic and demersal fishes. In the broadest sense fish assemblages can be classified by water depth into coastal (<30 m), offshore (31-60 m), and bluewater (>60 m). Many of the fish species utilizing these artificial reef habitats are managed by the Gulf of Mexico Fishery Management Council. Of particular concern are the snapper-grouper reef fish complex, migratory pelagics, and other managed species often present around offshore oil and gas structures. Many of these stocks have been overfished and are strictly managed while undergoing rebuilding.

Approximately 2600 oil and gas platforms remain on the U.S. OCS. Federal regulations require that within one year of lease termination, platforms be removed from the OCS or integrated into a State Artificial Reef Program. The most common platform removal method is explosive severance below the mud line. This method is used in approximately 60% of decommissioning activities. Explosive removal, regardless of whether the structure is deployed as a permanent reef or taken to shore for scrapping, represents a certain amount of lost fisheries potential. Fish kills are an unwanted consequence of the explosive removal process and given that decommissioning of older platforms currently outpaces the installation of new structures, the large number of removals has the potential to influence fish populations at the local and regional scale. Given our current understanding, it is not possible to accurately estimate the potential impacts explosive removals may have on stocks of commercially and recreationally valuable fishes. The only study in the GOM quantifying the impact of platform removal

on fish abundance was limited in scope with respect to spatial and temporal variation (Gitschlag et al., 2000) and conducted during a period of depressed fish stocks. In addition, the study occurred during a period of low platform removal rates. Given that fish stocks have improved and decommissioning rates have substantially increased, previous conclusions about the impacts of decommissioning activities may not accurately predict how fish stocks will respond given the current environment. It is important to more accurately capture data across the range of conditions and depths expected for future explosive removals if BOEM is to provide a thorough analysis of the potential impacts, as required by NEPA and demanded by other GOM stakeholders.

Objectives: The overall goal of this study is to quantify the impact to fishes and fisheries given the current state of fish stocks and fishing effort across a more comprehensive scale than previous research. Specifically, the objectives of this study are to: 1) estimate the number of fish killed during explosive decommissioning activities; 2) develop a model to more accurately estimate fish loss that incorporates spatial and temporal variation of removal operations; 3) compare results with fish loss estimates incorporated into current fisheries management policies; and 4) develop recommendations to guide BOEM and BSEE in authorizing decommissioning activities.

Methods: Sample explosive platform decommissioning operations in multiple water depth ranges: coastal (0-30m), offshore (30-60m), and blue water (>60m). Sampling should be conducted during the period of time when, historically, most platform removals have occurred (~May to October). Methods could include techniques such as hydroacoustic estimation of biomass and analysis of ROV video data to assess the species composition and relative abundance for the assemblage surrounding each platform before and after explosive removal. Underwater video could be analyzed to identify fish to lowest taxa and provide length estimates. Floating mortalities could be collected, weighed, and sub-sampled for species identification and length and weight distribution. Min-max analysis of ROV video data may be used to identify constituent species potentially inaccurately represented in post-blast mortality analyses. Inclusion of additional methods for collecting high quality data on explosive removal-related mortalities is encouraged.

Revised Date: March 26, 2014

Environmental Studies Program: Studies Development Plan FY 2015–2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Coastal Land Loss and Oil & Gas Infrastructure

BOEM Information Need(s) to be Addressed: This research will advance the agency's cumulative analysis of the OCS leasing program and help the agency address several critical issues raised by the State of Louisiana concerning the last 5-year and multi-sale EIS's. This study asks the questions of how coastal land loss and storm surges are currently impacting OCS industry as well as other related industrial concentrations, how preparations by these coastal industries might be measured, and whether these industries are preparing, and if so how, for potential impacts of coastal land loss and greater impact form storm surges. Because a large amount of OCS activity occurs within coastal areas of Louisiana that are being strongly affected by land loss and storm surges, these are particularly salient management issues.

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

Description:

Background: Coastal land loss in Louisiana is an ongoing threat to the people and industry of that region. The USGS determined about 1,883 (mi^2) of land became open water between 1932 and 2010 (25% of Louisiana's land area) (Couvillion et al., 2011 Barras et al., 2003). In 2004, the State of Louisiana's Department of Natural Resources commissioned Dr. Loren C. Scott of Loren C. Scott & Associates, Inc. and Dr. James A. Richardson of Louisiana State University to assess the economic impact of coastal erosion in Louisiana on state, regional and national economies (Richardson and Scott, 2004). The Richardson and Scott study posits that the "gradual erosion of Louisiana's coast may force the oil and gas industry to interrupt, postpone, or permanently delay the production and transportation of oil and gas products," and in the process impose larger costs to the state and the nation as a whole. With OCS infrastructure largely located in coastal parishes, continued coastal land loss poses a significant threat to the industry and the people whose daily life is structured by its presence. More and more infrastructure is exposed to the open sea and greater impacts from hurricanes and tropical storms without the aid of coastal wetlands to dampen storm surges.

BOEM's environmental assessments have not adequately addressed the current and potential impacts that land loss is imposing on industrial infrastructure. While the Scott and Richardson study creates scenarios of land loss and associated interruptions in navigation, oil and gas production and predicts economic losses, a study has yet to assess the industrial baseline, specifically with a focus on how businesses are preparing and mitigating potential impacts (if at all).

Objectives: Study objectives are to provide BOEM with an understanding of:

- Baseline of current effects coastal land loss and storm surges are having on coastal industry infrastructure and operations, particularly on OCS-related industry
- Identify industry trends to adapt (or not) to land loss impacts so that BOEM can better forecast economic and infrastructure impacts in the EIS cumulative scenario.

Methods: The research will compile baseline measures of the effects of coastal land loss and storm surges on the coastal oil and gas industry and related coastal industries and on their efforts to mitigate land loss and increased hurricane threat impacts. These measures will be based on existing studies of infrastructure (see BOEM Infrastructure Fact Book) as well as the latest data on coastal land loss. PI's will identify businesses across OCS industries and support industries with offices and infrastructure across coastal Louisiana. PI's will draft a survey tool, compliant with OMB regulations, to be distributed to a representative sample of OCS-related industries in coastal Louisiana. The survey instrument will seek to answer the following questions (but are not limited to): Are companies planning to move facilities further inland or are they taking measures to harden defenses? Are larger multinational companies taking greater initiative to harden their facilities or are local, smaller companies proving better equipped? Are accident rates expected to rise? How is industry integrating the risks inherent to land loss into the decision making or planning processes?

The research will also seek to acquire a more nuanced and industry specific understanding of the baseline impacts of coastal land loss on the oil and gas industry through literature reviews of relevant literature (e.g., company strategic plans), on informal discussions with facility operators, business owners and other relevant personnel on coastal land loss and hurricane surge preparations, and on other relevant materials (including relevant flood zone guidelines, Federal Emergency Management Agency (FEMA) flood program policy) covering the oil and gas and other industries and those reliant on the coastal system for current operations. The PI's will also coordinate with BOEM staff to identify past BOEM-related research, such as the Infrastructure Fact Book, to build upon existing efforts and avoid redundant efforts.

Field reports, bi-monthly progress reports, coordination meeting reports, survey instrument and results, databases and maps (coordinated with BOEM staff to use existing study maps if possible), annotated bibliographies, transcribed discussions, a final summary, and a final report will be submitted.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Chemical Products Used in Gulf of Mexico Oil & Gas Operations: Inventory, Disposal, and Risks

BOEM Information Need(s) to be Addressed: BOEM needs an up to date, descriptive inventory of all chemicals used in the offshore oil and gas industry in the GOM, including hydraulic fracturing chemicals, that includes volumes used and disposed of. Furthermore, BOEM needs this study to include assessing the risks of a spill of such chemicals and a comparison of the inputs of such chemicals from the offshore oil and gas industry to the inputs from other practices that use these chemicals in and around the GOM. BOEM needs this information to prepare NEPA documents that evaluate the waters and sediments of the GOM as well as the biota that live within the waters and the sediments of the GOM. A centralized, vetted, and citable study such as this will also aid greatly in responding to questions that have arisen during the biological consultation process and the renewal of the United States Environmental Protection Agency (USEPA) National Pollutant Discharge Elimination System (NPDES) permits (these are the required permits that regulate discharges from the oil and gas industry). Timely, reputable resources that address these needs are lacking. This study is also supported by BSEE's Environmental Enforcement Branch; representatives from that branch have expressed a need for this study for regulatory purposes.

Approximate Cost: (in thousands) $400 **Period of Performance:** FY 2015-2017

Description:

Background: This project is an update of the dated, but highly valuable MMS study by Boehm et al. (2001) with several significant additions. The additions include considering both shallow and deepwater chemicals for all portions of the study, being sure to include up to date information on hydraulic fracturing practices in the GOM, considering disposal volumes and methods (whether discharged to the GOM or returned to shore) for the described chemicals, and comparing inputs of these chemicals to the GOM from Federal OCS oil and gas sources to that of other sources that may impact the GOM such as the activities of other Federal agencies (including the military), natural events or processes, State oil and gas activity, and activities related to the direct or indirect use of land and waterways by the human population. The update on the use of hydraulic fracturing chemicals in the GOM will be of particular interest as the USEPA has inquired about these chemicals due to increased interest in fracturing practices on land and offshore California. Though the original study was labelled as a literature review, it had in practice, a broader scope as it involved important input from oil and gas operators, chemical suppliers, and a scientific review board which included a representative from the United States Coast Guard/National Oceanic and Atmospheric Administration in addition to industry representatives. The study also developed models for offshore exploration and production operations to estimate the volume of

chemical transported, stored, and expected to be used at any one time in the GOM and to assess the ecological risks of chemical spills.

Objectives: (1) Establish an updated baseline inventory of the chemical products, compounds, and mixtures in current use by operators in the GOM (including fracturing chemicals); (2) estimate the amount of such chemicals expected to be used in the future in the GOM (values should be broken out for shallow and deepwater); (3) locate and collect technical information on chemical volumes in typical GOM operations (values should be broken out for shallow and deepwater); (4) estimate the volume of each chemical disposed of and describe the common disposal method; (5) develop conceptual models using a range of chemical spill scenarios and predicted impacts as a result of these spills; (6) develop an inventory of types and amounts of hazardous substances stored, handled, transferred to and from, disposed of, and used on offshore oil and gas facilities in all water depths, and (7) compare volumes of chemicals released to the GOM by OCS oil and gas activities to other activities that input the same chemicals, or categories of chemicals, into the GOM directly or indirectly (e.g., runoff or river drainage).

Methods: The study methods will be similar to those used by Boehm et al. (2001) including the input from a team of experts, a thorough search the literature, and the use models or calculations as appropriate. For example, in the Boehm et al., (2001) study, models were used to estimate future use of chemicals, transport of chemicals as well as the ecological risks of chemical spills (i.e., CHEMAP). The voluntary team of experts should include oil and gas operators in the GOM as well as chemical suppliers that can provide input into these issues as well as possible representatives from BOEM, BSEE, USCG, NOAA, and/or the USEPA.

Revised Date: March 14, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Central

Title: Interdisciplinary Research at the Site of Three 19th Century Deepwater Shipwrecks: the Monterrey Shipwrecks

BOEM Information Need(s) to be Addressed: BOEM and BSEE are required under Section 110 of the National Historic Preservation Act to identify and protect historic properties and avoid unnecessary damage to them. Information obtained will assist BOEM and BSEE to comply with Standard 2 of the Secretary of Interior's Standards for Federal Agency Historic Preservation Programs, which directs federal agencies to provide for timely identification and evaluation of historic properties subject to effect by agency actions (Section 110(a)(2)(C)). In addition, BOEM scientists seek to understand how random, but regular anthropogenic inputs onto the deep seafloor are rendered bioavailable and subsequently colonized by benthic fauna in order to conduct environmental assessments required by NEPA. Very little research has been done in the GOM to investigate the role of historic shipwrecks in benthic community development, evolution, and senescence.

Approximate Cost: (in thousands) $300 **Period of Performance:** FY 2015-2016

Description:

Background: In March and April of 2012, BOEM and BSEE participated in a scheduled cruise of the research ship *Okeanos Explorer* that resulted in the discovery of the copper-sheathed remains of a wooden-hulled sailing ship with an artifact assemblage comprised of anchors, cannons, glass bottles, ceramics, navigation instruments, and flintlock muskets that has been initially dated between 1800 and 1840.

In July 2013, BOEM and BSEE participated in a privately-funded partnership that collected 60 diagnostic artifacts and three biological specimens for study and analysis, mapped the site to the centimeter level, and collected high-definition video for both archaeological and biological analyses. Wood samples were deployed for continuing site preservation analysis and sediment samples were acquired for geochemical and biological characterization. Two additional sonar targets reported by Shell were investigated nearby, resulting in the discovery of two additional shipwrecks. The three shipwrecks, all apparently sunk during the same time in the 19th century, have been designated Monterrey A, B, and C after the Shell Oil prospect in which they were discovered.

Objectives: The primary objective of the study is to thoroughly document the present condition of the visible remains of Monterrey B and C before any BOEM-permitted oil and gas activity occurs in the area and to determine their historical significance and relationship to the Monterrey shipwrecks assemblage. A second major objective of the study would be to involve and engage the public in the importance and excitement of scientific discovery, and to communicate BOEM and BSEE's role in historic

preservation, environmental protection and the stewardship of offshore resources through extensive web broadcasts and social media. A third objective is to complete the investigation of Monterrey A and recover larger diagnostic artifacts such as a cannon or the ship's stove that could not be recovered in 2013.

The biological objectives of this study build upon and are informed by the results of the 2012 investigation and will seek to: determine local controls on growth and replacement rates of vestimentiferan tubeworms on the shipwrecks; determine the relationships of the vestimentiferan tubeworms on the shipwrecks with other described populations in the Gulf of Mexico; identify and analyze the effects and potential effects of past and current site formation processes on these shipwrecks associated with vestimentiferan tubeworm activity; determine the spatial and temporal pattern of octocoral recruitment to Monterrey A; and quantify the influence of shipwrecks on benthic infaunal community structure and function ("artificial reef effect").

Methods: To accomplish the archaeological objectives, the investigation will seek: A) to obtain an accurate photogrammetric map of Monterrey B and C, placing the artifacts in their spatial context and accurately mapping the visible remains of the hull as was accomplished with Monterrey A in 2013; B) to recover a limited number of temporally diagnostic artifacts for detailed analysis; C) to recover a limited number of artifacts that will assist in placing the vessel in its cultural and historical context; and D) to analyze the collected and visually documented assemblage of artifacts to understand the role of the vessels in the global economy and international relations. Techniques successfully applied to the study of Monterrey A will be replicated during this investigation.

Biological objectives will be accomplished by: A) collecting samples of vestimentiferan tubeworms as deemed appropriate from different locations within each vessel; B) collecting samples of bacterial matting on each shipwreck; C) collecting replicate sediment push cores at specific locations in proximity to the vessel (building upon and expanding the analyses conducted at Monterrey A in 2012); D) laboratory identification of tubeworm specimens and tube remains including the creation of a genetics-based taxonomy; E) laboratory identification of bacterial matting; F) collecting 3-5 whole colonies of octocorals from Monterrey A; and conducting Radio-isotope age analysis of each octocoral sample.

Funding is requested to support *Okeanos Explorer*'s external day rate for a one to two-week period and to support the biological analyses through partner federal agencies (NOAA and USGS). NOAA will support the project by providing the balance of the funding for the research vessel, ROV, telepresence equipment, and support crew. The Meadows Center at TSU will provide funding for the conservation of artifacts recovered through the study. A long term curation agreement is already in place for the artifacts from Monterrey A, which will be amended to include artifacts from the two additional sites.

Revised Date: March 10, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Western and Central

Title: Fugitive Emissions Update - Component Count and Amounts

BOEM Information Need(s) to be Addressed: Fugitive emissions are the second largest platform emitter of volatile organic compounds (VOCs) and methane (CH4) behind only cold vents. Several state coastal areas have been designated non-attainment for ozone. Since ozone is formed by the combination of VOCs and nitrogen oxides (NOx), the OCS emissions inventory for VOCs needs to be as accurate as possible. In addition, GAO-11-34 is looking to reduce CH4 emissions by installation of control technology on platforms. Before control technology is required (with a significant cost to industry), the OCS emissions inventory for CH4 also needs to be as accurate as possible. This study will update the way fugitive emissions are calculated in the OCS emissions inventories to assure GAO and BOEM have the best and most accurate emissions to use for economic and environmental analysis.

Approximate Cost: (in thousands) $400 **Period of Performance:** FY 2015-2017

Description:

Background: The U.S. Environmental Protection Agency (USEPA) sets National Ambient Air Quality Standards (NAAQS) for criteria pollutants, including ozone. States must submit State Implementation Plans (SIPs) detailing how they will reduce pollution to meet the standards by a date that USEPA will establish in a separate rule. States will need to perform air quality photochemical modeling for use in their SIPs. In order to conduct this modeling, emission inventories must be generated as inputs to the models. The collection and compilation of an air emissions inventory is one of the tasks that BOEM conducts to assure coordination of air pollution control regulations between OCS offshore sources and state's sources onshore (as per Section 328(b) of the 1990 Clean Air Act).

Fugitive emissions are leaks from sealed surfaces associated with process equipment. Fugitive emissions are VOCs and methane (CH4). Specific fugitive source types include equipment components such as valves, flanges, and connectors. Fugitive emissions in past OCS emissions inventories were calculated by using component counts, stream type (gas, heavy oil, light oil, or water/oil), and average VOC weight percent of fugitives. If a component count is not provided by the operator during the OCS emissions inventory collection, a surrogate component count is used based on a study from API dated 1993. This study counted components on smaller, shallow water platforms. With the increase in larger, deepwater platforms, the default component count needs to be updated. Also, the THC emissions factors for oil and gas production operations for specific component type were last studied by API in 1996. These emissions factors need to be updated. Lastly, average VOC weight percent by stream type need to be updated. This fugitive

emissions calculation is detailed in the BOEMRE study (2010-045). This project is an update of the calculation of fugitive emissions in the OCS emissions inventories.

The importance of this study is twofold. One, an infrared camera was obtained by BSEE and has been used on platform inspections. The results of this camera show the platforms have little to no leaks, meaning the OCS emissions inventories could possibly be overestimating VOC and CH4 emissions. Second, GAO is looking at reducing methane emissions possibly by requiring controls on industry (GAO-11-34). Fugitive emissions are the second largest source of methane emissions only behind cold vents according to the OCS emissions inventories. However, if the OCS emissions inventories are overestimating VOC and methane emissions, then possibly control technologies would not be required.

Objectives: To update the calculation of fugitive emissions in the OCS emissions inventories by updating the default component count to include larger, deepwater platforms, to update the emissions factors, and to update the default speciation weight fractions for THC emissions by stream type. All this methodology is detailed in the BOEMRE study (2010-045) "Year 2008 Gulfwide Emission Inventory Study".

Methods: The Contractor would have to visit multiple shallow and deepwater platforms to count component types and bag fugitive emissions from leaks. The Contractor would have to study the bag emissions in a laboratory to assess emissions factors.

Revised Date: January 8, 2014

Environmental Studies Program: Studies Development Plan FY 2015–2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Forecasted Ecosystem Conditions in Gulf of Mexico OCS Habitats Using Coupled Modeling and Climate Scenarios

BOEM Information Need(s) to be Addressed: BOEM requires information on both current and future spatio-temporal variability in ecosystem productivity and related higher-trophic habitat to address the potential impacts of the offshore oil and gas industry in the GOM. This predictive need is identified in the OCSLA for understanding the cumulative impacts of multiple stressors on OCS ecosystems. Habitats of special interest to BOEM are the Flower Garden Banks and the marine mammal habitat in Mississippi and DeSoto Canyons. This study will inform NEPA analyses and Gulf long-term monitoring studies related to current and future variability in habitat and prey and will help fulfill the intent of the recent Executive Order on November 1st, 2013: "Preparing the United States for the Impacts of Climate Change".

Approximate Cost: (in thousands) $350 **Period of Performance:** FY 2015-2018

Description:

Background: Coupled biological-physical ocean modeling provides a powerful tool for forecasting of ecosystem conditions on both regional and global scales, augmenting more limited observational data. These types of coupled models are now 4-dimensional in space and time and are inherently interdisciplinary, incorporating aspects of physical forcing (e.g., ocean currents, winds, and solar radiation), chemical concentrations (e.g., carbon, nitrogen, and phosphorus), and biological components (e.g., bacteria, phytoplankton, and zooplankton). Coupled ocean modeling can help answer a variety of questions about the functioning of the marine ecosystem and habitat variability, including providing estimates of organic matter fluxes (e.g., primary and secondary productivity) at highly resolved spatial and temporal scales. In particular, the new generation of climate-based, ocean ecosystem models allow for forecasts of ocean habitat under a variety of greenhouse gas emission scenarios, providing a forecasting tool of future ecosystem conditions.

Only recently has the state-of-the-art in Gulf ecosystem modeling evolved from smaller regional scales to larger Gulf-wide domains (DeRada et al., 2009; Xue et al., 2013). It is these Gulf-wide models that are required to address BOEM-permitted activities, with relevance to the large footprint of the oil and gas industry and its potential impacts on key-prey and/or far-ranging biological species of interest, including plankton, cetaceans, and seabirds. Key processes in the Gulf which impact distributions of these species can be captured by coupled models, including areas of upwelling, convergence, eddy activity, and riverine inputs. Model output can help fill gaps in our understanding of the climatology and future conditions of these and other Gulf oceanographic conditions and how they impact Gulf habitat.

Objectives: The overarching goal of this 4-year study is to simulate through model hindcasts and forecasts how ecosystem conditions vary at detailed spatio-temporal scales in the GOM. The specific objectives to be addressed include:

- Determining statistical variability *to-date* in Gulf-wide productivity and higher-trophic habitat.
- Forecasting ecosystem conditions in BOEM planning areas through 2050-2100, and identifying relative sensitivities between planning areas to future climate-based change.
- Providing higher-resolution information on past and future habitat variability in select smaller regions of special interest to BOEM.

Methods: This study will be performed through an Inter-Agency Agreement (IAA) with the Naval Research Laboratory (NRL), leveraging initial funding provided by the National Aeronautics and Space Administration (NASA) and other agencies. The objectives of this study will be met through validation and implementation of NRL's coupled bio-physical model which covers the entire GOM. The model incorporates a well-vetted, data-assimilating ocean circulation model for the Gulf, biological components, including phytoplankton and zooplankton grazers, as well as linkages with nutrients, dissolved gases, and detrital pools. The coupled model will be validated using historical Gulf datasets of physical, chemical, and biological observations; there is no new field component to this study. Sensitivity analyses will be run on the validated model to determine how sources of uncertainty can be apportioned to different model inputs. The validated model will be run in both hindcast and forecast mode over a multi-year time frame to explore seasonal and interannual variability in ecosystem dynamics (e.g., nutrient fluxes, patterns of productivity, and organic matter sedimentation). Climate scenarios from the Intergovernmental Panel on Climate Change (IPCC) will be utilized in model forecast mode to project potential impacts on Gulf habitat. Spatial and temporal variability in modeled habitat will be analyzed for BOEM planning areas in the Gulf, and at higher-resolution (using model nests) for habitat of especial interest, including Flower Garden Banks and continental-slope regions that provide cetacean and pelagic seabird habitat, such as in De Soto Canyon, the Mississippi Canyon/Delta region, and/or along the Rio Grande slope. The impacts of areas of upwelling, convergence, eddy activity, and river plume dynamics on biological productivity will be analyzed, including the role of episodic and climatic events, such as storm activity and variable Mississippi River discharge.

Revised Date: March 27, 2013

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Western and Central

Title: Socioeconomic Impacts of OCS Infrastructure: Shifts in Recreational Behaviors

BOEM Information Need(s) to be Addressed: Offshore recreational activities, such as fishing and diving, contribute significantly to the social and economic frameworks of many communities along the Gulf Coast. However, the existing literature does not adequately describe the extent to which certain recreational activities are dependent on OCS infrastructure. In addition, technological advances, social changes, regulatory changes, and economic events have likely changed patterns of recreational behavior. This study would describe and quantify the recreational uses of OCS infrastructure. The information obtained from this study would be used in various pre-lease and post-lease NEPA documents.

Approximate Cost: (in thousands) $500 **Period of Performance:** FY 2015-2018

Description:
Background: Offshore recreational activities, such as fishing and diving, contribute significantly to the social and economic frameworks of many communities along the Gulf Coast. In 2011, recreational fishing alone contributed an estimated $4.4 billion in sales and $2.2 billion in value-added benefit to the combined economies of Texas, Louisiana, Mississippi and Alabama (USDOC, NMFS, 2012). This activity supported an estimated 42,272 jobs. However, the data provided by the NMFS does not describe how much of this economic activity is dependent on OCS infrastructure.

Hiett and Milon (2002) provided some information regarding the overall scale of fishing and diving near oil and gas platforms; it also estimated the economic impacts arising from expenditures by these fishermen and divers. However, that study was based on 1999 data and is therefore becoming less applicable as the recreational landscape changes. In addition, that study did not examine certain subcategories of these activities, such as the scale of recreational fishing and diving that occurred in state versus federal waters. Hiett and Milon (2002) also did not examine site-specific determinants of recreational uses of OCS infrastructure. In addition, there are no readily available estimates of the socioeconomic contributions generated by other recreational activities (such as offshore birding and invasive species management) occurring near OCS infrastructure.

Since the Hiett and Milon (2002) study, there have been technological advances, social changes, regulatory changes, and economic events with the potential to significantly alter recreational behavior along the Gulf Coast. For example, improved offshore communications (e.g., satellite and cellular), increased safety (e.g., Emergency Position-Indicating Radio Beacons (EPIRB), weather satellite services), and simplified navigational aids (e.g., GPS) have allowed the OCS to become increasingly accessible to

recreators. Technological advances support increased travel distances, trip durations, and activity intensity (site saturation, multiple activity use, and precise site targeting). Improved safety promotes participation in offshore recreational activities by a broader range of individuals. Public awareness of the oceans, environmental impacts, and climate change have resulted in increased ecotourism and other low-impact recreational activities. Furthermore, the nation recently experienced a long, deep recession and is now in recovery. How these factors have acted individually or in combination to impact recreational activity in the GOM and the coastal communities and businesses reliant upon recreational spending is not known. It is also unknown to what extent OCS oil and gas activities affect recreational activities and whether potential impacts are beneficial or detrimental.

Recreational activities have been associated with nearshore infrastructure for decades. However, as unsafe, obsolete and non-productive OCS structures are removed and fewer nearshore structures are installed, individuals and communities have to adapt to a changed recreational landscape. In particular, the number of oil and gas production facilities in the Gulf of Mexico federal OCS area fell from a peak of 4,049 at the end of 2001 to 2,634 at the end of 2013 (BSEE, 2014). Some recreational users have had long-term interactions with nearshore structures and may equate structure removals to losses of recreational resources. In this case, users of nearshore OCS waters may be undergoing a shift in recreational behavior, resulting in increased preference for recreational activities farther offshore, different nearshore locations, or curtailment of activities. This changing recreational behavior may cause a redistribution of economic benefits or reduced recreational spending. The addition of artificial substrate to areas suitable for fish habitat and conducive to recreational fishing and diving may encourage participants to continue pursuing activities locally. Fishermen and divers accustomed to the presence of OCS infrastructure might also benefit from outreach programs regarding the distributions of habitat and fishes in the Gulf, and recreational techniques suitable to the changed landscape. The findings from this study will help BOEM, recreators, businesses and communities to adapt to this changed landscape.

Objectives:

4. Assess recreational demand for OCS infrastructure.
5. Assess recreational demand for Rigs-to-Reefs associated artificial reef sites.
6. Identify key factors for structures particularly suitable for recreational activities.
7. Quantify the social and economic impacts of OCS infrastructure.
8. Identify and evaluate behavioral shifts (and anticipated shifts) resulting from removal of obsolete OCS infrastructure.

Methods: A methodology that entails conducting field interviews, telephone interviews, and written surveys will be developed to address the objectives of this project. The methodology will assess the overall scale of fishing, diving, and other recreational activities that depend on OCS structures. This will entail clarifying the scale of recreational use in certain areas, as well as clarifying the percentage of activities that

occur near OCS structures. This methodology will also obtain information on site-specific determinants of recreational use, as well as information on the substitutability of recreational sites. This methodology will employ both stated and revealed preference techniques in order to identify recreational preferences and likely substitution patterns. This study will obtain information from recreators and firms that provide recreational services. To the extent that appropriate methodologies exist, as well as the extent to which budget considerations allow, this project will also entail a statistical analysis of the interview and survey data in order to quantify the economic impacts of recreational uses of OCS structures.

Revised Date: March 26, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Central

Title: National Register Evaluations of Deepwater Archaeological Sites in the Gulf of Mexico

BOEM Information Need(s) to be Addressed: BOEM has a responsibility under Sections 106 and 110 of the National Historic Preservation Act (NHPA) to identify and assess potential cultural or historic resources that may be impacted by agency permitted activities. This responsibility includes assessing the eligibility of these resources for listing in the National Register of Historic Places (NRHP) and to nominate those resources that are determined eligible.

Approximate Cost: (in thousands) $75 **Period of Performance:** FY 2015-2017

Description:
Background: In March and April 2012, BOEM helped coordinate several shipwreck investigations conducted by NOAA aboard its flagship research vessel *Okeanos Explorer*, as part of a larger scientific expedition to research deepwater benthic habitat in the GOM. Using *Okeanos Explorer*'s live tele-presence capability, shore-based archaeologists from BOEM, BSEE, NOAA and other agencies and private contractors collaboratively directed Remotely Operated Vehicle (ROV) investigations of these wrecks.

At NOAA's request BOEM selected five known or suspected deepwater shipwreck sites within *Okeanos Explorer*'s general project area. These sites are designated within the BOEM/BSEE Archaeological Resource Database as follows: Vessel ID (VID) 359, 407, 15429, 15577 and 15584. Each of these selected sites are within areas actively leased for oil and gas production and were initially located during industry-conducted remote-sensing hazard and archaeological lease block surveys. Sites 359 and 407 had previously been the subject of brief ROV or Autonomous Underwater Vehicle (AUV) investigations in 2002 and 2009, respectively. These previous investigations provided limited archaeological information beyond visually confirming that they were wooden-hulled shipwrecks likely dating to the late-nineteenth or early-twentieth century. Prior to the 2012 *Okeanos Explorer* investigations, sites 15429, 15577 and 15584 had not received any additional investigation beyond their initial discovery. These sites were known only to be sonar targets that exhibited characteristics indicative of shipwrecks.

Over 20 hours of ROV video were collected at the five sites. Site 15577 was discovered to be an early to mid-nineteenth century, copper-sheathed sailing vessel with an abundant artifact assemblage. This wreck, termed the Monterrey Wreck, is the subject of separate, on-going research and will not be included in this study. Site 15429 was determined to be a highly intact, late nineteenth or early twentieth century iron-hulled vessel of unknown identity. Additional ROV video of previously investigated sites 359 and 407 confirmed their potential NRHP eligibility, as well as provided documentation of their

hull construction characteristics, artifact assemblage, and overall site condition. Site 15584 consists only of rigging elements from a probable eighteenth century sailing vessel and appears to be evidence of a de-masting event. Excluding site 15577, none of the remaining four sites has been subjected to additional investigations, or further analysis of the video data collected by *Okeanos Explorer*.

Objectives: The primary objective of this study is to prepare a thorough analysis and report of the three unidentified shipwrecks (sites 359, 407 and 15429) and the possible de-masting site (15584), which will fulfill BOEM's NHPA obligations by assessing the historical significance of these vessels. This report will attempt to identify each vessel's type, age, nationality, and function, as well as place each site within its appropriate historical context relative to the maritime history of the GOM. National Register nomination forms will also be prepared for any/all of the sites determined to be potentially eligible based on this analysis.

Methods: The existing *Okeanos Explorer* ROV video will be the primary source of information for this study. Additional archival research may also be necessary for comparative analysis, historical research, and to identify potential candidates for each wreck's identity. It is intended that this study would be performed as a contract with an archaeological consulting company, or potentially as a co-op with a Gulf-based university.

Revised Date: March 25, 2014

Environmental Studies Program: Studies Development Plan FY 2015–2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: An Assessment of OCS-Related Onshore Transportation Industries and Operations in the Gulf of Mexico Region

BOEM Information Need(s) to be Addressed: BOEM needs information on the onshore component of the transportation system to improve estimates of employment and economic impacts at planning area, state and regional (i.e., county/community) levels for environmental impact statements and assessments (EIS's and EA's). Coastal Zone Management consistence determinations, and other environmental documents; operations information will be used to support regional-level socioeconomic impact analysis (including Executive Order 12898 on environmental justice); locational and network information will be available for incorporation into a GIS-based assessment and monitoring system.

Approximate Cost: (in thousands) $350 **Period of Performance:** FY 2015-2016

Description:
Background: In the GOMR, many types of enterprises support offshore petroleum activities on the OCS and, over the last decade, the ESP has evaluated a number of industry types in terms of size, distribution, organizational structure and dynamics, links to offshore petroleum, operations, labor and environmental demands, legal regimes, and economic and growth trends. The ESP conducts this research because, for any type of industry, offshore and onshore activities differ markedly and these differences cannot be deduced from the available information (e.g., BEA economic surveys do not distinguish between offshore and onshore drilling although these have very different economic inputs). These enterprises, their operations, and the characteristics of both are primary sources of OCS-related socioeconomic impacts at the regional level and, hence, because differences in the distribution of these enterprises and operations are a source of the differences in socioeconomic impacts across regions and communities. Thus, BOEM uses the industry information to estimate sale- and program-level economic and demographic impacts, to assess infrastructure effects, and to address such questions as possible consequences to other activities (e.g., fishing or tourism) or to environmental justice.

The transportation support system is a primary difference between the offshore and the onshore petroleum industries. Much more needs to be transported for overwater work, doing so is much more demanding, and, for the Gulf OCS—with its thousands of active platforms and ever-present development, production, maintenance, and removal activities—the effort is massive. This transportation system is intermodal: (1) men and material arrive at coastal ports by road, railroad, or waterway where (2) they are transferred to a second mode of transportation and (3) then taken to their offshore destination by supply vessel and helicopter. While the second two are striking parts of OCS operations and have been the focus of ESP research, the onshore element is equally

important to an understanding of the system and its socioeconomic impacts. Like the two other elements, this one is composed of specific infrastructures, industries, operations, etc. and it also moves the same men and materials. However, it often moves them at greater distances than does the offshore leg, and in closer association with human populations.

Data limitations make difficult the delineation of the OCS-related transportation network and traffic flows. BOEM has conducted multiple studies to record, estimate, and/or map vessel and helicopter traffic to and from shore but has not addressed these questions landside. The extensive onshore transportation networks (e.g., roads, railroads and waterways) and traffic flows are well documented (e.g., Louisiana had 60,900 miles of highway in 2000 and trucks traveled 6,712 million miles) but the OCS-related portion of traffic has not been identified or mapped, nor has it or the quantity of its deliveries been recorded or estimated. Port Fourchon's dependence on highway LA 1 as its only means of ingress and egress suggests that onshore traffic raises socioeconomic assessment issues beyond those of infrastructure use and material flows. For example, there may be choke points in the transportation system associated with ports; there may be traffic disruptions and dangers associated with residential areas. Such concerns may become more pressing if deepwater development continues to concentrate support-related activities into fewer and fewer ports.

As with the two other elements of this intermodal system, the firms involved in onshore transportation—such characteristics as their size, distribution, organizational structure, growth trends, labor demands and working conditions, legal regimes, links to offshore, and relationships to coastal communities—are important sources of the positive and negative socioeconomic consequences of OCS-related activities. For example, one benefit of the OCS program is employment, but local jobs are of greater benefit to coastal communities, and higher paid and stable jobs are of more benefit still. The supply vessel industry supports a Gulf shipbuilding industry; barge companies may do likewise while the trucking industry does not have similar links. In this intermodal system, road, rail and waterway transport exhibits both general and specialized linkages to OCS-related demands. For example, just-in-time delivery of offshore equipment and supplies has been a specialty for small, local trucking firms, and the organization and working conditions of this sector of the industry significantly changed in the face of late 1900s deregulation.

Objectives: The transportation system supporting OCS activity is intermodal. The overall intent of this study is to improve our understanding system by:

1. Identifying major onshore transportation routes for offshore support and any significant limitations, choke points, and areas of likely conflict;
2. Assessing the OCS-related commercial (e.g., truck as opposed to automobile) use for Gulf States and for key transportation routes and intermodal transfer points; and,
3. Characterizing the nature and diversity of industries/firms that comprise this segment of the OCS-related transportation system.

Methods: The study will be based on literature review and analysis of available data (e.g., such as the satellite-based truck tracking data from the Department of Transportation and on discussions with participants and experts in fields related to transportation. This study will identify and map the major on-shore transportation routes used for offshore support including highways and key road connections, railroad trunk lines and key service spurs, and canals and other waterways. For each type of infrastructure, it will identify the various choke points (places where the transportation system is limited and/or the demands on it are high) where offshore has caused problems (e.g., LA 1) or where it may do so in the future due to OCS-related activities (e.g., if a service port were to significantly expand). For each type of industry, it will describe the range of products delivered. When appropriate, When appropriate, provide measures and/or estimates current use (traffic) that is due to OCS activity and its share of overall (cumulative) use for state/regional areas (e.g., highway demand in Louisiana) and for key transportation routes in the OCS intermodal system. When appropriate, develop techniques for estimating amount of OCS-related material moved to key transfer points Describe the types of industries/firms (e.g., trucking industry) that comprise this segment of the OCS-related transportation system in terms of size, distribution, organizational structure, technologies, operations, labor needs and working conditions, legal regimes, links to offshore petroleum, and economic and growth trends.

Revised Date: March 25, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Gulf of Mexico Land Loss Change Assessment and Application to Louisiana Coastal Habitat Loss

BOEM Information Need(s) to be Addressed: BOEM needs up to date information on resources that may be impacted by OCS activity to prepare NEPA documents such as Lease Sale Environmental Impact Statements. Among those resources are wetlands and coastal barrier beaches. To accurately describe the affected environment, and to assess cumulative impacts to wetlands and beaches, knowledge of rates of land loss over time is essential. This study would help to provide this much needed information.

Approximate Cost: (in thousands) $378 **Period of Performance**: FY 2015-2017

Description:

Background: Eighty-five percent of the coastal wetland loss in the contiguous United States occurs in the GOM (CCAP, 2006). Documenting and understanding the occurrence of this wetland loss will provide for effective planning, mitigation, and restoration activities. This research will conduct comprehensive land-water extent change analysis throughout the coastal zone of the GOM. This analysis will expand upon a recent analysis which assessed land loss change in coastal Louisiana detailed in USGS SIM 3164 (http://pubs.usgs.gov/sim/3164/). Wetland areas are highly dynamic, and variability in remotely-sensed land area estimates can often be attributed to temporary wind and water level fluctuations present at the date and time of acquisition of the imagery. As such, an analysis of land loss change cannot simply be based on changes between a pre- and post- set of imagery. Conversely, this research proposes to analyze land loss change from every cloud-free date of imagery throughout the entire Landsat period of record (1984-2014). This multi-temporal analysis enables the removal of transient phenomena such as temporary flooding and thereby facilitates the isolation of specific events. This effort will, for the first time ever, provide a high temporal resolution analysis of land loss change rates throughout the GOM, a type of investigation that has only been conducted in coastal Louisiana thus far.

With nearly 400 miles of coastline, barrier islands, bays and estuaries, and coastal wetlands coastal resources are important and valuable natural resource to the State of Louisiana. These resources provide habitat to an immense number of species of plants and animals. While land conversion to open water has been studied as parts of USGS SIM 3164 mentioned below, and may be further studied as part of Subtask 2 of this effort, habitat changes in coastal Louisiana are not as well understood. The impacts of habitat changes have far reaching impacts on the flora and fauna of the region as well as economic impacts associated with habitat loss. To accurately describe these resources and the cumulative impacts to the coastal landscape over recent decades, Subject Matter

Experts need relevant data on past and current habitat change rates, not just land loss rates.

Objectives: The objective of this study is two-fold: (1) to evaluate recent (1984-2014) land loss change in the GOM coastal zone, and (2) to evaluate habitat change in the Louisiana coastal zone from 2007-2014. Land/water data from Task 1 of this effort will be used as the base upon which to create habitat maps. Imagery will be used that closely matches the corresponding coastwide vegetation surveys of 2007 and 2013 (funded under the Coastwide Reference Monitoring System program) to create habitat maps that reflect the land loss. These datasets will then be used in the habitat change analysis. This effort in coastal Louisiana will serve as a pilot, with the potential to expand this subtask into other states of the GOM in future efforts. The habitat change and maps associated with this study will help to update NEPA documents by improving the descriptions of significant resources and cumulative impacts to these resources.

Methods: Cloud-free Landsat Thematic Mapper imagery will be collected for GOM coastal zone for the 1984-2014 time period. Imagery will be collected for 26 path/rows intersecting the coastal zone of the GOM. The majority of the data collection for the 7 path/rows which intersect coastal Louisiana has already been conducted and this effort will leverage projects already underway and funded in coastal Louisiana. Data will be collected and processed for the 19 remaining path rows. Processing will begin with the calculation of a modified normalized water index and other indices leveraging the near-infrared spectrum. These datasets will be used to classify land/water. Upon completion and Quality Assurance/Quality Control of all land/water classified datasets, change analysis and land loss change rate analysis will be conducted. Spatial datasets detailing land loss change, as well as rates of change by state and hydrologic basin will be provided. The findings of this analysis will be detailed in a final report to be provided to BOEM, and published in a scientific journal or a USGS publication.

Revised Date: March 17, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Deepwater Coral and Chemosynthetic Atlas and Modeling Program: Gulf of Mexico

BOEM Information Need(s) to be Addressed: BOEM needs to characterize the known distribution of deepwater corals and chemosynthetic communities and predict their occurrence in the GOM. This achievement will support the ability to protect these sensitive benthic habitats from potential impacts of oil and gas exploration and development and promote accurate environmental descriptions in National Environmental Policy Act documents.

Approximate Cost: (in thousands) $500 **Period of Performance:** FY 2015-2018

Description:
Background: In 1984, the first dense chemosynthetic communities were discovered in the Northern GOM as part of an ongoing study funded by BOEM. Recognized as unique and sensitive biological communities, BOEM has protected these communities since their discovery and has sponsored numerous research initiatives to identify and characterize these habitats. Coral communities have also been found in the deep waters of the GOM, frequently in association with chemosynthetic communities. Hard bottom areas in the deep Gulf are, in virtually all cases, created through biogenic precipitation of carbonate by chemosynthetic bacteria. Carbonate deposits can subsequently become exposed above surrounding sediments providing substantial substrate for attached animal communities to develop at these chemo sites. Coral communities have also been found on shipwrecks in the deep GOM. Remarkable discoveries were made on some World War II wrecks. *Gulfpenn*, sunk in 1942, lies at a depth of 1,820 ft and supports numerous large colonies of *Lophelia* coral. Some offshore oil and gas structures also serve as substrate for deepwater *Lophelia* coral.

A significant amount of information for chemo and coral communities in the GOM exists in a variety of formats and in scattered repositories, many of which are not readily available for use in assessments because they have not been reviewed and digitized in a common format. While the BOEM has conducted major studies, so have numerous other entities including academic and other Federal institutions. A more accurate and useful understanding of the available information could be produced if the information were reviewed, collated, analyzed, and organized for consistency and ease of access.

A major benefit of collating data of GOM chemo and coral communities would be the ability to produce better models for predicting their occurrence. Many locations with significant areas of hard bottom in the deep GOM are correlated with faulting associated with the movement of salt diapirs and the migration of hydrocarbons to the seabed. These areas are well represented in 3D seismic surface amplitude anomaly data. Recent BOEM analysis of industry 3D seismic seabed amplitude anomaly data has revealed over

20,000 separate features that likely represent carbonate hard bottom (BOEM, 2014). By combining these newly available 3D seismic data and other environmental predictors derived from hydrodynamic models, oceanographic databases, and multibeam bathymetry with a comprehensive deepwater coral and chemosynthetic community data atlas, a new generation of predictive maps will be developed that synthesize all of the best available information on the likelihood of deepwater coral and chemo communities throughout the Gulf OCS. Deepwater coral habitats are internationally recognized for their value as unique fish habitat, high biodiversity, and as sources for discoveries of compounds with biotechnology potential. The new database, predictive models, and resulting maps will help avoid potential impacts to these vulnerable habitats.

Objectives: The objective of this project is to (1) locate, review, collate and organize geo-referenced ecological information for deepwater chemosynthetic and coral communities in the northern GOM into a geodatabase and (2) use this geodatabase in combination with environmental predictors to model habitat suitability, occurrence probability and/or relative abundance of deep water coral and chemo communities and important component species.

Methods: This project will be conducted as a collaboration among research groups who have performed deepwater habitat research in the GOM. An interagency agreement will be created with the NOAA National Centers for Coastal Ocean Science (NCCOS). The NCCOS is building the database for NOAA's National Inventory of Deep Coral Distribution (NCCOS, 2014), and as such, will be collating information from numerous sources for GOM deepwater communities for this effort. NCCOS also has expertise in predictive modeling of deepwater corals, having produced models based on historical presence-only data for the GOM and Atlantic OCS in the past, and applied these models to research, exploration, conservation and management. NOAA/NCCOS will handle the bulk of the work, coordinating with BOEM, USGS, several other NOAA offices and numerous research institutions.

Data will be extracted from a variety of formats. These include sources such as video from manned submersibles and ROV, sonar and imagery from AUV, 3D seismic data, cruise reports, maps, museum records, and even old deepwater trawl data. The data targeted will be information that provides the locations and other ecological information for any structure-forming habitats in the deep GOM. This will specifically include all types of deep coral habitats, chemosynthetic communities, sponge communities, and relevant deep artificial reef information. The information will be processed for the objectives of the project and to maximize usefulness for environmental assessment. It will be quality-controlled and formatted into a usable database system. Data will be analyzed and predictive models and maps will be developed that synthesize all available spatial information on the distribution of sensitive GOM deepwater benthic communities.

Revised Date: March 17, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Evaluation of the Potential for Fresh Groundwater Reserves on the Gulf of Mexico OCS

BOEM Information Need(s) to be Addressed: According to a new study, continental shelves around the world are holding an estimated half a million cubic kilometers of either fresh or low-salinity water. Brackish water is increasingly seen as a resource for water supply because the costs of desalination are decreasing (Post et. al., 2013). These non-renewable reserves will become more valuable as terrestrial aquifers dry up, experience salt water intrusion, or become impacted by surface contaminants. If fresh groundwater reserves exist in offshore OCS lands, this would represent a natural resource that would need protection and management by BOEM. As existing terrestrial reserves of fresh water decline, and public awareness of offshore fresh groundwater reserves increases, it will be important for BOEM to have an inventory of this potential resource. If these offshore reserves do not exist, then BOEM will have justification for not considering potential impacts to this resource. Since the evaluation is closely linked to known hydrogeology onshore, it would be advantageous to conduct this study jointly with the USGS.

Approximate Cost: (in thousands) $150 **Period of Performance:** FY 2015-2017

Description:

Background: Water-bearing aquifers underlying the Coastal Plains of the eastern and southern United States are composed of semi-consolidated sand layers that dip seaward and may extend to the continental shelf edge (USGS, 2014a). Shelf areas that were exposed during sea-level low-stands in periods of glaciation were covered by freshwater lakes and river systems, were subject to infiltration of atmospheric precipitation and, in higher latitudes, glacial melt water. This led to sequestration of fresh groundwater on the outer shelf. Examples are given where fresh or brackish groundwater occurs in offshore aquifers up to 100 km from the coast, when sufficient piezometric head exists to flush the aquifer, and a competent confining layer exists to protect the aquifer from salt water intrusion (Post et. al., 2013).

The coastal lowlands aquifer system consists of a seaward-thickening wedge of discontinuous beds of sand, silt, and clay. The aquifer system extends from the Rio Grande in Texas, across southern Louisiana into southern Mississippi. A small part of the system extends into southern Alabama and the western part of the Florida panhandle. Numerous water-yielding and confining zones within the coastal lowlands aquifer system have been identified and mapped locally. The coastal lowlands aquifer system is capable of yielding large quantities of water (up to 4,000 gallons per day from a single well, and cumulative up to 5 million gallons per day in New Orleans). Groundwater seepage has been reported from the aquifer to overlying major rivers, low-lying coastal marsh, and to the ocean seabed in shallow, nearshore areas (USGS, 2014a).

The Floridan aquifer, a thick (up to 3,000 feet) sequence of carbonate rocks, encompasses the entire state of Florida and is one of the most productive aquifers in the world. The aquifer system generally thickens seaward from a thin edge near its northern limit. The state-wide yield from the Floridan aquifer was estimated to be 3 billion gallons per day in 1980. Before large-scale groundwater withdrawal began, discharge from the Floridan aquifer to offshore springs was common on the Gulf side of the northern part of peninsular Florida (USGS, 2014b).

Because the continental shelves are presently covered by seawater, hydrogeology, a scientific discipline with an almost exclusive focus on fresh terrestrial groundwater resources, has conventionally paid little attention to them (Post et. al., 2013). Existing studies of these aquifers have not included comprehensive delineation or geologic descriptions to properly evaluate the potential for fresh groundwater reserves on the adjacent continental shelf.

Objectives: To compile existing information to conduct an initial evaluation of the potential for fresh groundwater reserves on the GOM OCS. The work should focus on whether or not fresh groundwater reserves exist in federal waters that constitute a natural resource that warrants protection by BOEM.

Methods: It is anticipated that the work will include performing a literature search of existing studies, a review of available boring logs, well yield, and offshore high resolution geophysical data, preparation of maps and cross-sections with piezometric head, an estimate of reserves, and recommendations for additional investigation in federal waters on the GOM OCS. All work will be documented in a report and peer reviewed publications, if applicable.

Revised Date: January 8, 2014

2.3 Profiles of Studies Proposed for the Fiscal Year 2016 NSL

Table 3. BOEM Gulf of Mexico Region Studies Proposed for the Fiscal Year 2016 NSL

SDP Page Number	Discipline	Study Title
155	AQ	Enhancing Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling
157	PO	Gulf Oxygen Deepwater Experiment (GODEX): An Interdisciplinary Field Survey of Rates and Processes Controlling Distributions
159	SE	Impacts to Wooden Shipwreck Remains from Exposure to Crude Oils, Chemical Dispersants, and Hydrocarbonoclastic Bacteria
163	PO	Mississippi Delta Mudslide Mapping, Hazard Susceptibility Assessment, and Monitoring Program
167	HE	Multidisciplinary Assessment of Deep-Water Coral Ecosystems: Tools to Detect Impacts of Sub-Lethal Stress
169	HE	Nearshore Reefs Along the South Texas Convergence Zone and Their Susceptibility to OCS Development
173	SE	NRHP Eligibility Criteria and Environmental Impact Analyses of Post-WWII Shipwrecks
175	MM	Passive Acoustic Monitoring (PAM) Program for the Northern Gulf of Mexico
177	HE	Quantifying Changes to Infaunal Communities Associated with Several Deep-Sea Coral Habitats in the Gulf of Mexico and Their Potential Recovery from the DWH Oil Spill
179	SE	The Demographic Consequences of the Gulf of Mexico Offshore Petroleum Industry
183	AQ	Upgrading Air Quality Modeling in the Gulf of Mexico: Integrating Local and Remote Emissions with Photochemical Models
Discipline Codes		
AQ = Air Quality	FE = Fates & Effects	HE = Habitat & Ecology
IM = Information Management	MM = Marine Mammals & Protected Species	
PO = Physical Oceanography	SE= Social & Economic Sciences	

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Enhancing Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling

BOEM Information Need(s) to be Addressed: Meteorological and wave measurements are needed to improve meteorological and air quality modeling and to derive dispersion parameters for use in air quality model and assessment. These field measurements will improve the accuracy of meteorological and air quality models and benefit air quality assessments to be used in environmental impact statements. The data will be used to improve meteorological air quality modeling, and to predict and assess the impact of the lower 8 hour ozone and the new one hour NO_2 and SO_2 standards, visibility, greenhouse gas (CO_2, H_2O, and CH_4), and haze in NEPA documents.

Approx. Cost: (in thousands) $1,500 **Period of Performance:** FY 2016-2018

Description:

Background: BOEM has an ongoing study of meteorological modeling using a real time advanced WRF model (Weather Research and Forecasting Model). Correct assessment of on-shore air quality requires the accurate meteorological modeling, and correctly charactering the land/sea breeze circulation is critical to the accurate assessment of potential on-shore air quality impacts from OCS sources. This study seeks to understand the physical processes in the atmospheric boundary layer and examine the model uncertainty and the seasonal weather circulation patterns, such as sea breeze circulation that will affect the estimate of air pollution concentration. Previous studies of wind-wave measurement are very limited in scope and the effects of oil platform and its operational activities on the data quality are not known. Simultaneous measurements of meteorological variables at the shallow water and deep water sites are not available. Currently, there are no meteorological observations of the atmospheric boundary layer in the GOM or data for the WRF model verification. High quality data will be collected due to the recent advance in developing better measurement systems and analysis tools. Therefore, there is a critical need to continue the collection of near surface micrometeorological and upper air data in the GOM.

Robust meteorological modeling requires near surface and upper air data analyses. Meteorological and wave measurements will be used to better characterize the atmospheric boundary and turbulence structures and air-sea interaction (flux parameterization) and to test theories (e.g., COARE algorithm, flux calculations) such that this information can be used to improve the application of meteorological and air quality models in the offshore environment and the coastal area. BOEM has conducted several meteorological studies in the GOM; however, due to recent advances in meteorological instruments and analysis capability, for example, a ground–breaking new capability for automated processing of eddy covariance raw data in real time is now

available; therefore, these wind-wave measurements need further updating for the WRF modeling and for offshore meteorological and air quality assessments.

Objectives: This study intends to collect meteorological and wave data. This information will be used to further improve meteorological and air quality modeling in the GOMR for NEPA applications. Specifically, this study intends to measure wind, virtual temperature, relative humidity and turbulence in the atmospheric boundary layer, especially to obtain turbulent fluxes in the atmospheric surface layer.

The objective of this study is to characterize the atmospheric boundary layer processes over the GOM, turbulence structures, and air-sea interaction for improving meteorological and air quality modeling over coastal transition zone, shallow water and deep water areas. The ocean waves and swell can also affect the atmospheric boundary layer and turbulence structures. Furthermore, this study is to focus on the data gaps between sea surface to 100 m above the sea surface and the transition zone between land and ocean.

Methods: Previous studies of wind and wave measurements are limited in scope in view of an ongoing study of WRF modeling. For example, it lacks the vertical resolutions (multi-levels) of wind and turbulence measurements near the surface in the surface boundary layer, no buoy has been deployed, and wind profilers are not simultaneously deployed at the shallow water and deep water sites. Observations at two sites are critically needed for model verification of the sea-breeze circulation.

There are still data gaps between sea surface and 100 m, the vertical multi-levels of wind and turbulence measurements are necessary, but still not available, since the ocean waves and swell can also affect the atmospheric boundary layer and turbulence structures. The information gathered from previous studies will help set up a more comprehensive field measurement system to collect more accurate wind and wave data. The proposed study will take advantage of existing boundary layer studies and provide updated data, science and information for improving the accuracy of meteorological and air quality modeling. Therefore, it is proposed to install a suite of meteorological measurement systems offshore to obtain information for atmospheric boundary layer study.

Conduct field observations and data collection. Plan and install a suite of new (or additional and better sensors) wind measurement systems using wind profilers, microwave radiometer, sonic anemometer, lidar, Li-COR (greenhouse gas (CO_2, H_2O, and CH_4)), and energy flux systems), buoys*, ADCP, and meteorological wind measurement sensors mounted on an offshore platform or a 100 m meteorological tower.

*Note: National Data Buoy Center had submitted a proposal to deploy a buoy in the Gulf of Mexico: A Statement of Work for MMS in April 29 2008. BOEM air dispersion (AERMOD and CALPUFF) modeling training for offshore was held on March 24-28, 2014, in the GOM. The deployment of a buoy was also recommended by the instructor. It takes time to deploy a buoy, and setup and conduct the field experiment.

Revised Date: March 28, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Gulf Oxygen Deepwater Experiment (GODEX): An Interdisciplinary Field Survey of Rates and Processes Controlling Distributions

BOEM Information Need(s) to be Addressed: BOEM requires information on the biological, chemical, and physical factors controlling deepwater oxygen dynamics to address the potential impacts of accidental oil and gas releases in the GOM. Given potential spill effects on dissolved oxygen (DO) concentrations, and thus deep ocean life, this study is in line with OCSLA which stipulates environmental studies be conducted to assess the marine environment which may be affected by industry and to identify any significant changes in environmental quality. The updated oxygen-related dataset to be collected by this study will expand time series information in the Gulf, thus informing data trend analyses and identification of possible cumulative effects, including from climate change. Information from this study will inform NEPA biological and water quality analyses, EFH consultations, and potential future spill response efforts.

Approx. Cost: (in thousands) $5,000 **Period of Performance:** FY 2016-2020

Description:

Background: Oxygen minimum zones (OMZs) in the deep ocean can significantly impact the surrounding environment and play an important role in structuring ocean life. In the GOM, the OMZ is generally found between 300-700 m, and is primarily derived from Tropical Atlantic Central Water inputs and the decay of organic matter. On average, concentrations in the Gulf OMZ do not typically drop below ~2.5-2.9 $mL \cdot L^{-1}$. However, there is the potential for localized reductions, as well as more major impacts during oil spill response using subsea dispersants. For example, during the DWH oil spill, DO depressions of 0.1-2.6$ml \cdot L^{-1}$ below background were observed in the subsurface plume (JAG, 2010). Additionally, long-term trends may occur in ocean DO concentrations under future climate change scenarios which predict oceanographic changes, such as in temperature, stratification, and productivity (Gruber, 2011).

This study is intended to fill significant data gaps previously identified in the 2005 MMS Study: "Understanding the Processes that Maintain the Oxygen Levels in the Deep Gulf of Mexico". This MMS Oxygen Study provided a benchmark report with critical information that was heavily referenced during the DWH Oil Spill. The study performed a synthesis and reanalysis of historical datasets with the objective of understanding the following: (1) the types and rates of processes occurring in the deep GOM that affect oxygen levels, and (2) the balance that maintains these levels. In particular, the study identified a series of Knowledge and Data Gaps regarding DO in Gulf deepwater, each of which could be addressed by a combination of high-quality field measurements of DO, currents, and other parameters specific to the particular question, as well as detailed modeling studies using coupled physical-biogeochemical models.

The study being proposed here will focus on the suggested field measurements in the report, with a follow-on modeling study to come later.

Objectives: The overarching goal of this 5-year study is to collect and analyze dissolved oxygen and related measurements in Gulf deepwaters to fill gaps previously identified in the 2005 MMS Study. Specific objectives include:

- Identifying the Gulf-wide horizontal structure of DO distributions and related measurements in the OMZ and below 1500 m.
- Determining rates of DO consumption and related carbon cycle dynamics throughout the water column, particularly below the mixed layer.
- Measuring whether anthropogenic activities related to oil and gas operations in the deepwater Gulf affect DO levels locally.

Methods: The objectives of this study will be met through a multi-year field experiment in deepwaters of the GOM, followed by data synthesis and analysis. The field component will be composed of a Gulf-wide study performed across multiple years and seasons, which incorporates site-specific measurements. All field work in this study will be conducted in the deepwater GOM, that part of the Gulf with water depths of 400 m or more (as defined in the MMS 2005 Study). A combination of ship-based surveys and autonomous underwater vehicles, in this case high-resolution glider transects, will be utilized to perform the various aspects of this study, with field work anticipated in two seasons per year for two years. The gliders will fill-in spatially between the more limited ship-based station measurements and will also collect site-specific measurements. Measurement of Gulf-wide horizontal oxygen distributions in deepwaters, including on either side of the EEZ, will require coordination with Mexican scientists and/or government.

Appropriate methods will be employed for accurately measuring oxygen concentrations and related measurements, including currents, temperature, salinity, nutrients, carbon, and particulate matter. At a subset of stations, measurements will also be made for DO consumption rates, microbial community structure, trace metals, and hydrocarbons. Select shipboard incubation experiments for measuring DO consumption rates will be inoculated with oil and dispersant in order to measure how rates potentially change in the event of an oil spill. Determining whether anthropogenic activities are locally affecting DO levels may be performed either at selected sites of oil and gas operations, or potentially at natural seeps to provide a natural experiment, and will additionally include hydrocarbon measurements. Data analysis and synthesis will provide information on oxygen variability and contributing processes (both natural and anthropogenic) across multiple years and seasons in Gulf deepwaters, and will reanalyze the historical Gulf oxygen dataset for any change in long-term trends given these new field measurements.

Revised Date: March 27, 2013

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Impacts to Wooden Shipwreck Remains from Exposure to Crude Oils, Chemical Dispersants, and Hydrocarbonoclastic Bacteria

BOEM Information Need(s) to be Addressed: To date, no laboratory studies have been conducted on the impact of oil spills to submerged cultural resources. Studies on the impacts to archaeological resources after the 1989 Exxon Valdez spill in Alaska focused exclusively on terrestrial sites and sites within the tidal zone while largely excluding shipwrecks. During the DWH oil spill in 2010, the scientific community quickly recognized the lack of information regarding potential impacts to these non-renewable and culturally-significant resources and the need to gather baseline data to assess potential impacts from hydrocarbon discharge, use of chemical dispersants, and increased populations of hydrocarbonoclastic bacteria to the preservation potential of wooden shipwreck remains. Crude oil may settle on the seafloor due to dispersant use at the wellhead and could come into contact with archaeological resources. We know that a significant portion of the crude oil expelled into the northern GOM from the Macondo well did not rise to the surface, but rather was emulsified at the well head due to turbulent mixing, reduced buoyancy at depth, and the addition of Corexit 9500 and 9527 chemical dispersants.

Section 106 of the NHPA (1966) requires Federal agencies to take into account the effects of their permitting actions and undertakings on historic properties. The information obtained from this study will allow BOEM to evaluate potential impacts to submerged cultural resources and strengthen NEPA analyses prior to issuing permits. Results would enhance worst case discharge analysis and be integrated into oil spill response plans. The completion of this research would be integrated into future NEPA documents and would serve as a response to both professional and public inquiries into the potential effects of specific oil development and possible resulting spills on historic properties in the GOM.

Approximate Cost: (in thousands) $300 **Period of Performance:** FY 2016-2020

Description:

Background: Crude oil from an oil spill, particularly one associated with a catastrophic blowout, could come into contact with wooden shipwrecks and artifacts on the seafloor and accelerate their deterioration. The stewardship of the OCS's archaeological heritage is a well-established function of BOEM. The Bureau has paid special attention to archaeological resources on submerged lands because Bureau-permitted activities may have a negative impact on these unique resources. Shipwrecks are known to occur throughout every region under the jurisdiction of BOEM. Since permitting activities related to oil and gas development are a major portion of the Bureau's regulatory function, determining potential impacts to cultural resources from exposure to

hydrocarbons is important for informed decision-making under NEPA, oil spill response plans, and worst-case discharge analyses.

Research has shown that both chemical and biological degradation/deterioration of wood "reduces its mechanical and physical properties." During long-term exposure to submerged conditions, all wooden structures and artifacts contain microorganisms that can breakdown and/or alter the cellular components of wood, resulting in the hydrolytic leaching of starches and sugars, ultimately making the wood more porous and decreasing its structural stability. Over time, and given the right environmental conditions, waterlogged wood often becomes increasingly fragile and is dependent on surrounding water and lignin (found in the cell walls) to support the original form of the wood. In certain environmental conditions (e.g., low oxygen or low temperatures), the bacterial and chemical degradation of submerged wood can be very slow, resulting in the survival of wooden shipwreck elements for hundreds and sometimes thousands of years. A recent experimental study has suggested that, while the degradation of wood in terrestrial environments is initially retarded by contamination with crude oil, at later stages, the biodeterioration of wood is accelerated. While there are different environmental constraints that affect the degradation of wood in terrestrial and waterlogged environments, soft-rot fungal activity, one of the primary wood degrading organisms in submerged environments, was shown to be increased in the presence of crude oil. The introduction of crude oil, chemical dispersants, and hydrocarbonoclastic bacteria has the potential to alter shipwrecks' local environmental conditions, which may rapidly accelerate the degradation of wooden structures and artifacts. The proposed laboratory experiments would allow researchers to test the hypothesis that exposure to crude oil, chemical dispersants, and hydrocarbonoclastic bacteria in the submerged environment negatively impacts the preservation of wooden structures and artifacts, accelerating their natural breakdown.

Objectives: Our objective is to determine if the exposure to crude oils and chemical dispersants to wooden archaeological remains would increase destructive bacterial activity and/or remove natural and protective oils found within. Furthermore, the study will determine if an oil spill and typical spill response has the potential to accelerate the destruction of wooden shipwreck remains.

Methods: The study will develop and recreate potential spill-impact scenarios in a laboratory setting. Chemists, microbiologists, and archaeologists familiar with working in the marine environment of the GOM will develop impact metrics and laboratory-based tests to assess oiling effects on shipwreck remains. The laboratory, under guidance provided by BOEM, will introduce a set of crude oil types, dispersants, and hydrocarbonoclastic bacteria species commonly found following oil spills in the GOM to wood types commonly used in the construction of historic vessels.

We hypothesize that the presence of crude oils and chemical dispersants would accelerate the deterioration of wooden artifacts thereby significantly affecting their long term preservation. The first experiment will determine if bacteria, such as *Alcanivorax borkumensis*, will transition from the consumption of crude oils into the natural oils found in wooden shipwreck remains. The second experiment will determine what effects the sudden introduction of chemical dispersants like Corexit 9500 and 9527 has on the

stability of waterlogged archaeological wood. There are a number of facilities that store water-logged archaeological wood that has neither been exposed to crude oil, chemical dispersants or hydrocarbonoclastic bacteria, nor have undergone preservation. For example, the State of Florida's Conservation Laboratory houses a variety of remains dating to the mid-16th century, and the University of West Florida has access to 16th century Spanish shipwreck remains and continues to excavate two period wrecks. This is, of course, only a sampling of materials originating from the GOM that could be used for these purposes. It will be the responsibility of the contract laboratory to obtain samples for testing including, crude oil, strains of bacteria and the archaeological wood remains. Results can easily be integrated into future NEPA analyses of proposed oil and gas activities on the GOM OCS.

Laboratory tests will introduce crude oil, dispersants (in isolation and in combination) and strains of hydrocarbonoclastic bacteria found in the GOM (such as *Alcanivorax borkumensis*) to submerged archaeological samples and modern submerged wood under laboratory controls. The lab will be using water similar to that found in the GOM controlling for factors like pH. The water used during testing must by necessity be temperature controlled to inform more specifically if either seasonality or temperature at depth could be factors in the successful migration of bacteria to the samples.

This study may be a good choice to competitively advertised through the the Gulf Coast Cooperative Ecosystem Studies Unit to allow the Agency to work collaboratively with a University on the research. This would also allow the costs to be controlled at an overhead of 17.5 percent allowing for significant portions of the budget to go into actual research.

This study is focused on direct questions that can be answered in a laboratory setting without the need for expensive or intensive fieldwork. It also distinguishes itself from the ongoing study on the effects of an oil spill on the biota of deep water shipwrecks by solely addressing wooden shipwreck remains and exclusively focusing on laboratory experiments based upon shallow water resources. This would be the first experimental study of its kind and will increase the body of knowledge related to oil impacts on wreck preservation.

Revised Date: March 28, 2014

Region: Gulf of Mexico

Planning Area(s): Central

Title: Mississippi Delta Mudslide Mapping, Hazard Susceptibility Assessment, and Monitoring Program

BOEM Information Need(s) to be Addressed: BOEM needs an updated map of the mudslide prone area offshore of the Mississippi River delta, a modern assessment of hazard potential, and a monitoring program to better support decision making, lease valuation, oil and gas infrastructure, and environmental impacts.

Approx. Cost: (in thousands) $14,000 **Period of Performance:** FY 2016-2021

Description:

Background: Hazards to oil and gas infrastructure associated with seafloor mass wasting have been documented offshore of the Mississippi River delta (Shepard 1955; Bea et al. 1975; Coleman et al. 1980) and are of concern to BOEM and BSEE. This mudslide prone area is highly dynamic and catastrophic failures occur with each major hurricane, drastically altering the seafloor morphology and increasing susceptibility to future mass wasting events. While BOEM and industry have devoted considerable investment during the past decade toward better understanding the processes that drive and govern these mudslides, these studies have been small scale and locally focused (e.g. Hitchcock et al. 2006; Nodine et al. 2007). Catastrophic failures during hurricanes Ivan and Katrina highlighted the need for updated information about the area. Mudslide damage to oil and gas infrastructure in the GOM after Hurricanes Camille in 1969 (Bea et al. 1975) and Ivan and Katrina in 2004 and 2005, respectively (Hooper and Suhayda 2005; Nodine et al. 2007; 2009), highlight our poor understanding of these events and the need for updated information to support decision making. This slide prone area on the shelf results from rapid deposition of large volumes of fine-grained, gas laden sediment associated with the Mississippi River that become unstable and “liquefy” during triggering events such as major hurricanes. The frequency of mudslide activity is currently unknown beyond those triggered by major storms. Moreover, it is unknown if smaller but more frequent storm events, such as cold fronts, might play a role in mudslide initiation. Thus, recently active hurricane seasons makes understanding and quantifying the risk associated with the slides more timely because younger mudslide deposits are more prone to reactivation during a subsequent storm.

The most recent information, on a scale that encompasses the entire mudslide prone area was collected in the late 1970s (Coleman et al. 1980). Subsequent, more localized studies have attempted to document seafloor changes associated with hurricane events, collected and analyzed geotechnical and geochemical information from slide deposits, and proposed methods for predicting or quantifying hazards risks. However, these studies have been limited to individual slides, were sampled using antiquated techniques, or developed predictive tools that are overly simplistic or have not been validated. Moreover, no in situ monitoring of the mobile muds has occurred to

characterize and quantify the mode and failure frequency. This study proposes to 1) provide new baseline geomorphic data for the entire mudslide prone area, 2) provide new subsurface geophysical and geological data of the sediment deposits, 3) implement a monitoring program that would collect real time mud motion data and relate it to physical oceanographic and riverine forcing, 4) develop a tool that can be updated as new lease block hazards surveys data are collected and tools to predict and quantify hazard susceptibility, and 5) reoccupy select survey and sampling locations post-storm to document actual change and validate models, e.g., those being currently developed for "Shelf-slope sediment exchange in the northern Gulf of Mexico (NT-11-06)" with BOEM funding.

Objectives:

- To develop updated baseline geomorphic and geologic data for the mudslide prone area that identifies the most highly dynamic zones;
- To develop a program to monitor mudslide activity and drivers that can quantify motion rates, frequency, and mode(s) of failure; and
- To develop and test predictive tools that BOEM can use to quantify mudslide hazard susceptibility to support leasing, OCS infrastructure, resource evaluation, and environmental assessments.

Methods: This study and monitoring program will be implemented in multiple phases.

Phase 1: Conduct seafloor bathymetric and subbottom geophysical mapping, geomorphic and seismic stratigraphic analysis of new and historical bathymetric data for the entire mudslide prone area. Zones of gas-charged sediments and important seismic reflectors will be mapped. This would also incorporate any lease block-specific hazards survey data available for comparisons.

Phase 2: Development and implementation of geological and geotechnical sampling plan based on interpretations from Phase 1. Historically sampled locations would be considered for reoccupation to detect changes. Results would be related to drivers and dynamics mapped during Phase 1.

Phase 3: Implementation of monitoring program to deploy and maintain in-situ instrumentation to track mud motion and oceanographic instrumentation (wave, water level, and current meters) to quantify physical processes governing mudslide activity similar to Prior et al. (1989).

Phase 4: Synthesis of all previous phases, findings and path forward defined. Develop spatial database tools that would incorporate future site-specific (lease block) data, and predictive tools and models based on data collected in Phases 1-3.

Phase 5: Maintain long term monitoring program implemented in Phase 3.

Phase 6: Reconnaissance work after storms or other events of interest documented in Phases 3 and 5 to reoccupy select survey areas to test and refine predictive tools developed in Phase 4.

Revised Date: March 28, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Multidisciplinary Assessment of Deep-Water Coral Ecosystems: Tools to Detect Impacts of Sub-Lethal Stress

BOEM Information Need(s) to be Addressed: Long-term changes and potential for recovery in deep-sea coral ecosystems remains unresolved, as does knowledge regarding deep-sea coral response to the DWH oil spill. This study addresses a critical gap needed for informed decision making: tools to detect impacts of sub-lethal stress and to quantify health and resilience factors in deep-sea coral ecosystems. Multidisciplinary in nature, deliverables include aspects of the geologic, biologic, and chemical components of these complex ecosystems. These data will be critical for NEPA analyses assessing the cumulative effects of the spill by providing time series and data trend information for identification of significant changes in the quality and productivity of these environments, and to identify the causes of these changes.

Approx. Cost: (in thousands) $ 1,560 **Period of Performance:** FY 2016-2018

Description:

Background: The GOM OCS supports extensive and valuable commercial and recreational fisheries, and unique deep-sea communities, including corals and chemosynthetic seeps. Deep-sea corals have extremely variable growth rates and little is known about their reproduction. Mortality is of limited use as a metric and provides no information on sub-lethal impacts. In order to protect these corals, better assessment tools are needed to determine their environmental sensitivity to events like the DWH spill, plumes of drilling mud, or climate change. Samples in hand from previously supported BOEM projects (e.g. Lophelia II) are available for expanded analysis to address these questions and to develop assessment tools for future events.

An early organismal response to environmental stressors includes the alteration of gene expression. Sub-lethal, chronic effects detectable at the molecular and cellular levels may be indicative of impacts. Through examination of transcriptomes, or the set of all RNA molecules present at a particular time within an organism, genes (or gene systems) that are actively expressed can be identified, including those involved in genomic stress responses. Developing a suite of biomarkers that reflect cold-water coral health will provide an inexpensive and effective method of monitoring the state of deep coral reefs exposed to oil spills or other environmental perturbations throughout the GOM.

Corals have associated microbiomes that are a fundamental part of their biology and critical to their health. Microbiomes can alter quickly (hours to days) in response to environmental stress, often preceding visible effects. Determining baselines that encompass both the taxonomy (‘who is there’) and metabolic functionality (‘what are they doing’) of these coral microbiomes will allow us to better predict shifts that signal disease or sub-lethal impairment.

Surface-derived organic matter exported to the deep sea is an important food source for deep-sea corals and can be characterized as an ecological indicator of quality and quantity of food sources, potentially controlling their slow growth rates and extreme longevities. Characterizing inter-annual changes in food quality and quantity and linking this to coral reef growth, will provide a critical tool to understanding the life history and ecology of these habitat-forming corals.

Objectives:

1. Characterize functional genes in corals (transcriptomes) to develop biomarkers of coral health or sub-lethal stress.
2. Characterize taxonomic and functional genes in coral microbiomes (metagenomes) to develop indicators of coral health or sub-lethal stress.
3. Track changes in nutrient dynamics (e.g., changes in quality, quantity, and source) and impact of oil spill on biomass production. Obtain better estimates of coral ages, and define and trace isotopic composition of petro-based-carbon into the GOM deep-sea coral food web.

Methods:

Task 1: Transcriptomes of *Lophelia pertusa* and *Madrepora oculata* will be developed from samples collected on BOEM-sponsored Lophelia II cruises before and after the DWH incident (2009-2010) with additional samples from the Atlantic Ocean (2010-2013). The annotated transcriptomes will be interrogated for genomic stress-response genes that will respond predictively to chemical stressors. Fast and inexpensive quantitative PCR (qPCR) assays will be developed that target cellular stress response genes.

Task 2: Metagenomes from 12 *L. pertusa* colonies will be developed from samples collected before and after the DWH incident (2009-2010) at three sites in the GOM (Viosca Knoll 826 and 906, West Florida Shelf) and one site in the Atlantic Ocean. Bioinformatic analysis of this deep sequencing effort (2 – 63 million sequences per sample) will provide a critical baseline (the first deep-sea coral metagenomes). Metagenomes will be examined to identify microbial indicators of health and any shifts in function associated with sub-lethal stress to develop screening assays.

Task 3: Surface-derived organic matter collected in sediment traps during two year-long deployments between 2008 and 2011 in the GOM will be analyzed for a suite of geochemical tracers (e.g., trace metals, lipid biomarkers, compound specific stable isotopes) to investigate changes in the food quality and quantity to the deep-sea, and potential links to changes in sediment and nutrient transport after the DWH. Coral ages and growth rates will be conducted using radiocarbon dating techniques. Complimentary stable and radio-isotopes (e.g., $\Delta^{14}C$ and $\delta^{13}C$ in coral tissue samples) will be analyzed to determine the degree of petro-carbon uptake in the deep-sea coral community and evaluate the robustness of the large-scale tracer of the DWH footprint.

Revised Date: March 27, 2014

Region: Gulf of Mexico

Planning Area(s): Western

Title: Nearshore Reefs Along the South Texas Convergence Zone and Their Susceptibility to OCS Development.

BOEM Information Need(s) to be Addressed: The south Texas convergence zone and jet current is one of the most unique features in the GOM and occurs in an area that may be home to many undocumented reefs in less than 40m. The unique combination of oceanographic and geologic features has resulted in an environment with high biodiversity that is dissimilar to reefs outside this zone; however, baseline biological and ecological information for these reefs has not been collected. These sites are located in the Western OCS Planning Area and the same oceanographic features that make them unique may also make them more sensitive to OCS development than other areas. As such, there is a need to map and quantify these shallow water reef communities to determine if the area functions different than areas outside the convergence zone and evaluate how OCS operations may affect the reef field at a landscape scale. Information would be critical for the development of NEPA related documents, especially the catastrophic analysis for sight-specific environmental assessments for structures that could influence this area.

Approximate Cost: (in thousands) $850 **Period of Performance:** FY 2016-2018

Description:

Background: The south Texas convergence zone is one of the most unique features in the GOM. Occurring near 27° latitude, a north-bound longshore current and a south-bound longshore current collide, creating a jet current that runs perpendicular to the shoreline (Walker 2005). The range of this current is approximately 30 miles N-S as evident by the presence of shell deposits on the adjacent beaches of the Padre Island National Seashore (Weise and White 1980, Kellerlynn 2010). Because of this current, the remnant sections of fossilized biogenic and geologic structures scattered across this area can have a high degree of biodiversity and uniqueness. However, this current also makes this area vulnerable to OCS activities.

In the spring and fall, this convergence forces offshore water inshore onto the coastal shelf, providing larvae, juveniles, or adults to the low-relief, hard-bottom structures that are scattered throughout the area. Because this field was one of the first fields developed offshore, minimal high resolution survey work has been completed in this area compared to many others; as such, little is known about the abundance of these reefs. At least 6 reefs have been confirmed near 27° latitude, but data collected from anecdotal sources and from BOEM's database on "fishing hangs" suggests that many more small structures exist but are undocumented. For example, the area known locally as the "North Mansfield Rocks" has at least 50 individual structures spread across ~38 mi^2.

The combination of the jet current and the long distances from the nearest port has resulted in this area becoming a biodiversity hotspot that has remained relatively pristine compared to more accessible reefs. It also suggests that we have a minimal understanding of the biology and ecology of these reefs and that baseline data are needed. Reefs in this area are different from other reefs throughout the GOM as they have a high degree of inshore species, offshore species, and tropical species. They also must contend with high rates of siltation and resuspension of sediments due to the presence of a nepheloid layer and the heavy silt loads of the longshore currents (Tunnel 2009).

A small spill or blowout at any of platforms affected by the jet current could result in unweathered material being transported more rapidly to these reefs compared to reefs in other locations in the Gulf. In addition, entrainment in the bottom current could increase the possibility of product coming in contact with critical reef habitat along the seafloor, especially if a dispersants are used. If there is a high degree of habitat connectivity among these isolated reefs, then a cascading or domino effect could be seen beyond the location of the spill. For example, if a reef tract close to a platform is damaged, an animal using these isolated reefs as stepping stones to disperse throughout the environment may not be able to survive long enough to pass through the "dead" area or may get lost due to the lack of environmental "clues" used to locate the reefs. It remains unknown how the jet current directly or indirectly influences the biology and ecology of the area and what is the magnitude of that effect. Like other previously developed fields, as new drilling and extraction techniques are advanced, reserves once thought to be played out in the Mustang Island, North Padre Island, and North Padre Island East area may become obtainable, leading to an increase in OCS activity and an increase the likelihood of an accident.

In addition to reporting baseline data on the basic biology and ecology of this unique region, it is expected that detailed maps of the reef structures in this area will be developed that are geo-referenced to be incorporated into the BOEM/BSEE databases to aid in the approval of permits and completion of NEPA related documents.

Objectives: The objectives for this study are to:

1. Map and identify previously unknown reefs within 24 km north and south of 27° latitude between the eastern boundary of the Padre Island National Seashore to a depth of 40m (estimated to be 37 km east).

2. Identify and catalogue the abundance, diversity, and ecology of reef inhabitants to provide baseline information.

3. Quantify the degree of habitat connectivity among reefs as a result of the surface and bottom components of the jet current.

4. Model the potential effects of an OCS spill at multiple locations along the current's path on the biology and ecology of the area.

Methods: Mapping of the resources could be done via side-scan or multibeam mapping while survey of the reefs could be done via SCUBA or ROV work. To understand the ecology or the connectivity of the reefs, there may be a need to conduct *in situ* or laboratory experiments using innovative techniques like stable isotopes, otolith chemistry, or other techniques that could associate a particular animal with a habitat or area. In addition, the BOEM OSRA model may be a useful tool for connecting the physical environment with the biological environment.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: NRHP Eligibility Criteria and Environmental Impact Analyses of Post-WWII Shipwrecks

BOEM Information Need(s) to be Addressed: The proposed study will identify shipwrecks in the Gulf of Mexico (GOM) that date between 1946 and 1965, conduct archival analysis to populate BOEM's archaeological database, determine potential site integrity and eligibility for listing in the National Register of Historic Places (NRHP), and identify environmental hazards associated with shipwreck site formation processes.

Information obtained from this study will assist BOEM in meeting the requirement of Section 110 of the National Historic Preservation Act (NHPA) by identifying archaeological sites that may be eligible for the NRHP. It will allow the agency to more effectively carry out the requirement of the NHPA Section 106 process for the protection of cultural resources and fulfill its responsibility in evaluating potential effects to the environment from energy production, sand and mineral extraction, and oil and gas industry-related activity.

Approximate Cost: (in thousands) $75 **Period of Performance:** FY 2016-2018

Description:
Background: There is significant variability in the types and attributes of the 323 post-WWII historic shipwrecks identified in the GOM; however, only three have been evaluated, as federally-mandated, for NRHP eligibility. Shipwrecks under consideration in this study date to between 1946 and 1965. These resources include personal craft, commercial transports, cargo carriers, fishing/trawling vessels, derelict military vessels, and vessels related to the oil and gas industry. They range from small vessels capable of at most day trips on open water to global transports of several thousand tons, which may still contain several hundred gallons of fuel. Depths of these shipwrecks range from a few feet to several thousand feet. The majority of these shipwrecks were identified by BOEM through their listing in the Merchant Vessels of the United States (MVUS), National Imagery and Mapping Agency (NIMA) Worldwide Shipwreck Database, and Automated Wreck and Obstruction Information System (AWOIS); therefore, the location information and attribute data recorded for many of these shipwrecks is considered fair to poor.

The historical significance of historic post-WWII shipwrecks are in question since sites may have suffered impacts from oil and gas industry activity before becoming potentially eligible to the NRHP. Additionally, because many of these shipwrecks are currently undergoing first-order site formation processes with the potential to negatively impact the environment, eligibility criteria must be evaluated against the need to mitigate current and future environmental concerns, which could lead to a loss of integrity as defined by the NRHP.

Objectives: The primary objective of this study is to conduct archival analysis and to populate the attribute tables in BOEM's archaeological database, identify specific shipwrecks that represent a range of vessel, wrecking, and site types that date between 1946 and 1965, and develop a range of temporal, structural, and social attributes associated with vessels of this period that may be applied to the specific criteria to be used to evaluate archaeological site integrity and eligibility to the NRHP.

The secondary objective is to determine how first-order formation processes of the sites that are determined eligible for the NRHP are potentially affecting the local environment in order to develop mitigation strategy with which to fulfill BOEM requirements under Section 106 and NEPA and to minimize potential negative impacts to the environment.

Methods: The BOEM Archaeological Database will be analyzed in concert with the MVUS, NIMA, and AWOIS databases and available vessel registry archives to compile historic data and information related to shipwrecks that date to between 1946 and 1965 that may inform significance criteria related to the inherent properties of the vessels (NRHP Criteria A, B, and C). Shipwrecks for which this data is available will then be ranked according to quality and significance of historical information which may include: association with an identified historic event; representative vessel construction and form; wrecking cause and process; extent of previous field research; and physical/environmental dispositions.

Based on the results of the analysis, up to three shipwreck sites will be chosen for nomination to the NRHP. Preparation of material for the nomination will include historical research, literature review, and pre-existing field analysis of the shipwreck and site. Nominations will be prepared and submitted for consideration to the keeper of the NRHP.

For those sites with available historic and environmental data, an evaluation will be conducted of each site for active and potential environmental hazards associated with the degradation of the shipwreck and associated site formation processes (for example using NOAA's Remediation of Underwater Legacy Environmental Threats [RULET] criteria). An environmental mitigation strategy will be proposed for those shipwrecks determined to have an active negative effect on the local environment.

Revised Date: March 28, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Passive Acoustic Monitoring (PAM) Program for the Northern Gulf of Mexico

BOEM Information Need(s) to be Addressed: Data on the ambient noise environment in the GOM is extremely limited. Other than some short-term recordings associated with previous studies and recent PAM work done as part of the Natural Resource Damage Assessment for the *Deepwater Horizon* event, little data exist. Noise impacts to protected species (primarily cetaceans) may occur as a result of BOEM and BSEE activities (e.g. seismic, decommissioning, drilling, vessel noise, etc.) however characterizing this is difficult without any "baseline" data about the current ambient noise environment in the GOM. BOEM and BSEE are required to assess potential impacts to protected species, specifically under the Marine Mammals Protection Act (MMPA), ESA, and NEPA. The future BOEM MMPA rulemaking for seismic activities in the GOM has a considerable monitoring requirement associated with it and data on both ambient noise as well as noise associated with seismic activities will be required by NMFS. A PAM program would provide a relative baseline with which to assess any BOEM/BSEE authorized activities as well as provide additional information about cetacean presence/absence based on vocalizations detected by the PAM system.

Approx. Cost: (in thousands) $5,000 **Period of Performance:** FY 2016-2021

Description:

Background: Worldwide, the ocean has become a very noisy habitat for marine animals as ambient noise levels rise as a result of anthropogenic activities. Cetaceans rely on sound as a primary sense for vital life functions and increased noise levels may mask important sounds (including non-specific vocalizations) as well as cause direct harm. As ambient noise levels have increased in some areas, cetaceans have changed the frequency at which they vocalize in order to communicate in a noisy environment (Parks et al. 2007). Cetaceans in the GOM inhabit a highly industrialized environment with multiple anthropogenic acoustic inputs including shipping, oil and gas activities, and military operations. In 2006, NOAA conducted a National Passive Acoustics Workshop (Van Parijs et al. 2006), which recognized the need for a Passive Acoustic Oceans Observing System. While a National program is still not in place, there are smaller scale PAM programs in some areas (e.g. Bering Sea, Stellwagen Bank National Marine Sanctuary that have proven effective in measuring ambient noise levels, detecting marine mammal presence, and monitoring anthropogenic noise (e.g. seismic, vessel noise).

Objectives: This project will establish a long-term passive acoustic monitoring program using moored acoustic recorders at permanent stations throughout the GOM. The program will establish a "baseline" for ambient noise in the GOM against which to judge potential future noise impacts from BOEM/BSEE activities as well as characterize the

sound budget from other kinds of noise already occurring in the GOM (e.g. shipping). In addition, acoustic recorders will be able to detect vocalizing marine mammals, providing both spatial and temporal information about cetacean species in the GOM.

Methods: Hydrophones will be deployed, maintained, and redeployed on a regular schedule throughout the GOM. Placement will include shelf, slope and deep water depths as well as all planning areas in order to gather a comprehensive data set representative of the entire GOM. Ideally this program should be put in place for no less than 5 years (period of MMPA rule) in order to adequately capture seasonal and temporal variations. Placement of the hydrophones will be dependent on the number of recording stations selected and the capabilities of the hydrophones used. In addition, areas of particular concern can be identified for monitoring (e.g. Mississippi and DeSoto canyons). Hydrophones collect huge volumes of data and a significant expense will be the post-processing of these acoustic data.

Revised Date: December 19, 2013

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Quantifying Changes to Infaunal Communities Associated with Several Deep-Sea Coral Habitats in the Gulf of Mexico and Their Potential Recovery from the DWH Oil Spill

BOEM Information Need(s) to be Addressed: The DWH oil spill was responsible for changes in multiple ecosystems within the GOM, leading to shifting baselines within coastal and deep-sea ecosystems. However, estimates of baseline ecological conditions are scarce despite representing a critical component to long-term monitoring in the GOM. In addition to supporting large and valuable commercial and recreational fisheries, and numerous threatened or endangered species, the GOM OCS supports unique and diverse benthic communities, including deep-sea corals and chemosynthetic seeps, that are important to deep-sea ecosystem functioning and health. Few studies have documented the acute impacts of the spill to deep-sea communities, including soft sediments (Montagna et al 2013) and corals (1 site, 7 miles from wellhead; White et al. 2012, Hsing et al. 2013). However, quantifying long-term changes and recovery of communities remains unresolved. This study will provide the long-term datasets that BOEM requires to measure the success of mitigations and terms required for developers to guarantee the protection of natural resources. In addition, these data will be useful for NEPA documentations assessing the cumulative effects of the spill to these communities, enhancing their robustness.

Approximate Cost: (in thousands) $761 **Period of Performance:** FY 2016-2018

Description:

Background: Sediment macrofauna and meiofauna represent important indicators of oil-spill disturbance primarily due to their sedentary lifestyle and their rapid response to change; thus, examining these communities has proven useful in impact assessments of coastal and deep-sea communities. Monitoring of benthic infaunal communities will yield important insights into the patterns and trajectory of change within these ecosystems by identifying their sensitivity and resiliency to disturbance. As industry moves into deeper water, questions remain regarding impacts to deep-sea ecosystems. Therefore, it is imperative that monitoring efforts effectively identify and differentiate impacts from oil and gas activities from other forms of disturbance, including hurricanes and climate change.

BOEM has partnered with the USGS in several major research programs examining the distribution and community ecology of deep-sea coral ecosystems, including the National Oceanographic Partnership Program-sponsored studies, Lophelia I and Lophelia II. Since 2004, the USGS DISCOVRE (http://fl.biology.usgs.gov/DISCOVRE/) program has provided ecosystem-based scientific reviews that meet the recommendations of the National Commission on the BP Deepwater Horizon Oil Spill

and Offshore Drilling final report to the President to methodically collect critical scientific data in areas that are being considered for oil and gas leasing.

While these multi-year studies have produced important baseline data, we lack information regarding the long-term impact of the DWH oil spill on benthic infaunal communities. In coordination with the BOEM Study Profile "Multidisciplinary Assessment of Deep-Water Coral Ecosystems: Tools to Detect Impacts of Sub-Lethal Stress", this work will provide valuable data to help guide long-term monitoring programs of deep-sea environments. The research described here will provide the data necessary for impact assessments, and the information gathered will help inform the development of future restoration plans and delineation of protected areas.

Objectives: The primary objective is to assess changes in benthic infaunal communities following the DWH oil spill at several deep-sea coral sites located in proximity to the well head and at reference sites. Samples collected from 2007-2013 at deep-sea coral and chemosynthetic ecosystems will provide key time series information needed for identification of significant changes in benthic communities and trends in their response to disturbance, as well as factors responsible for these changes. This study profile will take advantage of data and samples presently in hand in order to represent the current baseline conditions in the deepwater GOM from which to establish long-term monitoring studies.

Methods: This task will characterize infaunal community structure at deep-sea corals in areas impacted by the spill compared to reference sites. Sediment cores (n=118) were collected from 10 BOEM lease blocks between 2007 and 2013. Pre-spill cores were collected at 5 lease blocks, while post-spill collections were collected at all 10 lease blocks. Cores were collected directly adjacent to deep-sea coral habitats and reference areas to assess infaunal abundance, diversity, evenness, and composition. Among these sites, there is at least one impacted coral site (White et al. 2012), and potentially two additional sites. While the pre-spill cores were not taken in the impacted sites, cores were collected at sites with similar coral species composition, allowing us to address temporal change in unimpacted deep-sea coral habitats. This work will also include comparing coral-associated infaunal communities to other habitats in the GOM, including seeps, soft-sediments, and shipwrecks for which we have existing data (Rowe and Kennicutt, 2009; Wei et al. 2010; Demopoulos et al. in review). These comparisons will quantify community changes since the spill, estimate resilience, and determine whether these systems have recovered to comparable community structures near healthy reference areas.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: The Demographic Consequences of the Gulf of Mexico Offshore Petroleum Industry

BOEM Information Need(s) to be Addressed: Study results will support BOEM social and economic assessment in several important ways. The GOMR has long hosted a large, complex and mature offshore petroleum industry and its associated large and varied labor force. In this context, the relationships between "new" OCS labor demand, new vs. continuing jobs, new hires vs. employee retention, and in-migration vs. population retention demographic change remain outstanding questions. Information from this study will improve MAGPLAN estimates of sale-driven employment and population impacts and, thereby, also support the cumulative analysis, such as the consideration of the function of additional sale-related labor demand within an OCS industry witnessing a slow declining labor demand overall. The focus of this study will be at the regional (to economists) or local (to sociologists) level and on demographic change defined more broadly. These results will support BOEM social and economic assessment at state and regional (local) levels. The results will support a more detailed baseline description. The regional-level analysis of relationships among OCS activities, labor demand, and demographic change and stability, differences in relationships among regions and over time and space, and factors generating these differences will support the GOMR's ongoing development of more regionalized and detailed socioeconomic impact analysis and, in particular, it will support baseline, impact, and cumulative impact assessments for the Gulfs newly restructured Socioeconomic Impact Areas.

Approximate Cost: (in thousands) $300 **Period of Performance:** FY 2016-2017

Description:

Background: The analysis of demographic effects is important to social impact assessment, leading to issues of growth and decline, benefits and burdens, social change and conflict. The petroleum industry has affected Gulf Region demographics directly, and indirectly as a catalyst for other changes. However, while important and long-lived, the demographic consequences of the OCS leasing program do not fit the customary socioeconomic assessment emphasis on new actions, new labor demands, and new people because of the Region's large, in-place onshore petroleum industry and its associated experienced labor force. In this situation, the demographic outcomes of the industry are consequential—probably more so in the long run than the booms and busts normally analyzed—but in this situation these outcomes are also complex and difficult to assess.

In the GOM, any ties between the new activities and labor demand generated by OCS lease sales and demographic impacts do not resemble this classic pattern. The petroleum industry has played a major role in the Gulf for over one hundred years, the

offshore industry for over fifty. During this time, the offshore industry and associated support sectors have become a large and well integrated part of the Gulf's economy. Projects are familiar, local labor is poised to meet the demand, and each project blends into the next. These effects are from the routine operations of varied oil-related enterprises rather than from the concentrated activities of the construction trades.

The analysis of demographic effects is important to social impact assessment, leading to issues of growth and decline, benefits and burdens, social change and conflict. Even basic questions have proven difficult to answer such as: How many "new jobs" due to an OCS sale are actually new as opposed to providing support for current jobs through new contracts? How many new jobs are filled by the existing labor force (overtime, job switching, commuting, etc.) as opposed by individuals moving into the area? What are the characteristics of people and their families that do move into the area due to new labor demand? How much of this moving is permanent as opposed to, say, based on work visas? Beyond these immediate questions are others. How do the answers to these questions vary by industrial sector, across the region, and over time? How has the demographic consequences of the offshore industry affected the characteristics of the Region's labor force, regional population growth, Houston, and New Orleans? What are the demographic consequences of the petroleum industry when it is booming and not, and where to they occur, and have they changed from decade to decade? Has the industry led to any instance of a "boomtown" in the coastal Gulf in the last 50 years, and if so, under what conditions? While past research projects have addressed the industry's demographic consequences in the Gulf, answers to basic questions need clarification and updating regarding relationships between the OCS program, employment and demography.

Objectives: The objective of the study is to better understand relationships between the OCS lease sale program, labor demand, and demography at the GOMR, state, and regional or local levels.

Methods: This study will assess the relationships between OCS sales, labor demand, new vs. continuing jobs, and demographic change. Much BOEM assessments—the 5-Year Programmatic EIS and the MAGPLAN/IMPLAN model, for example—use generalized OCS Region- or State-wide estimates of these relationships (e.g., the percent of new vs. continuing jobs and the numbers of in-migrants for each new job). In the Gulf context, these estimates remain problematic because the relationships themselves have not lent themselves to standard analytic and estimation techniques based on easily acquired data. Among the many other problems, differences across the Gulf, among industrial sectors, and labor populations have confounded these approaches, as has factors such as long distance commuting and the use of guest workers. This study will also describe the relationships between OCS sales, labor demand, new vs. continuing jobs, and population changes at the regional (or local) level. Here, the primary focus is anticipated to be on selected BOEM-defined Socioeconomic Impact Areas, aggregations of counties/parishes that reflect the distribution of OCS-related industry and economic activities. For this analysis, demographics will be defined broadly to include population size (e.g., growth, decline), structure (e.g., age, sex), dynamics (e.g., fertility, mortality, morbidity), racial/ethnic composition, household structure (e.g., size, composition),

migration and commuting (e.g., magnitude, characteristics), and such other population characteristics as health, education, poverty, and employment status) and the research team will identify and analyze a set of questions that will illuminate the current and longer-term relationships between the Gulf Region oil industry and offshore petroleum development and its demographic consequences. The goal is to select and answer a set of research questions that, together, will provide a better understanding of the demographic consequences, through time, of GOM petroleum development. The study shall address effects at least three levels of aggregation: GOMR, state, and BOEM-defined impact areas. While some effort will be directed toward data at the higher levels of aggregation, such approaches have not proven out in the past. Here, the strategy will be to emphasize regional (local) level analyses, to explore multiple approaches, and to construct the more general estimates based on an evaluation of them all.

Revised Date: January 14, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Upgrading Air Quality Modeling in the Gulf of Mexico: Integrating Local and Remote Emissions with Photochemical Models

BOEM Information Need(s) to be Addressed: To support environmental reviews in NEPA documents and evaluation of post-lease activities, BOEM needs to address the impact of air pollutant emissions from oil and gas (O&G) sources at onshore areas of the GOM. Only local sources of pollutants have been considered in historical reviews; however recent scientific research has revealed that external sources also have a serious impact on regional air quality (AQ) and that they are beyond the regulatory control (Bozlaker et al., 2013). An integration of advanced AQ models with combined locally and externally transported emissions is needed to: 1. comprehend atmospheric processes and appropriately address AQ concerns, and 2. objectively answer federal and state requests on environmental impact matters. This broader approach enhances prediction of pollutant concentrations by realistically including most of the contributing pollutants in the region.

Approximate Cost: (in thousands) $400 **Period of Performance:** FY 2016-2018

Description:

Background: There have been extensive discussions among BOEM and the U.S. Environmental Protection Agency (EPA) about AQ impact analysis at onshore areas of GOM from O&G emission sources. EPA often requests BOEM to improve its AQ modeling systems and analytical procedures to estimate such impacts in pre-lease NEPA documents and site specific, post-lease sale activities. To scientifically respond to EPA's concerns, it is imperative to upgrade the analytical tools to state-of-the-art photochemical models; update datasets to include local and transported emission sources in the analysis; survey the dominance of criteria pollutant components defined by EPA; and finally, to develop research to support BOEM offshore resource management activities along with scientifically based decision making. To pursue those goals, it is important to configure modern models, like the photochemical CMAQ (http://cmascenter.org/cmaq/) and WRF (http://www.wrf-model.org/index.php) which also has a chemistry module, to represent in an optimal way the atmospheric transport and chemical transformation processes in GOM. These photochemical models offer more complete physical and chemical options to describe complex coastal and marine boundary layer processes influencing chemistry and pollutant concentrations at local and regional scales.

Improving air emission data to better understand emissions and potential risks from oil and natural gas production sector are part of the recent tasks embarked by EPA (U.S. EPA, Report 13-P-0161, 2013). Additionally, EPA has proposed changes to O&G emissions reporting for greenhouse gases. In 2011 EPA set new short-term National

Ambient Air Quality Standards (NAAQS) and currently more stringent ozone levels are in place making it necessary for BOEM to re-analyze exemption levels to ensure that outer continental shelf sources do not significantly affect onshore AQ. The exemption level study is part of the larger Cumulative Effects Study and is expected to be awarded in 2014.

Bozlaker et al., (2013) quantify the relative contributions of local and global mineral dust sources in Houston, Texas, to find that the average particulate matter concentration more than doubled during a dust storm in 2008. The Trans-Atlantic transport of Saharan dust (originated in northwest Africa) increased 64% of PM 2.5μm particles and 85% of PM 10 μm particles during this event in Houston. Satellite imagery and observational data have clearly confirmed seasonal mean dust peak concentrations in summer for decades in Miami and Barbados (Propero and Mayol-Bracero, 2013). Mineral aerosols, like those from dust storms, are estimated to be a major health problem worldwide (Liu et al, 2009); however there is scarce research on related threats to sensible populations. The recurrent peaks first pass Louisiana on its way to Texas, and higher concentrations at New Orleans than Houston are expected since these metropolitan areas are at similar latitudes.

Louisiana has a higher O&G platform density in its coastal and offshore waters than Texas, and to our knowledge there is no yet reported investigation about a comparative distribution of pollutants from local O&G sources and remote natural emissions like those from northwest Africa. There are key interrogations to address in this study, including, when in the year, how much of NAAQS criteria pollutants are present and which are the areas more likely to be impacted in the region.

Objectives: There are three complementary objectives and a request for publishing scientific findings

1. Configure CMAQ and/or WRF-Chem photochemical modeling systems to analyze criteria pollutants concentration and transport in the GOM region.
2. Regionally survey contributing pollutants considering conventional receptors data, new data sources including satellite information, sampling monitoring systems and global model transport results.
3. Evaluate photochemical models using complementary emission products (emission inventories and satellite) and compare predicted concentrations to receptor data in areas with high density of O&G platforms.
4. Prepare at least 3 peer-review publications.

Methods: This project involves modeling research and compiling new and existent field data, receptors and meteorological observations related to air quality. Also, this project should look to thoroughly search for and synthesize information from available scientific literature. An appropriate configuration of AQ models is very important before carrying out any simulation. To accomplish this fundamental step, physics and chemistry model options should be first evaluated by comparing numerical results with observed data. Gathering receptors and analyzer monitoring data to evaluate dominant

contributing pollutants is a key task in this study. Reformat and prepare satellite imagery, transport model outputs and emission inventories as input information for AQ photochemical models. Perform simulations to determine time and spatial distribution of pollutants in the region and at local scales employing model nested domains.

Revised Date: January 8, 2014

SECTION 3 TOPICAL AREAS FOR FY 2017

The GOMR is expecting a continuation of offshore oil and gas activities; however, future activities in the Atlantic Region are uncertain. With the continuation of the Administration and a new five-year program, our responsibilities could increase as we move into new alternative energy projects and new OCS areas. If leasing occurs in new areas, many of the same issues will need to be addressed though modifications will be needed depending on the planning area. In some cases, there is little or no information existing, in other cases there are data available which could be used to support the OCS program. More significantly, the DWH oil spill in 2010 created many new information needs that relate to the recovery and long-term impacts to the Gulf's natural and cultural resources. These information needs will continue beyond FY 2016.

3.1 Deepwater

BOEM and the larger scientific community recognize the importance of continued and expanded study of deepwater habitats, especially as the number of direct and indirect stressors to these habitats grows (e.g., oil and gas activities, deep-water fishing, debris deposition, climate change, etc.). Deepwater habitats, including the mid-water pelagic realm, represent an important economic and scientific frontier, but are the least understood marine environments of the GOM. Several major deepwater studies are ongoing to broaden our limited knowledge base of deepwater benthic ecology, including studies of plankton, coral distributions, and Potentially Sensitive Biological Features (PSBF's). The results from these studies will lead to new areas for further investigation.

The agency is responsible for the protection of deepwater habitats (e.g., deepwater corals, sperm whale habitat, etc.) from routine oil and gas activities by regulating the potential impact of activities on these habitats. Although the regulations are put in place to protect the habitats from routine activities, accidental events, such as an oil spill, may result in impacted deepwater communities and damage to the environment. Establishing a long-term monitoring and modeling program of these deepwater habitats would be beneficial to determine if offshore oil and gas activity is causing a change in the habitat structure and what the long-term impacts are of accidental events. For example, application of a Gulf-wide coupled bio-physical model and climate scenarios would provide improved prediction of the cumulative impacts of the oil and gas industry on marine biota. As well, further monitoring is needed of the deepwater coral communities damaged by the DWH oil spill to assess how the corals and associate infaunal communities recover. In addition, a large number of cetacean species inhabit deepwater, and we require improved understanding of how seismic exploration and decommissioning activities might impact populations.

Recent archaeological discoveries made in deep and ultra-deep water suggest a greater population of historic shipwrecks far from land off the continental slope than was previously suspected from prior BOEM studies. One recently completed study investigated the potential for losses along the Vera Cruz-to-Havana route routinely followed by Spanish vessels, which would have taken them through the southern boundary of the EEZ. Another study in the Gulf and one study in deep water off Virginia

combine archaeological investigation of deepwater shipwrecks with biological characterization of the organisms that have colonized them. A new study, procured in FY 2013, seeks to understand the microbiological processes occurring on deepwater shipwrecks as a result of exposure to oil and dispersant. These processes could affect degradation rates which, in turn, could have implications for future site preservation as well as long-term availability for recruitment of motile fauna, corals, and other deepwater communities. Understanding the diversity of resources, site formation processes, and their potential eligibility to the National Register of Historic Places is a concern for designing appropriate mitigation strategies to fulfill agency obligations under Section 106 of the NHPA.

Several major studies have recently completed measurements of currents in deepwater. This dataset spans the GOM from 87°W to 97°W and down to 24°N in Mexican waters. Ongoing studies are examining the Loop Current and making Lagrangian observations of deep currents over the entire Gulf basin. The next step will include modeling of the data and incorporation of the information into oil spill assessments and cross referencing with pelagic biology studies.

3.2 Need for Monitoring

The development of long-term monitoring programs is of international interest for measuring trends in ecosystem indicators and assessing the vulnerability and resiliency of human and natural systems. Given its broad scope, the design and implementation of monitoring efforts are currently engaging multiple interested partners, including Federal and State agencies, academia, and industry, drawing from expertise in both the U.S. and Mexico. Monitoring programs would provide BOEM the long-term data sets necessary to evaluate the effectiveness of mitigations and stipulations placed on developers to ensure the protection of natural and cultural resources. The analysis of long-term data collected from monitoring programs also reveals trends as biological populations and oceanographic conditions shift in response to perturbations, such as hurricanes, oil spills, periodic climate events, ocean acidification, and/or climate change. With these data available, mitigation requirements can be adjusted to be more effective, analysis of cumulative effects in NEPA documents will be more robust, and approaches to addressing climate change may be uncovered.

We define environmental monitoring as: "a continuing program of measurement, analysis, and synthesis to identify and quantify ecosystem conditions and trends to provide a technical basis for decision making." Thus, monitoring activities can be used to assess the state of the GOM ecosystem, and when viewed over time, indices can be developed as measures of changing states or trends in the ecosystem or in system components. Ecosystem parameters of interest include some variables for which the data will be gathered and served, others for which specific new products will be developed, and finally parameters for which new measurements will need to be obtained. Under this broad definition, monitoring may include such activities as collecting new oceanographic and water quality measurements from a moored array, compiling a multi-decadal, climate-quality time series from multiple satellite sensors, or numerical modeling to synthesize observations and produce new products. As part of

post-DWH planning, including related to RESTORE Act funding, significant planning and coordination is currently underway in the Gulf community to develop partnerships and long-term plans for expanded environmental monitoring Gulf-wide.

3.3 Fates and Effects

Fates and effects studies are performed in the GOM to evaluate the physical-chemical and biological processes that affect the impacts of oil and gas drilling and production discharges, spilled oil, and chemical dispersants on biological communities. The OCS supports large and valuable commercial and recreational fisheries, various threatened or endangered species including sea turtles and marine mammals, and unique benthic communities. Concern has been expressed that the oil and gas industry may contaminate these resources or alter the supporting ecosystem. Understanding the chronic, sublethal impacts that may be associated with offshore oil and gas activities is a concern to many. Questions continually arise as industry moves into deeper water and new technology is applied; the DWH oil spill further served as a reminder of this. Several ongoing and recently initiated studies are currently addressing fates-and-effects issues in the GOM, including development of a new 3D blowout model (GM-11-02), applications of remote sensing to understanding spill movement (GM-12-02), and the impacts of anthropogenic noise on marine mammals and sea turtles (GM-13-05). The ongoing Gulf SERPENT project is collecting measurements of deep sea pelagic and benthic communities, which over the long-term have proven useful in identifying pre- and post-spill impacts. Additionally, improved understanding is required of explosive removals on Gulf fish populations and of the ambient noise environment in the Gulf. The studies program is continuously addressing the information needs in this constantly evolving area and will develop new studies as the need arises.

3.4 Decommissioning

There are approximately 3,000 oil and gas platforms on the U.S. OCS. In recent years the number of removals has increased and this activity will likely remain elevated; over the last decade, platform removals have begun to outpace emplacements. Bottom-founded platforms supply an artificial hard substrate that spans the water column, potentially changing diversity and altering the distribution of species where they are located. Since the 1980's, Gulf States have been granted permits to reef decommissioned oil and gas platforms through the Rigs-to-Reefs Program. The practice of reefing platforms has gained acceptance and use over time as approximately 420 platforms have been reefed. Over 500 reefing locations and multiple reef planning areas and zones have been approved on the Gulf OCS where public and private artificial reefs have been deployed with the objective of enhancing recreational activities, increasing fish production and/or furthering research. As decommissioning continues, there remain gaps in understanding how the OCS will be influenced. Will the Gulf States continue to request the decommissioned oil and gas platforms for artificial reef material? Will the percent of decommissioned platforms used increase? How will the removal of large numbers of oil and gas structures affect the ecosystem of the GOM? Planned and ongoing studies will identify additional research gaps.

3.5 Physical Oceanography

Should renewed oil and gas interest in the Atlantic Region develop in the future, additional BOEM oceanographic studies are highly recommended. Only a few past BOEM oceanographic studies have focused on the Mid-Atlantic offshore waters, for example, and most of these studies were conducted more than a decade ago. Information from new BOEM oceanographic studies would be used by BOEM to improve the accuracy of oil spill trajectories and error estimation, as well as for producing EIS's and other NEPA documents and for management decisions. The studies, *Literature Synthesis for North and Central Atlantic,* and *Mid-Atlantic Ocean Model Calculations*, were completed in 2012. Additionally, two ongoing studies: *South Atlantic Information Resources: Data Search and Literature Synthesis* and ***E**co**S**patial **I**nformation **D**atabase – U.S. Atlantic Region*; are expected to be published in 2014. These studies will provide a review of the state of knowledge that will help guide any future studies planning and EIS's in this Region.

3.6 Social Sciences and Economics

Section 1.4.6 describes challenges facing Gulf Region social impact assessment (SIA), the three basic approaches taken to address them, and the FY 2015-2017 study profiles. This section discusses Gulf social and economic information needs more long-term.

Industry focus: As the world's most developed offshore oil province, the intensity and variability of OCS activities respond to worldwide trends in the petroleum industry, energy markets, and business practices.

The GOMR will continue efforts to define, describe, and measure OCS industry sectors that drive its onshore impacts. Service ports are vectors for many industry impacts but have proven particularly difficult to address and, currently, BOEM is engaged in limited efforts to address this issue through an annual purchase and analysis of GOM vessel movement data. Ports function as hubs of an intermodal transportation system where material destined for the OCS is transferred from inshore modes of transportation to offshore ones. Past BOEM research addressed the offshore leg of this system; planned research will address the onshore leg, with a particular emphasis on the trucking industry.

BOEM estimates of future OCS-related economic activity are based on past industry behavior. Developing and updating these data is an ongoing need. Past experience has led BOEM to a strategy that emphasizes public, commercial, and expert information sources. The approach is iterative, progressive, and assumes that most data will be pieced together or extrapolated and that each study will build on the last. The Gulf expects that it will eventually include a limited use of more burdensome collection methods (e.g., workshops, industry surveys) for data deemed critical and "good enough" estimates are unavailable.

Baseline focus: The GOMR has been reexamining questions of geographic focus. The current onshore analysis area consists of the 132 counties/parishes from Texas to the

Florida Panhandle, and these are aggregated into 13 Economic Impact Areas. The GOMR is preparing a revised version which will include 23 Economic Impact Areas built largely on the distribution and activities of oil-related industries. As part of this preparation, BOEM is conducting a study that is analyzing the regional economies of the newly proposed impact areas and their relationships to the OCS industry. One objective is to improve our understanding of the linkages between offshore activities on the OCS and onshore activities in support of the OCS. A related objective is to support BOEM economic modeling. This study will also help define longer-term information needs regarding baseline description. For example, past research will need to be updated and synthesized to reflect the modified focal areas.

Topical Focus: The DWH oil spill and its aftermath define much of the current topical focus. BOEM is winding down a study that began within days of the event and has documented socioeconomic consequences as they occurred and changed. The oil spill has raised the profile of questions related to multiple uses of the coastal environment. Along with updating baseline information, ongoing and planned research on subsistence, commercial fisheries, recreation and tourism, and environmental justice will all assess the oil spill's long-term consequences. The Gulf will also continue to pursue its systematic reexamination of standard and OCS-specific SIA topics (see NRC, 1992). Field-based research in the 1990's proved to be a powerful tool for understanding the relationships of Gulf Coast communities and families to the oil industry. Similar research is being considered that would reassess earlier findings in the light of changes to the industry that have occurred. These broader studies may identify more focused needs, such as the assessment of local-level fiscal impacts on education or health systems. The DWH oil spill is a watershed, baseline-changing event. Future study efforts must address it. Still, over decades of OCS operations, the Region's economy and society have largely adjusted to its demands and opportunities, and many typical SIA effects occur only under unusual circumstances, or not at all, or are difficult to separate from the "background noise."

BOEM
Bureau of Ocean Energy Management

CHAPTER 4
ALASKA OCS REGION

U.S. Department of the Interior
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The inclusion of studies proposed in this document does not constitute a commitment by the U.S. Department of the Interior, Bureau of Ocean Energy Management to conduct or fund any or all of the studies. The scope of the studies is subject to change prior to initiation of any work.

Any use of trade names is for description purposes only and does not constitute endorsement of these products by the Bureau of Ocean Energy Management.

SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

1.1.1 Background

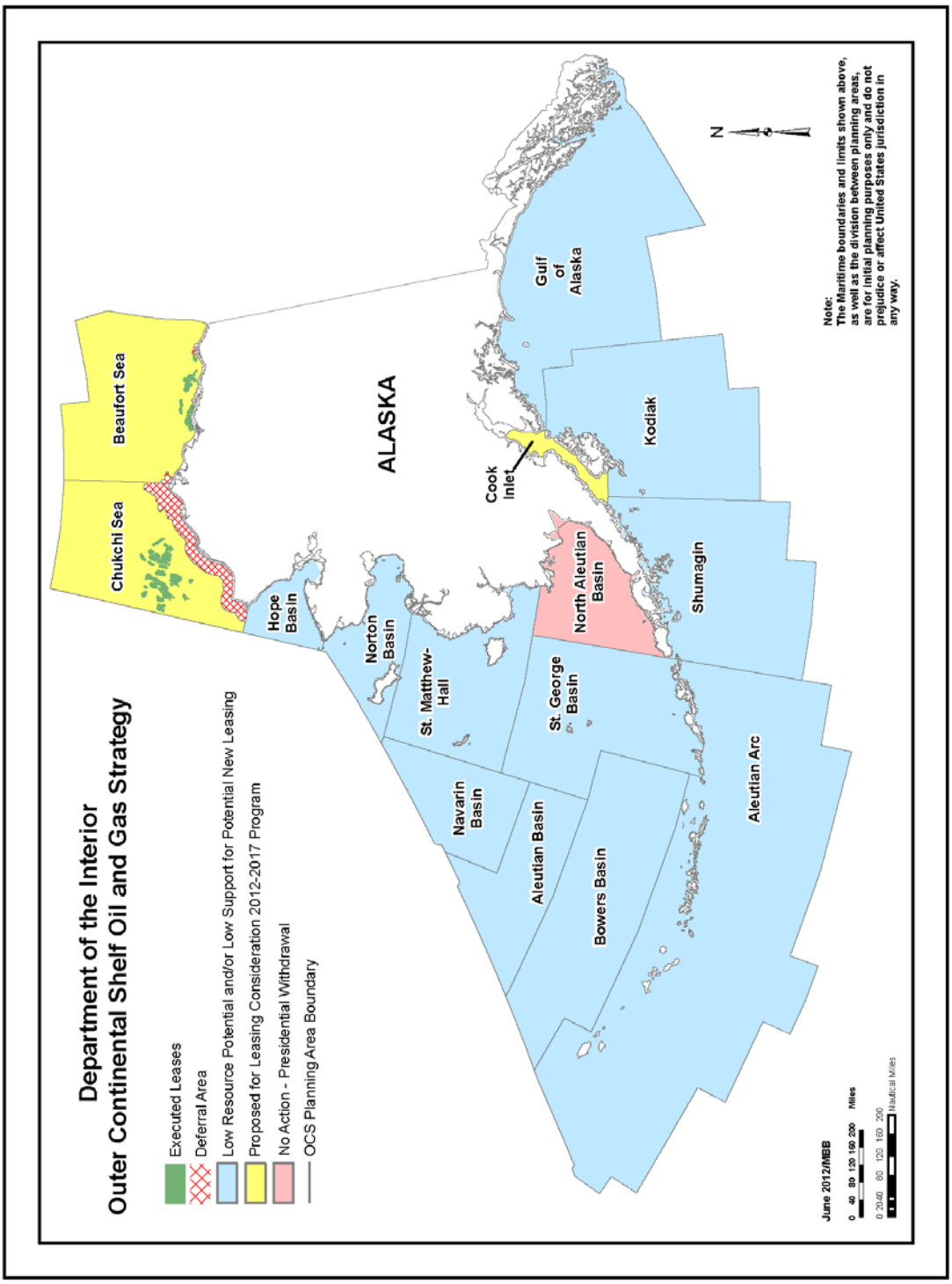
The Environmental Studies Program (ESP) of the Bureau of Ocean Energy Management was established and funded by the United States Congress to support the offshore oil and gas leasing program of the U.S. Department of the Interior (USDOI) in pursuit of national energy policies. The Environmental Studies Program was administered originally by the Bureau of Land Management (BLM) from 1973 until 1982, then by the Minerals Management Service (MMS), and presently by the Bureau of Ocean Energy Management (BOEM) since October 2011. The consistent mandate of the ESP since its inception has been to establish the scientific information used for assessment and management of potential impacts from oil and gas development on the human, marine and coastal environments of the Outer Continental Shelf (OCS). The OCS refers to 1.7 billion acres of Federal jurisdiction lands submerged under the ocean seaward of State boundaries, generally beginning three statute miles off the coastline (for most states) and extending for 200 miles. The Alaska OCS Region alone contains approximately 1 billion acres.

The Outer Continental Shelf Lands Act (OCSLA) of 1953, as amended (43 U.S.C. 1331 et seq.), provides direction for implementing an OCS oil and gas exploration and development program based on the need to balance orderly energy resource development with protection of the human, marine, and coastal environments. Also, the National Environmental Policy Act (NEPA) of 1969 requires that all Federal Agencies use a systematic, interdisciplinary approach that will ensure the integrated use of the natural and social sciences in any planning and decision-making that may have effects on the environment. Federal laws impose additional requirements on the offshore leasing process, these include the Coastal Zone Management Act; Federal Water Pollution Control Act Amendments; Marine Mammal Protection Act (MMPA); Endangered Species Act (ESA); and Marine Protection, Research and Sanctuaries Act.

The ESP operates on a national scale to assist in predicting, projecting, assessing and managing potential effects on the human, marine and coastal environments of the OCS that may be affected by oil and gas development. Lease-management decisions are enhanced when current, pertinent and timely environmental information is available. Final reports from the ESP are most directly utilized by teams of NEPA analysts within the BOEM Environmental Analysis Sections when they prepare Environmental Impact Statements (EIS's) and Environmental Assessments (EA's), and review Geological and Geophysical permit applications, Exploration Plans (EP's) and Development and Production Plans (DPP's). Of course, a wide range of scientists, stakeholders and decision-makers also make use of our study products.

Since the ESP began, the USDOI and BOEM have funded nationally more than $1 billion for environmental studies through fiscal year (FY) 2013. More than $425 million of that amount has funded studies in Alaska across 15 planning areas in the Arctic,

Figure 1. Alaska OCS Region Planning Areas



Bering Sea and Gulf of Alaska sub-regions (see Figure 1) to produce more than 500 different study reports, as well as more than 300 peer-reviewed publications since 1990. The ESP manages ongoing study projects in Alaska (currently about 50) in disciplines such as physical oceanography, air quality, fate and effects of pollutants, protected and endangered species, marine ecology, and the social sciences, including traditional knowledge. Completed study reports are posted on our website at http://www.data.boem.gov/homepg/data_center/other/espis/espisfront.asp. An alternate location for browsing Alaska Region study reports by year is http://www.boem.gov/BOEM-Newsroom/Library/Publications/Alaska-Scientific-and-Technical-Publications.aspx.

Early in the development of the program, the focus was on obtaining baseline information on the vast biological resources and physical characteristics of the Alaskan environment for pre-lease decision-making. These studies included biological surveys of marine species, basic oceanography and meteorology, and geologic and sea ice phenomena. As a broader base of information was established, it became possible to focus on more topical studies in smaller areas to answer specific questions and fill identified information needs. In addition, generic studies were initiated to examine the potential effects of oil spills on biological resources and different oil development scenarios were modeled to determine the most likely routes of transport and dispersion of oil that might affect the marine environment. The use of computer modeling techniques has been implemented to aid in the assessment of potential oil spill and other pollutant risks to the environment, and to key species such as fur seals, sea otters and endangered whales. Modeling has also been used in ecosystem studies, especially where extrapolation to other areas provided valid analysis.

As studies information has been amassed, improved focus has required greater integration of various scientific disciplines. The ESP has initiated Synthesis Meetings, Information Transfer Meetings (ITM's) and Information Update Meetings (IUM's) to gather maximum expertise and assess the status of existing information, as well as to plan the best possible approach to a study within the constraints of time and resources. As BOEM and other Federal and State agencies collect more pertinent information, BOEM funds studies to search and evaluate existing literature and data prior to initiation of field efforts. This prevents duplication of effort and saves valuable resources by focusing study efforts on the areas of greatest information need and highest usefulness. Of course, additional research coordination with groups external to BOEM occurs continuously through a variety of institutional mechanisms, as discussed in the following section.

1.1.2 Scientific Studies are Conducted in Partnership

The ESP in Alaska, through its day-to-day operations and studies planning process, works to:

- Coordinate plans and studies with other ongoing programs and research projects, both internal and external to BOEM, to assure optimal studies management and efficient use of funding resources.

- Enhance utilization of existing information.
- Enhance interdisciplinary approaches to project planning, data collection and data interpretation.

Currently, a major portion of the ESP in Alaska is conducted on a collaborative basis with an extensive range of bilateral and multilateral partnerships. The ESP in Alaska coordinates routinely on major projects with numerous Federal entities, including: National Oceanographic Partnership Program (NOPP); National Oceanic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service (NMFS) Alaska Fisheries Science Center; NOAA's National Marine Mammal Laboratory (NMML); the National Weather Service (NWS); U.S. Geological Survey (USGS)-Alaska Science Center; U.S. Fish and Wildlife Service (USFWS) and the Arctic Landscape Conservation Cooperative (LCC); USDOI Coastal Impact Assistance Program (CIAP); the North Slope Science Initiative (NSSI); National Aeronautics and Space Administration (NASA); National Science Foundation (NSF); U.S. Arctic Research Commission; and the Polar Research Board.

In addition, the ESP works directly on specific projects with the Alaska Ocean Observing System (AOOS); the North Pacific Research Board (NPRB); Alaska Department of Fish and Game (ADF&G); the North Slope Borough (NSB) Department of Wildlife Management; the Alaska Eskimo Whaling Commission (AEWC); and academic institutions including the University of Alaska Anchorage (UAA), University of Alaska Fairbanks (UAF), Woods Hole Oceanographic Institution (WHOI), University of Washington (UW), Idaho State University, and University of Texas (UT). The ESP also coordinates closely with active industry research and monitoring programs in Alaska conducted by BP, Shell Offshore Inc., ConocoPhillips, and others.

In 1993, the University of Alaska Coastal Marine Institute (CMI) was created by a cooperative agreement between the University of Alaska and the ESP to study coastal topics associated with the development of natural gas, oil and minerals in Alaska's OCS. Under this arrangement, the ESP taps the scientific expertise of regional and local experts through the University of Alaska to collect and disseminate environmental information about resource issues of mutual interest. Through the CMI, the ESP stimulates important studies in a cost-saving one-to-one match structure. Since its inception, the CMI match has come from more than 50 different organizations and has leveraged over $20 million of agency funds into $40 million worth of relevant marine-based research. During that time, the CMI program has also provided roughly 137 years of student support and completed over 80 studies. The ESP has extended the cooperative agreement through 2017. For this agreement, the Alaska OCS Region has planned $1,000,000 per year with a dollar-for-dollar match arrangement. More information about the CMI can be found at http://www.sfos.uaf.edu/cmi.

The ESP also conducts cooperative research with universities through the Cooperative Ecosystem Studies Units (CESUs). The CESUs are working partnerships among leading academic institutions, Federal, State, and non-governmental organizations. A national network of seventeen CESUs has been established, with each unit focusing on a separate biogeographic region. The goal of the CESU network is to facilitate collaboration

through the working partnerships to provide high quality research, education and technical assistance for stewardship of cultural and natural resources. BOEM currently participates in seven CESUs that encompass the State of Alaska, the Pacific Northwest, California, Hawaii and the Pacific Islands, the North Atlantic Coast, the South Atlantic Coast, and the Gulf of Mexico.

Additional linkages have been established at an international level with other arctic nations' research and regulatory entities. The U.S. and seven other arctic nations voluntarily agreed to cooperate on an Arctic Environmental Protection Strategy, which evolved into the formation of the Arctic Council in 1996. The ESP in Alaska has coordinated with Arctic Council activities, such as the Arctic Monitoring and Assessment Program, Conservation of Arctic Flora and Fauna, Arctic Climate Impact Assessment and others. The ESP provides information to these working groups through review of reports and plans, and helps to inform participants of available information sponsored by BOEM. Further, the ESP identifies and facilitates specific studies that can coordinate and integrate with working group activities.

Since the people of Alaska's remote arctic and subarctic communities rely so heavily on subsistence resources of the marine environment, they are especially concerned about industrial activities that may directly or indirectly affect hunting success or the habitats of the species important to subsistence. The people of Cook Inlet also have concerns about potential effects of OCS activities on subsistence, commercial fishing, sport fishing and tourism. Many other related issues potentially could be affected by OCS activities, such as the well-being of marine mammals and threatened and endangered species. Coastal residents of Alaska have concerns about these resources, as do State and Federal agencies responsible for their management by law.

In ESP field oriented studies, researchers typically coordinate directly with local communities to discuss their plans, seek advice and ensure that interested individuals learn about the project and its results. The ESP strives to assimilate local and traditional knowledge of Alaskan residents directly in the preparation of its study products and interpretation of results. The process of melding local and traditional knowledge varies from project to project, but the outcome of better information for decision making is a common goal.

1.1.3 Alaska OCS Studies Planning Process

In the Alaska OCS Region of BOEM, research planning is a continual process that follows a longstanding annual cycle, beginning with the distribution of the Alaska Annual Studies Plan (ASP). The ASP is distributed in autumn to more than 200 stakeholder groups across Federal, State, Native, academic, and industry sectors spanning international, regional, and local interest groups. While the ASP describes ongoing research and reveals approved new studies for the coming fiscal year, it also serves to initiate the next planning cycle by circulating a letter that calls for suggestions about new information needs from all interested parties, including scientists, stakeholders, and the general public.

In Alaska, we typically receive more than 60 study profiles from external institutions and BOEM staff with suggestions for new research. Correspondence from agencies such as NMFS, USFWS, and the State of Alaska are carefully considered; particularly those that are relevant to interagency consultations under the Endangered Species Act and other processes. Additional ideas for new research derive throughout the year from program reviews and public meetings, including science conferences, multilateral planning sessions, and public hearings. Study profiles also address recommendations from broad programmatic reviews or "data gap" analyses, such as those coming from the National Academy of Sciences, the Interagency Ocean Policy Task Force, the 2011 USGS Circular 1370, and the Arctic Council. Furthermore, we prepare and advertise a web docket every autumn to facilitate convenient public submission of study ideas for consideration. Of course, the majority of incoming proposals for new research still originate with BOEM staff and managers in the regular performance of their duties.

From these multiple sources of input, BOEM subject-matter experts assimilate the various study comments and recommendations and consolidate them into discrete study profiles. Often, this involves merging several related objectives from multiple sources into a single study effort. It also involves revising submissions to enhance mission-focus or to provide more conclusive results. Consistent with our mission, the Environmental Studies Program funds studies that have strong applicability to pending pre- and post-lease decisions under the OCS Five-Year Oil and Gas Leasing Program. The most important considerations for establishing priorities within the national context include: program relevance; timing in relation to assessment needs; feasibility and likelihood of conclusive findings; and availability of information from other sources.

After evaluation of incoming proposals for completeness and extensive internal discussions, we prepare a short-list of the high priority study profiles to be considered by regional and national senior managers. In late January, the short-list of proposed profiles, as defined by priority of information need and consideration of budgetary constraints, is shared and coordinated with other agencies through multilateral partnerships such as the North Slope Science Initiative and the Arctic Landscape Conservation Cooperative. The proposed new profiles are then formally reviewed each spring by our OCS Scientific Committee (an external peer-review advisory body) to evaluate the priority and quality of each proposed study, as well as the technical aspects of proposed study methods. The proposed profiles are again revised and reprioritized as needed, and finalized by August for funding allocation in the new fiscal year. The Annual Studies Plan is then finalized and circulated to the public in autumn, when the cycle starts all over again.

Once a research project achieves funding and gets underway, interim reports and project websites facilitate data sharing and report dissemination. When a project is complete, final study reports are posted to the BOEM website and a number of other scientific web portals to facilitate distribution. Project data are typically delivered to the National Oceanographic Data Center (NODC) and to customized project websites. The Environmental Studies Program is also developing new platforms for enhanced data sharing with all stakeholders. Thus, from start to finish, the entire planning,

procurement, and dissemination process involves constant coordination with multiple organizations and scientific entities.

1.1.4 Issues To Be Addressed

The *Alaska Studies Development Plan FY 2015-2017* complements and reinforces the goals of the Environmental Studies Program. The ESP is guided by several broad themes, which include:

- Monitoring Marine Environments
- Conducting Oil-Spill Fate and Effects Research
- Minimizing Impacts to Marine Mammals and Other Biota
- Understanding Social and Economic Impacts
- Maintaining Efficient and Effective Information Management
- Integrating Scientific Results with Local and Traditional Ecological Knowledge

To be responsive to current and future offshore activities and changing technologies, the Alaska OCS Region continually proposes new studies and pursues information needs in conjunction with ESP goals. Due to the great differences that exist between Alaskan environments and other OCS areas, the ESP in Alaska must remain especially flexible in planning and implementing needed studies.

At each step of the offshore leasing, exploration and development process, a variety of potential issues or resource-use conflicts may be encountered. Two questions are fundamental:

- What is the expected change in the human, marine and coastal environment due to offshore activity?
- Can undesirable change be minimized through mitigation measures?

Environmental studies are the primary means to provide information on these questions for use by decision-makers. Currently the ESP in Alaska has primary focus on upcoming lease sales, as well as planned and proposed exploration activities in the Beaufort Sea and Chukchi Sea Planning Areas. Offshore oil and gas-related issues addressed by ongoing and proposed studies in the Beaufort and Chukchi Seas include, but are not limited to:

- What refinements can we make to our knowledge of major oceanographic and meteorological processes and how they influence the human, marine and coastal environment?
- What role will currents play in distribution of anthropogenic pollutants near exploration and development prospects?
- What long-term changes in heavy metal and hydrocarbon levels may occur near exploration and development prospects, or regionally along the Beaufort and Chukchi coasts?

- How do we improve our model predictions of the fate of potential oil spills?
- If oil is spilled in broken ice, what will its fate be?
- What effects might pipeline construction have on nearby marine communities or organisms?
- What changes might occur in sensitive benthic communities such as the Stefansson Sound "Boulder Patch," and other Beaufort Sea kelp communities or fish habitats?
- What are the current spatial and temporal use patterns of these planning areas by potentially sensitive species such as bowhead whales, polar bears, other marine mammals, seabirds and other birds, or fish?
- What is the extent of endangered whale feeding in future proposed or potential lease sale areas?
- What changes might occur in habitat use, distribution, abundance, movement or health of potentially sensitive key species such as bowhead whales, polar bears, other marine mammals, seabirds and other birds, or fish?
- What interactions between human activities and the physical environment, including noise, have affected potentially sensitive species?
- What changes might occur in socioeconomics and subsistence lifestyles of coastal Alaska communities?
- What are current patterns of subsistence harvest, distribution and consumption and what changes might occur in key social indicators as a result of offshore exploration and development?
- How can we continue to integrate local and/or traditional knowledge into studies related to the ESP in Alaska?

Many of these same issues are also relevant to the Cook Inlet Planning Area. Some additional concerns in Cook Inlet include:

- What are the potential effects of oil exploration and development on key economic activities such as commercial fishing, sport fishing, and tourism?
- How do we improve our model predictions of the fate of potential oil spills in locations with extensive intertidal areas?
- What are the current spatial and temporal use patterns of this planning area by potentially sensitive species such as beluga whales, fin whales, Steller sea lions, sea otters, other marine mammals, seabirds and other birds, or fish?

1.2 Projected OCS Activities

This *Alaska Studies Development Plan* reflects consideration of the many changes occurring in the Alaska OCS Region, as well as anticipated needs for the future. In a frontier region such as the Arctic, planning lead-time is necessary to conduct adequate environmental studies. Challenges include: large and remote planning areas, diverse

and extreme environmental conditions, still-evolving hydrocarbon extraction technology, and potential environmental hazards associated with offshore activities.

1.2.1 Pre-lease Considerations

Preparation of an EIS based on the best available information is an essential part of the pre-lease process and ensures that decisions on whether to make areas of the OCS available for leasing are based on consideration of potential environmental impacts. This introduces an additional time-sensitivity to the information need. Although much relevant information exists for certain Alaska OCS lease areas, data are sparse in other areas and environmental and other conditions are changing over time. Updating past studies to address information needs and changing conditions can substantially improve the quality of the information upon which our environmental analyses are based and help facilitate informed leasing decisions.

On June 28, 2012, BOEM released the *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017* (USDOI, BOEM, 2012). This Proposed Final Program schedules three potential lease sales in the Alaska OCS. These potential lease sales are deliberately scheduled late in the program to allow for further development of scientific information regarding the sensitive habitats, unique conditions and important other uses, including subsistence hunting and fishing, as well as the oil and gas resource potential in these areas. The first potential sale is scheduled for 2016 in the Chukchi Sea Planning Area (see Figure 2). The *Proposed Final Program* includes a pre-existing 25-mile nearshore buffer and an additional deferral area to the north of Barrow that will not be considered for leasing due to its documented importance for subsistence use. Another sale is proposed for 2017 in the Beaufort Sea Planning Area (see Figure 3). Two subsistence whaling areas near Barrow and Kaktovik will be excluded from this lease sale. Also, the *Proposed Final Program* includes a sale in the Cook Inlet Planning Area (see Figure 4) in 2016. BOEM has determined that the scope of potential industry interest is sufficient to warrant completion of a full environmental impact statement prior to making a final determination about the lease sale. Historically, industry interest in this area was limited and environmental analysis must be updated for the proposed sale.

1.2.2 Post-lease Considerations

Prior to FY 1982, most studies offshore of Alaska were planned, conducted, and concluded before a lease sale was held in order to provide information for decision making and EIS production. However, not all needed information can be obtained prior to a lease sale. In accordance with mandates of Section 20 of the OCS Lands Act, the need for studies continues into the post-lease period to address environmental concerns and monitoring related to specific areas of industry activity. The ESP acquires additional information for environmental analyses related to exploration, development and production in the post-lease phase. Thus, an increasing number of studies have become more closely related to proposed exploration and development schedules and related monitoring in addition to those broader studies related to the pre-lease stage. As with the pre-lease stage, the wide range of environmental conditions from Cook Inlet to the Arctic is considered during the process of formulating new studies. Post-lease activities that require environmental data and assessment include:

Figure 2. Chukchi Sea Oil and Gas Leases

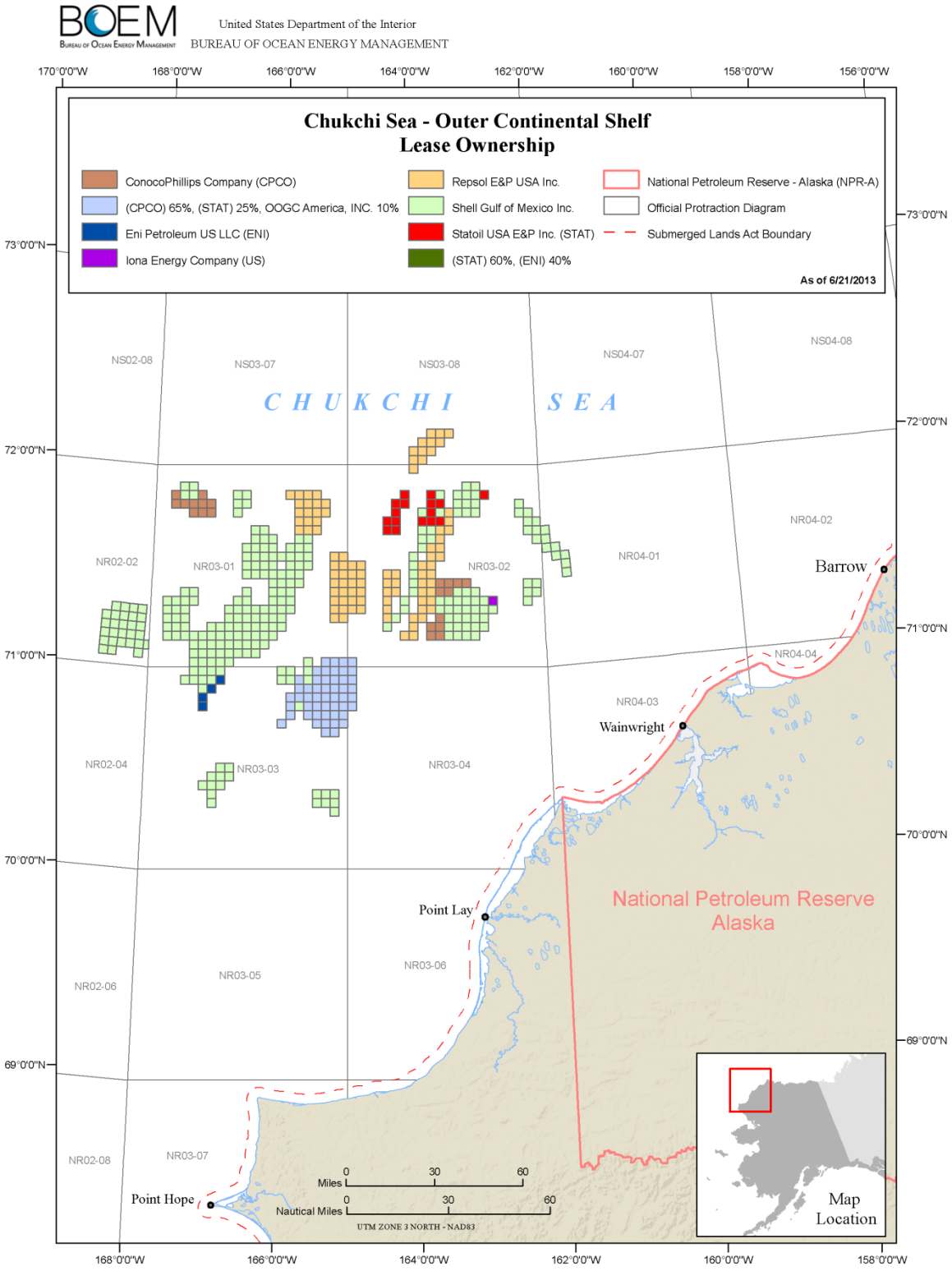


Figure 3. Beaufort Sea Oil and Gas Leases

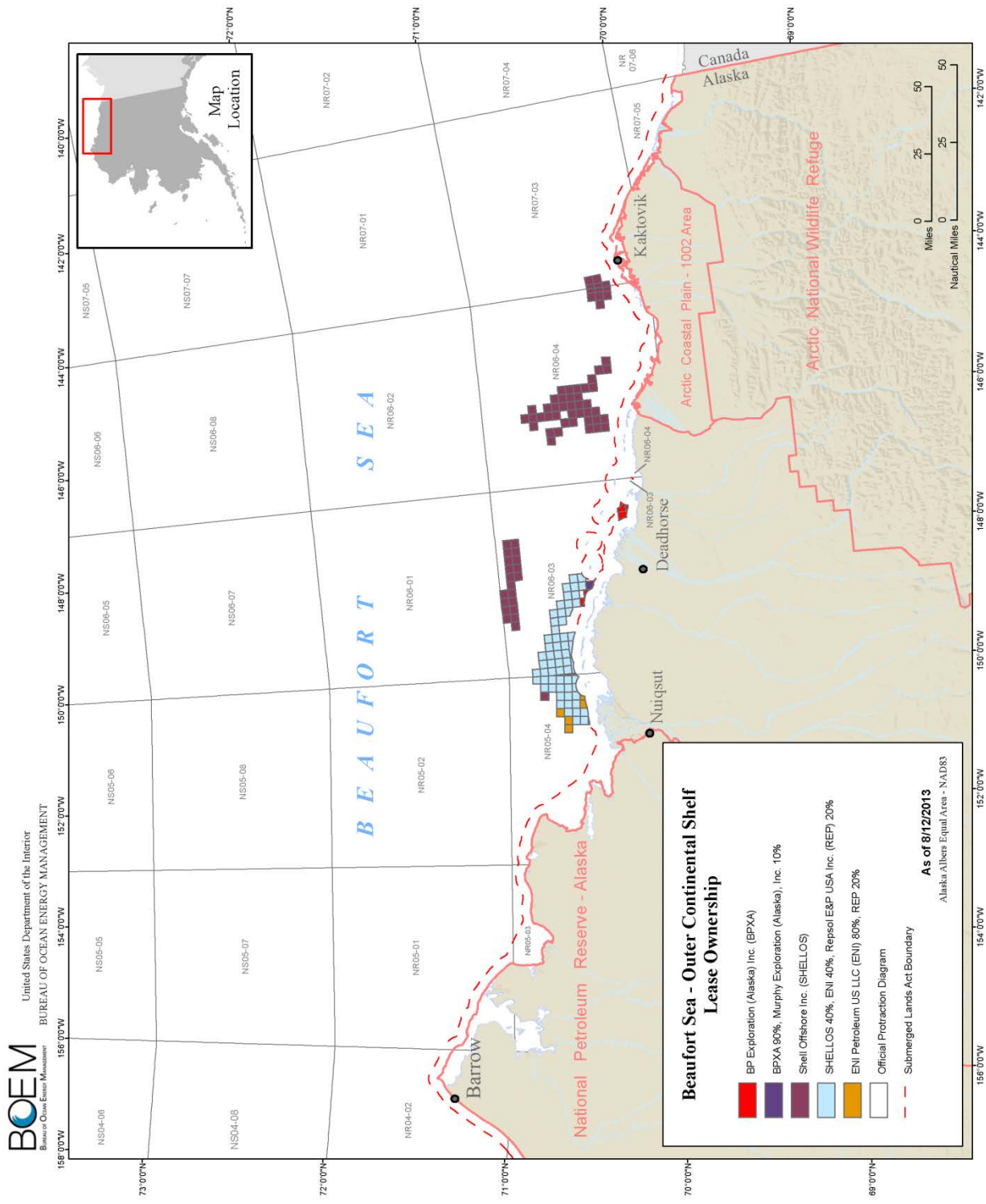
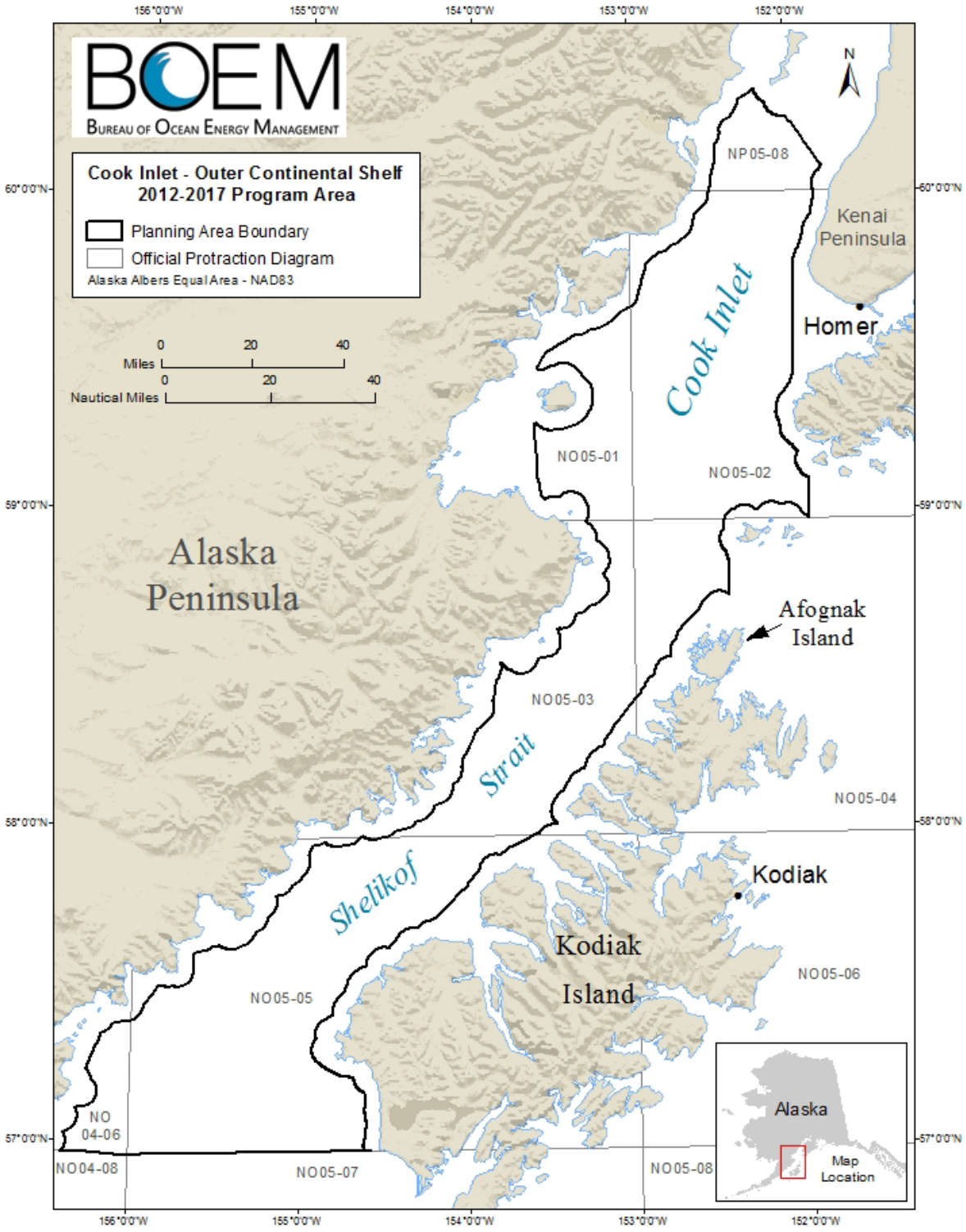


Figure 4. Cook Inlet Planning Area



- Geophysical surveys
- Review of Exploration Plans (EP's)
- Monitoring of exploration drilling Review of Development and Production Plans (DPP's)
- Monitoring of development, construction and production activities
- Oil and gas transportation
- Platform decommissioning
- Oil spill detection, containment, clean-up and damage assessment

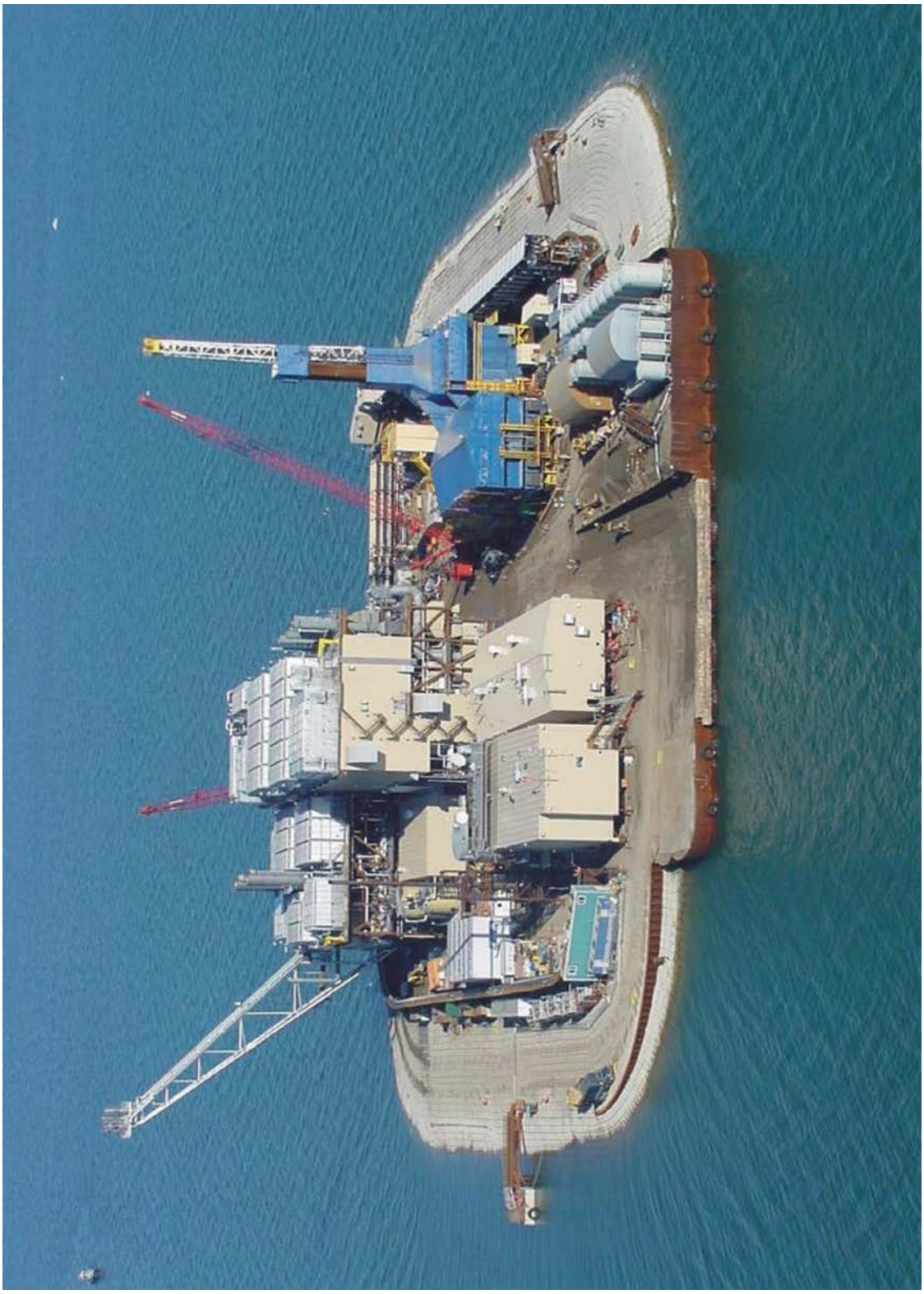
In the Beaufort Sea Planning Area, there have been 929 tracts leased in ten OCS lease sales. Industry has drilled 30 exploratory wells and determined 11 to be producible. Lease Sale 193 in February 2008 resulted in 487 leases being issued in the Chukchi Sea Planning Area. As of February 2014, there are 147 active leases in the Beaufort Federal offshore area and 460 active leases in the Chukchi Sea. There are no active leases from previous lease sales in the Chukchi Sea or Hope Basin portions of the Arctic Subregion or in the Bering Sea, Cook Inlet or Gulf of Alaska Subregions.

Production:
Northstar – Northstar (see Figure 5) is a joint Federal/State of Alaska unit located in State waters in the Beaufort Sea about 6 miles northwest of Prudhoe Bay. BP Exploration Alaska, Inc. (BPXA) is the lessee and operator of Northstar. The six producing Federal wells fall under Bureau of Safety and Environmental Enforcement (BSEE) regulatory authority, the State wells fall under the State's oversight. Production started in 2001 and peaked in 2004. Total production of crude oil through January 2014 is nearly 160 million barrels, with the Federal portion comprising about 28.5 million barrels.

Development:
Liberty – The Liberty prospect is located in the central Beaufort Sea about 6 miles east of the existing Endicott Satellite Drilling Island (SDI). BPXA is considering development options, including potential construction of a gravel island. BPXA estimates that the reserves for the Liberty project total 150 million barrels of oil.

Exploration:
Conditionally Approved Exploration Plan for Camden Bay (Beaufort Sea) – Shell plans to drill up to four exploration wells in the Beaufort Sea over multiple years. The wells will be located about 20 miles offshore, in waters approximately 120 feet deep. BOEM approved the Beaufort Sea EP subject to 11 conditions on August 4, 2011. The conditions included requirements for Shell to receive specific permits and authorizations from the EPA, NMFS and USFWS. The conditions also included requirements that Shell submit documentation for approval on the procedures for deployment, installation and operation of the subsea well-capping and containment system, as well as relief well plans. Under the conditions of the plan, Shell must employ an approved, site-specific bowhead whale monitoring program, beginning on August 1. Shell must also suspend any drilling operations in the Beaufort Sea from August 25 until nearby Alaska Native villages have completed their subsistence hunts and Shell has received approval from BOEM to resume

Figure 5. Northstar Island, August 2000



activity. During 2012, Shell completed the top hole section of one well at its Sivulliq Prospect in the Beaufort Sea. Due to problems encountered with towing their drill rig out of Alaska in December 2012, Shell did not return in 2013, but they have expressed interest in continuing their exploration in the Beaufort Sea.

Conditionally Approved Exploration Plan for the Chukchi Sea – Shell proposes drilling up to six exploration wells in the Chukchi Sea over multiple years. The wells will be located about 85 miles northwest of the coastal village of Wainwright, in waters approximately 140 feet deep. On December 16, 2011, BOEM approved the Chukchi Sea EP subject to 15 conditions. Among the conditions of approval is a measure designed to mitigate the risk of an end-of-season oil spill by requiring Shell to leave sufficient time for response and cleanup. Consistent with the Department's cautious approach to offshore oil and gas exploration in the Arctic, Shell was directed to cease drilling into hydrocarbon zones in the Chukchi Sea 38 days before the earliest anticipated date of ice encroachment. Approval is also conditioned on a series of other measures to increase safety and confirm the availability of response equipment, including a well capping and containment system, and to ensure that Shell takes important steps to avoid conflicts with subsistence activities. Approval to operate is also conditioned upon receipt of necessary approvals from other agencies, including BSEE. During 2012, Shell completed the top hole section of one well at its Burger Prospect in the Chukchi Sea. Due to problems encountered with towing their drill rig out of Alaska in December 2012, Shell did not return in 2013, but they have expressed interest in continuing their exploration in the Chukchi Sea.

Air Quality: The Consolidated Appropriations Act of 2012 transferred jurisdiction to regulate air emissions associated with oil and gas activities on portions of the Alaska OCS from EPA to BOEM. Companies seeking to operate facilities on the Chukchi Sea OCS and Beaufort Sea OCS no longer require an air quality permit from the EPA. Rather, their proposed facilities' emissions will be verified by BOEM as a prerequisite to approval of the operator's exploration plan or development and production plan. BOEM's existing regulations are designed to ensure that air quality in coastal areas complies with national ambient air quality standards as promulgated by EPA. These regulations have protected air quality in coastal states along the Gulf of Mexico for decades and were also used to regulate oil and gas exploration activities in the Arctic during the 1980's.

Legal Challenges: Litigation remains a factor for Alaska OCS activities. Currently, there are two active cases.

Native Village of Point Hope v. Jewell (Sale 193). In January 2008, a coalition of environmental groups, a local government, a Federally recognized tribe, and an Alaska Native organization challenged the government's decision to hold Lease Sale 193, which offered tracts in the Chukchi Sea. The plaintiffs alleged inadequacies in the environmental reviews supporting the leasing decision. On July 21, 2010, the U.S. District Court for the District of Alaska issued an order that enjoined all activity under Lease Sale 193 and remanded the action back to the government for additional NEPA review. Specifically, the Court instructed the government to: (1) analyze the environmental impact of natural gas development; (2) determine whether missing

information identified in the Sale 193 Final EIS was essential or relevant under 40 CFR 1502.22; and (3) determine whether the cost of obtaining the missing information was exorbitant, or the means of doing so unknown. BOEMRE (now BOEM) prepared a Final Supplemental EIS to satisfy these three concerns, and on October 3, 2011, the Secretary of the Interior signed a Record of Decision that affirmed Sale 193 as held. On February 13, 2012, finding that BOEM had satisfied its remand, the District Court entered an order dismissing the matter in its entirety. On April 12, 2012, Plaintiffs filed a Notice of Appeal.

The Ninth Circuit Court of Appeals heard oral arguments on March 5, 2013. On January 22, 2014, the U.S. Court of Appeals for the Ninth Circuit released a published opinion which (1) upheld BOEM's treatment of incomplete or unavailable information in the Lease Sale 193 SEIS, and (2) concluded that reliance in the final environmental impact statement (FEIS) on a one billion barrel development scenario was arbitrary and capricious. As a result, the court reversed and remanded the case back to the district court for further proceedings consistent with the opinion. The Solicitor's office is reviewing the opinion.

Center for Sustainable Economy v. Salazar. In October 2012, a non-profit organization filed a petition in the U.S. Court of Appeals for the District of Columbia Circuit challenging the *Proposed Final Program for 2012-2017*. Based on its subsequent filings, the petitioner is expected to assert violations of the Outer Continental Shelf Lands Act, the National Environmental Policy Act, and the Administrative Procedures Act. Arguments will likely focus on BOEM's economic and environmental analysis.

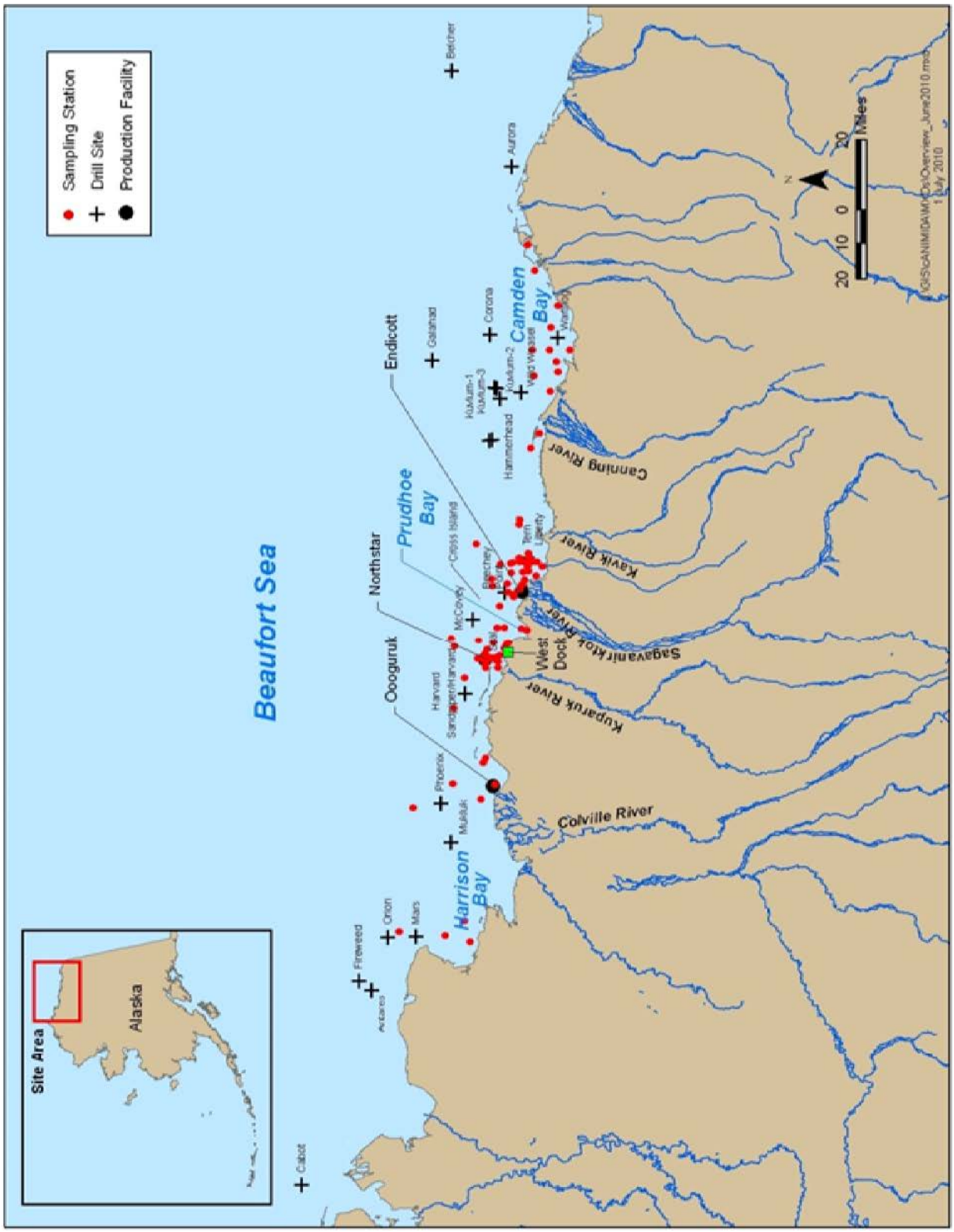
1.3 Identification of Information Needs

1.3.1 Beaufort Sea General Information Needs

Both offshore and onshore oil and gas development and production activities are continuing across Alaska's North Slope. Residents of Nuiqsut, Kaktovik and Barrow are particularly concerned about long-term effects of offshore developments at Northstar and other possible developments, as well as long-term and cumulative effects of any exploration from OCS Beaufort Sea lease sales. Key constituents have identified the need to monitor under-ice currents, sedimentation and potential effects on social systems in the vicinity of Northstar and Liberty, as well as other potential offshore activities. Related questions that need to be addressed include the characteristics of major oceanographic and meteorological processes and how they influence the human, marine and coastal environment.

Interdependent Physical, Biological and Social Processes: The Alaska OCS Region has a long history of supporting multidisciplinary research, beginning with the "Outer Continental Shelf Environmental Assessment Program" (OCSEAP) surveys conducted between the 1970's and early 1990's and the "Beaufort Sea Monitoring Program" (BSMP) in the 1980's. The "Arctic Nearshore Impact Monitoring in Development Area" (ANIMIDA) program and its continuation (cANIMIDA) started in 1999 to provide baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites (see Figure 6). This work continues today with the studies "ANIMIDA III: Boulder Patch

Figure 6. Locations of sampling stations for the cANIMIDA Program. (Neff, 2010)



and Other Kelp Communities in the Development Area," begun in 2012, and the recently awarded "ANIMIDA III: Contaminants, Sources, and Bioaccumulation," which has been expanded to include Camden Bay.

In addition to the ongoing need for integrated research programs, there is also a need for synthesis of results from multiple studies to facilitate interpretation of data across disciplines. The ongoing "Synthesis of Arctic Research" (SOAR) study brings together a multidisciplinary group of Arctic scientists and Alaskan coastal community representatives to explore and integrate information from completed and ongoing marine research in the northern Bering, Chukchi and Beaufort seas. A number of ongoing studies also take an integrated approach to examining the interdependence of physical, biological and social processes and filling identified information needs across the various disciplines. Highlights of these and other important research projects are provided in Section 1.3.5.

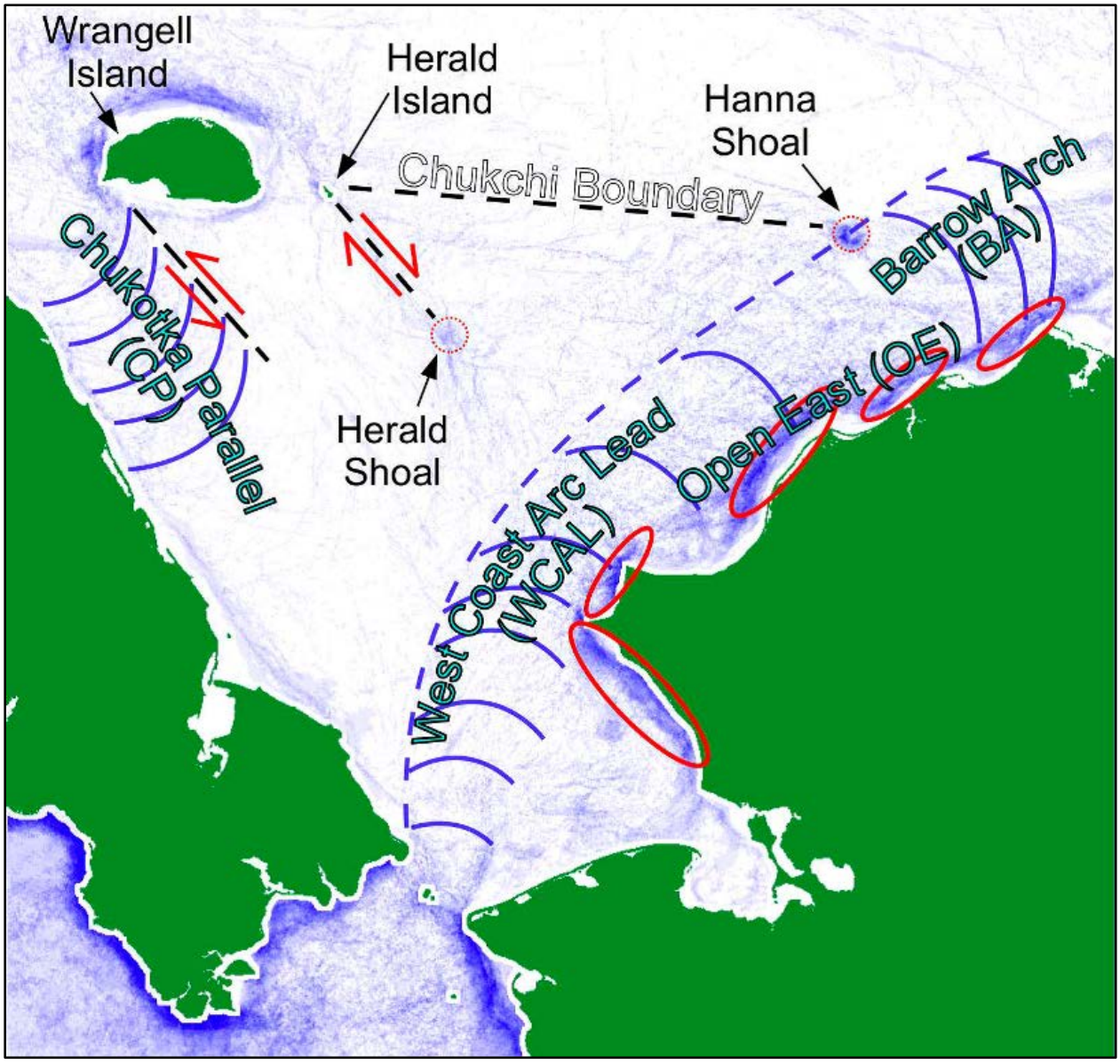
Ocean Circulation and Sea Ice: Accurate information on surface wind fields, ocean currents, and sea ice is important for determining the fate of spilled oil in this region and the potential impacts on biota associated with these systems. Studies conducted by the Alaska OCS Region have demonstrated that water motion is very different under landfast ice than in adjoining open or pack-ice areas. It becomes very important to know locations and seasonal changes in the distribution of polynyas, leads, and landfast ice. Figure 7 shows a schematic of key sea ice lead patterns sketched onto a map of recurrence probability estimates in the Chukchi Sea computed for the month of April between 1993 and 2010. Information about ice gouge characteristics and recurrence rates is also needed to assess risks associated with burial of oil production pipelines to support BOEM's fault tree modeling.

Air Quality: The transfer to BOEM of authority to regulate industrial emissions in OCS areas of the Beaufort and Chukchi seas necessitates increased focus on Arctic OCS air quality considerations. Arctic oil and gas exploration and extraction activities proposed for the OCS require environmental evaluations pursuant to the National Environmental Policy Act and air quality operating approval to comply with the impact analysis required under NEPA and the Clean Air Act. Information will be used to assess the cumulative air quality impact of off-shore Arctic oil and gas activity, including oil spill response equipment and associated support equipment not already accounted for through State and Federal air quality permit requirements. The recently awarded study "Arctic Air Quality Impact Assessment Modeling" will compile a dataset of emission sources that will be used to drive EPA-approved air quality models.

Pollutants: North Slope residents are concerned about potential contamination of their food supply. In the Beaufort Sea such foods include bowhead whales, seals, waterfowl and fish. Of particular concern are environmental effects of development on these biota, including those from potential oil spills. Up-to-date information on ocean currents and sea ice is necessary to fully address these concerns. Contaminant monitoring in biota and sediments is ongoing in both the Beaufort and Chukchi seas.

Concern has also been raised over increasing spillage from corroded pipelines on the North Slope. The ongoing study "Oil Spill Occurrence Estimators for Onshore Alaska

Figure 7. Schematic of sea ice lead patterns sketched onto a map of recurrence probability in the Chukchi Sea for the month of April. (Mahoney et al. 2012)



North Slope Crude and Refined Oil Spills" will update spill data for the Alaska North Slope and estimate occurrence rates for onshore oil spills. Information on the fate (weathering) of oil spills has recently been examined as part of a joint industry consortium (Oil in Ice JIP [Joint Industry Program]) doing field experiments on cleanup, behavior, and weathering of oil in broken ice. The study "Physical and Chemical Analysis of Crude and Refined Oils: Lab and Mesoscale Oil Weathering," proposed for FY 2014, will conduct laboratory and mesoscale oil weathering tests on a number of Alaskan crude or condensate oils, as well as refined oils.

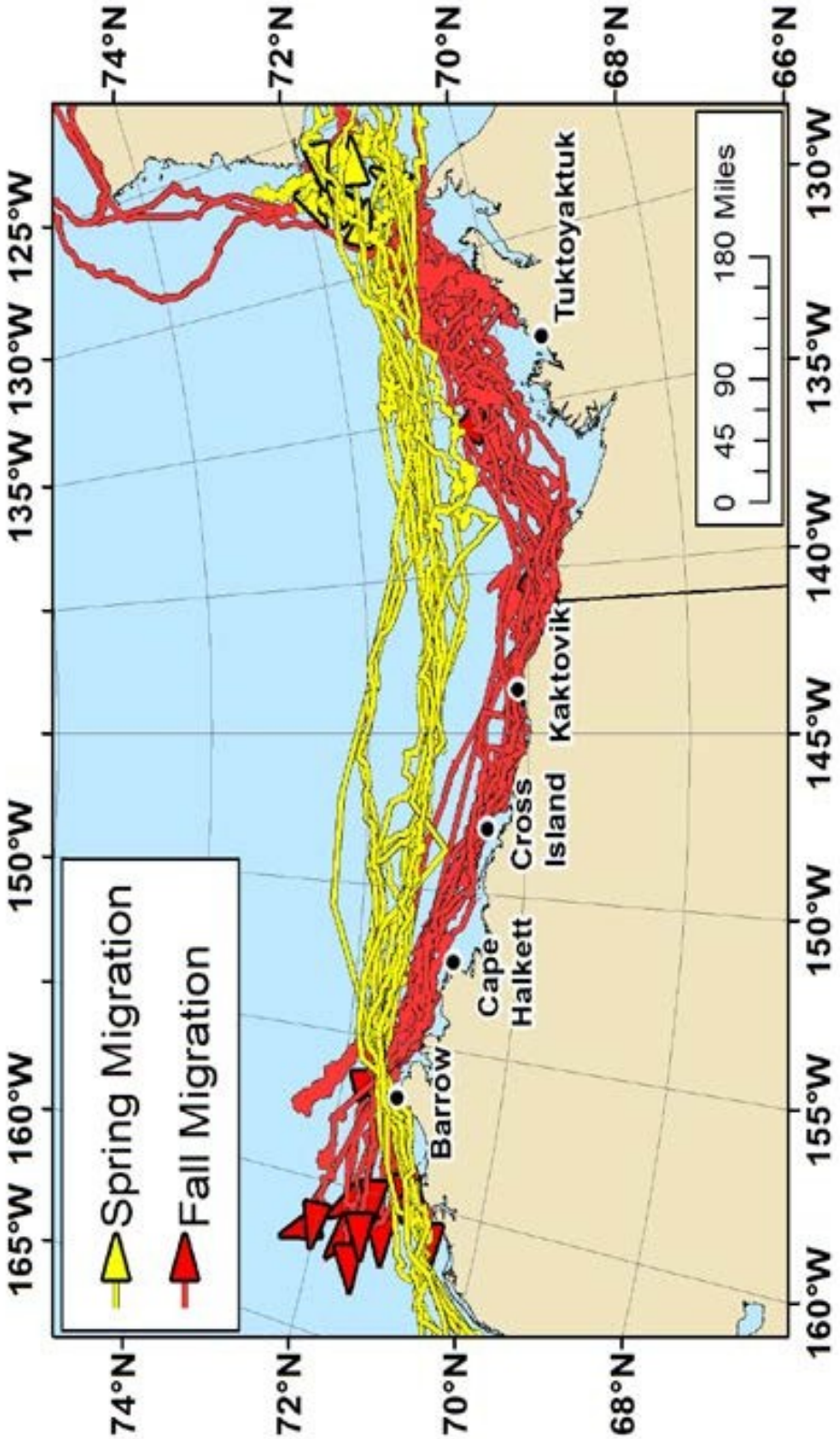
Information on Bowhead Whales and Other Wildlife: The Iñupiat rely heavily on bowhead whales for subsistence. The bowhead whale is central to village cultural and spiritual life. Whale hunters have reported that migrating bowhead whales deflect from their normal migratory route well upstream of active industry vessels and may divert a great distance from their migration route. A concern is that deflection around oil and gas activity (including seismic surveys, drilling activity and associated icebreaker support) makes whales skittish and more difficult to hunt. Figure 8 depicts a synthesis of tracks from satellite-tagged bowhead whales during the spring and fall migrations showing that spring migration occurs farther from shore than in fall. A total of 57 bowheads were tagged between 2006 and 2010. Information about bowhead feeding and habitat use is needed, and it is important to assess the factors that may be affecting the habitat use, health, population status and migration routes of bowhead whales. Noise from industrial activity is a central concern. Additionally, Iñupiat whale hunters and the scientific community have raised concerns about potential cumulative impacts on bowhead whales.

The populations of bowhead whales, polar bears, spectacled eiders, spotted and ringed seals, and other threatened and endangered species, as well as candidate species such as walruses and some ice seals, are an ongoing concern. Potential effects from loss of sea ice are a particular concern. More comprehensive abundance estimates for these ice-associated marine mammals enhance the assessment of potential impacts under NEPA and to ensure compliance with Federal management and regulatory mandates for marine mammals under the MMPA. North Slope villages are also concerned about potential disturbance of beluga whales, ringed seals, waterfowl and other subsistence-wildlife species by oil and gas activities such as helicopter overflights.

Fish and Lower Trophic Communities: Fishes in the Beaufort and Chukchi seas fill an essential role in the Arctic ecosystem by consuming small prey and in turn providing a food resource for larger fishes, birds, marine mammals, and people. It is important to assess the distribution and abundance of fishes in these areas and to distinguish between changes due to anthropogenic and natural effects. In addition, assemblages and populations of fish and benthic organisms in marine ecosystems off Alaska have undergone observable regime-shifts in diversity and abundance over the last 20-30 years.

The Magnuson-Stevens Fishery Conservation and Management Act is the Federal law that governs U.S. marine fisheries management for all outer continental shelf waters. Under the Magnuson-Stevens Act, each fishery management plan must describe and identify Essential Fish Habitat (EFH) for the fishery, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other actions to encourage the

Figure 8. Tracks from satellite-tagged bowhead whales during the spring and fall migrations (Quakenbush et al. 2012)



conservation and enhancement of EFH. BOEM and other Federal agencies must consult with NMFS regarding any action that may adversely affect EFH. BOEM engages in consultation with NMFS officials and EFH assessment related to adult and late juvenile life-stages of a number of species, including Arctic cod, Pacific salmon, and saffron cod.

Alaska Native Culture: The Iñupiat report in public testimony that their culture is vulnerable to short-term, long-term and cumulative effects from OCS activities. They are concerned that OCS activities might lead to:

- Social disruption and a change in cultural values through population shifts (immigration of large numbers of non-Iñupiat to the North Slope)
- Employment changes (potential effects on subsistence way of life by a cash economy)
- Cumulative effects of multiple industrial activities, alteration of subsistence-harvest patterns and displacement of hunters and subsistence resources

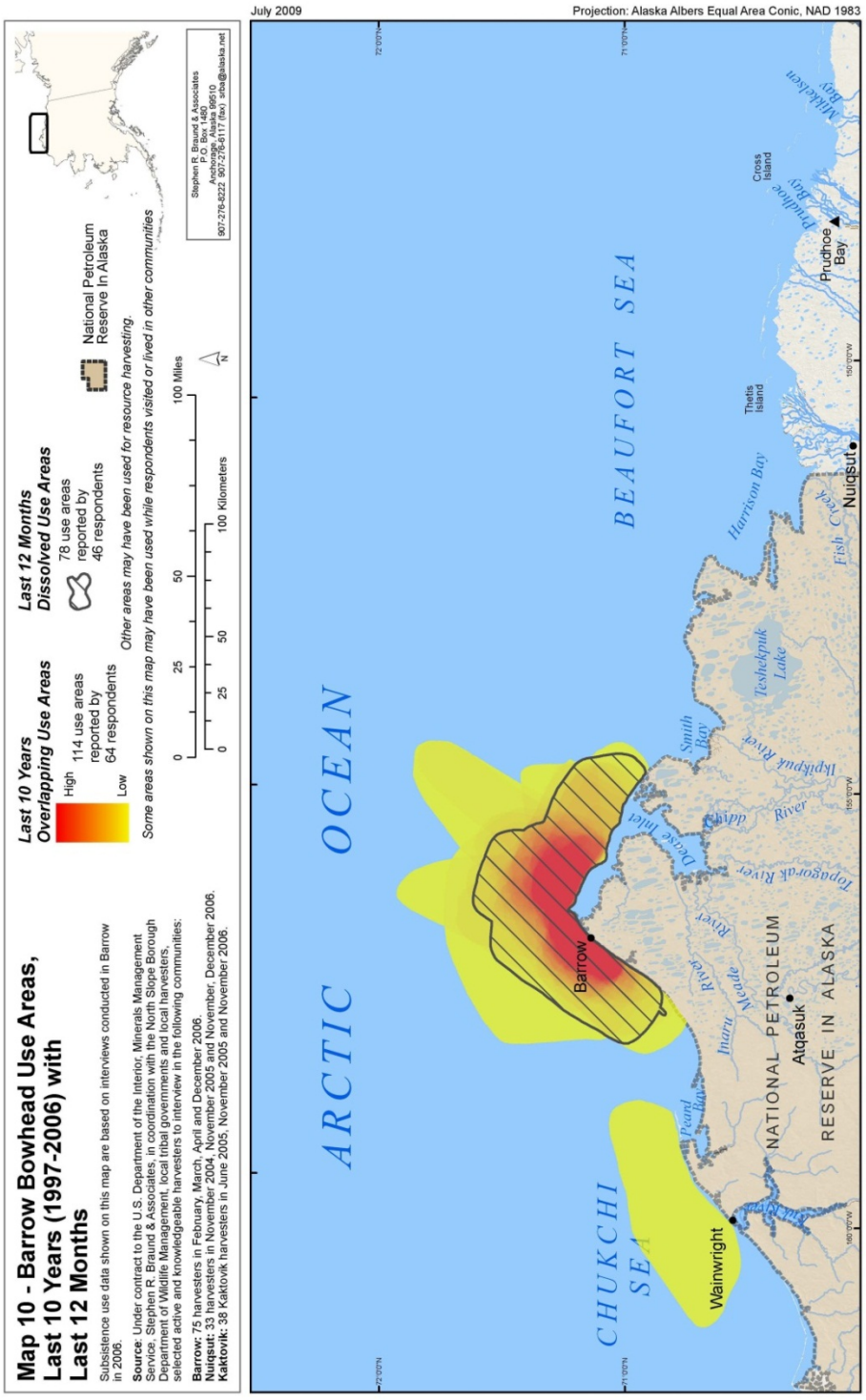
There is an ongoing need to monitor key indicators of socioeconomic and cultural changes on the North Slope. The Iñupiat rely on a wide variety of marine resources as significant sources of food. In addition, the harvesting, sharing and consuming of subsistence resources form an important part of the traditional Iñupiaq culture and spiritual life. People are concerned that a temporary or permanent elimination of primary subsistence foods would cause North Slope residents either to shift to less desired subsistence resources or to replace subsistence foods with expensive western foods. Figure 9 provides an example of a synthesis map depicting bowhead whale subsistence hunting areas near Barrow over time. The Iñupiat are concerned about mitigation of impacts and compensation for potential losses. An anticipated decline in oil revenues to the NSB is also an issue of concern. Another concern is the use of local and traditional knowledge in analysis of potential environmental effects. We continue to seek and include firsthand knowledge of local subsistence hunters to enhance the scientific knowledge base.

Archaeological Resources: The archaeological significance of offshore areas has been recognized in recent years and marine archaeological studies have been showing the presence of prehistoric sites on the shelves beneath the modern ocean. Basic information and analysis is needed for assessments of archaeology potential in the Beaufort and Chukchi seas to support the National Historic Preservation Act and NEPA review. Data are very limited in the Chukchi Sea, and the last baseline study in the Beaufort Sea is decades old.

1.3.2 Chukchi Sea General Information Needs

The fundamental issues in the Chukchi Sea are very similar to those in the Beaufort Sea (see Section 1.3.1), although many species that regularly appear within the Chukchi Sea are not typically found within the Beaufort Sea. One major difference is that USDOI placed less emphasis on studying the Chukchi Sea than the Beaufort Sea beginning in the mid-1990's in recognition of leasing priorities at the time. Since 2007, however, the Alaska OCS Region has developed a new suite of studies in the Chukchi Sea, leveraging

Figure 9. A synthesis map depicting bowhead whale subsistence hunting use areas for the community of Barrow over time. (Stephen R. Braund & Associates, 2009)



more than $65 million (through FY 2013) to conduct interim baseline research and monitoring in all the following fields of interest: meteorology, ice dynamics and basic oceanography, benthic fauna and sedimentation, marine mammals (including whales, walrus, seals, and polar bear), fish, birds, and social systems. Most of the projects exhibit complex, multilateral collaborations, with explicit inter-disciplinary linkages between the physical and biological sciences, and many of them also provide a role for active participation by Alaska Native residents and input from sources of traditional knowledge. Most of them pursue multi-year data collection efforts on a regional scale, with careful attention to inter-annual variability and ecosystem processes.

1.3.3 Cook Inlet General Information Needs

The Alaska OCS Region has not undertaken a thorough environmental analysis of the Cook Inlet Planning Area since 2003. Updated information about the physical and biological environment in Cook Inlet and Shelikof Strait is needed to support NEPA analysis for potential future lease sales in this area. Specific information needs in Cook Inlet include, but are not limited to:

- An improved understanding of circulation and water mass movement in lower Cook Inlet
- Assessment of variability and long-term trends in oceanographic conditions and biological communities
- Use of the area by sensitive species including cetaceans, sea otters, pinnipeds, and seabirds

1.3.4 Renewable Energy General Information Needs

Section 388 of the Energy Policy Act of 2005 amended the OCSLA to give discretionary authority to BOEM to issue leases, easements or rights-of-way on the OCS for alternative energy projects, such as wind, wave, or ocean current facilities. Under this authority, the areas that BOEM makes available for alternative energy leasing are likely to be determined through a process that assesses different types of alternative energy resources, anticipated and potential environmental impacts, and other relevant information on a national, regional, or local basis. No lease sales for renewable energy are currently planned for the Alaska OCS.

1.3.5 Current Keystone Studies

Integrated Multidisciplinary Studies:
Hanna Shoal Ecosystem Study: This study continues the ecological monitoring of the Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA): Chemistry and Benthos (CAB) study and extends it to the region of Hanna Shoal. The study also will document the circulation and density fields, as well as ice conditions, at Hanna Shoal and examine important chemical, physical and biological interactions with the unique ecological regime in this highly productive area.

U.S.-Canada Transboundary Fish and Lower Trophic Communities: In collaboration with the Department of Fisheries and Oceans Canada, this partnership with UAF will document baseline fish and invertebrate species presence, abundance, distribution and biomass in the U.S. and Canadian Beaufort Sea. The hydrographic structure of the eastern Beaufort shelf also will be documented to provide enhanced understanding of the effects of habitat variables such as temperature and salinity on species distributions under different climate conditions.

COMIDA: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic: This study documents the general presence of bowhead, right, fin, gray, and other baleen whales in areas of potential seismic, drilling, construction, and production activities. Data will be useful for estimating temporal limits and formulating designs of mitigation for such activities. The study funds the fabrication and deployment of arrays of long-term acoustic recorders that are capable of continuous year-round recording. The recently awarded three-year study "Chukchi Acoustics, Oceanography and Zooplankton (CHAOZ): Hanna Shoal" will extend this monitoring to the area of Hanna Shoal.

Synthesis of Arctic Research: Between the years 2005 and 2015 BOEM will have invested more than $50 million in marine mammal and related oceanographic studies in the western Arctic. These data serve to increase our ecosystem knowledge about the region considerably, but interpretation will be complicated by concurrent environmental changes. This study will conduct a synthesis of multidisciplinary marine science information in the northern Bering, Chukchi and Beaufort seas from recent and ongoing research conducted by BOEM, as well as other Federal and State agencies and industry.

Use of the Chukchi Sea by Endangered Whales: In collaboration with NMFS and the Pacific Marine Environmental Laboratory (PMEL), this study assesses patterns of spatial and temporal use of the Chukchi Sea by endangered bowhead, fin and humpback whales, and beluga and gray whales, and evaluate ecological relationships that affect critical habitat for these species. This effort combines targeted oceanographic sampling with biological sampling and satellite tagging of individual humpback, fin and gray whales to expand scientific understanding of whale behavior and to improve predictions about where and when aggregations of feeding whales are likely to occur. This study extends the research of the "Bowhead Whale Feeding Ecology Study" (also known as BOWFEST) into the Chukchi Sea and expands the scope to include other cetacean species.

Air Quality and Meteorology:
Arctic Air Quality Modeling: This study will conduct air quality modeling using existing dispersion models to reasonably predict the potential cumulative air quality effects associated with onshore and offshore emission sources. The study will evaluate existing methods for establishing emissions exemption thresholds and, if necessary, suggest improved methods.

Physical Oceanography:
Characterization of Circulation in the Northeast Chukchi and Western Beaufort Sea: In collaboration with UAF, ocean current circulation fields are being mapped and

analyzed along the coast of the northeastern Chukchi and western Beaufort seas through the deployment of coastal High Frequency radar systems, offshore bottom mounted Acoustic Doppler Current Profilers (ADCPs), gliders and surface drifters. Such direct circulation measurements improve understanding of the ocean currents that drive oceanographic processes and influence the transport and fate of spilled oil.

Marine Mammals:

Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea: In partnership with NMML, this study merges the Bowhead Whale Aerial Survey Project (BWASP) and the Chukchi Sea aerial surveys of marine mammals. This combined effort collects aerial survey data on seasonal distribution, relative abundance, and habitat use of marine mammals in the Beaufort and Chukchi seas. Observations are focused on bowhead whales, but also help to monitor gray whales, beluga whales, Pacific walrus, polar bears, bearded seals, and several other species of ice seals. All of these species are subject to changes in environmental variables such as oceanographic currents, sea temperature, sea ice cover, prey availability, and anthropogenic impacts. MMS/BOEM has conducted aerial surveys of the fall migration of bowhead whales each year since 1987. Methods are comparable from year to year and based on similar monitoring dating to 1979.

Satellite Tracking of Bowhead Whales: Habitat Use, Passive Acoustic and Environmental Monitoring: In collaboration with the Alaska Department of Fish and Game, this study will track the movements and document the behavior and habitat utilization of bowhead whales using satellite telemetry. Tags equipped with environmental sensors will be deployed to monitor, collect, and transmit ambient oceanographic conditions during bowhead whale migrations. Acoustic tags will document vocalization rates and ambient noise levels to develop analysis of call rates relative to behavior and disturbance. Data will be used to examine inter-annual variation in bowhead feeding concentrations and vocalizations. Other large cetacean species (gray whale, humpback whale and fin whale) may be opportunistically tagged and tracked as a pilot study for future research.

Demography and Behavior of Polar Bears: In partnership with the USGS Alaska Science Center and USFWS Marine Mammals Management, this study collects data to estimate the demographic composition and inter-annual patterns of use of coastal areas by the sub-population of polar bears summering on land in Alaska. The project will also evaluate the implications of extended summer use of land on polar bear health and nutrition, behavior, and population status.

Abundance Estimates of Ice-Associated Seals in the Chukchi Sea: In collaboration with scientists at NOAA's National Marine Mammal Laboratory (NMML) and the Russian Institution Giprorybflot, this study will conduct surveys of ice-associated seals using high-resolution digital photographic and thermal imaging sensors and calculate abundance estimates for bearded, spotted and ribbon seals in the Bering and Chukchi seas. Abundance estimates will be computed using hierarchical models for seal abundance developed at NMML.

Habitat and Ecology:
Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area: This partnership with NOAA and UAF documents and characterizes the distribution of pelagic and demersal fish and invertebrate communities in the Chukchi Sea lease area. The study includes field surveys to obtain baseline data on the structure and function of the Chukchi ecosystem and the ecology of important fish species in the region. This project is a component of the "Arctic Ecosystem Integrated Survey," a collaborative effort involving scientists from UAF, NOAA's Alaska Fisheries Science Center, USFWS and ADF&G.

Biogeochemical Assessment of the OCS Arctic Waters: In collaboration with the Coastal Marine Institute at UAF, the objective of this cooperative study is to assess the effect of ocean acidification on the marine environment of the Bering Sea and Chukchi Sea. Dissolved organic and inorganic nutrients and carbon, total alkalinity, particulate organic matter, and pCO2 measurements are used to calculate net ecosystem production and acidification.

Distribution and Habitat Use of Fish in the Nearshore Ecosystem of the Beaufort and Chukchi Seas: In partnership with NOAA, this study will inventory the distribution and diversity of nearshore fish, their habitat and prey along high priority sites in the Beaufort and Chukchi Seas. The age and diet of the fish, as well as ambient oceanographic conditions, will be assessed to improve understanding about the effect of habitat variables like temperature and salinity on fish species distributions.

Social Systems:
Social Indicators in Coastal Alaska: Arctic Communities: This study will update key socio-cultural and economic baseline data for analysis of potential local and regional impacts from offshore exploration and development activities. It will evaluate the pace, direction and magnitude of regional socio-economic changes experienced by residents in select Arctic coastal communities including: Point Lay, Wainwright, Barrow, Nuiqsut and Kaktovik.

1.4 New Starts for FY 2014 and Ongoing Studies

Table 1 lists new studies planned to start in FY 2014 and ongoing studies, categorized by discipline. Profiles for these studies can be found at: http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Alaska-Region/Index.aspx

Table 1. BOEM Alaska OCS Region New Starts for FY 2014 and Ongoing Studies

NSL #	Study Title	Planning Area(s)	Start FY	Partners
**** PLANNED NEW STARTS (FY 2014)***				
Physical Oceanography				
AK-13-03-07	Development and testing of a low-cost satellite-tracked ice drifter for Arctic Alaska	Chukchi	2014	CMI
AK-13-03-09	Sea Level Measurements along the Alaskan Chukchi and Beaufort Coasts	Beaufort, Chukchi	2014	CMI
AK-13-04	Enhanced Verification and Interpretation of Arctic Ice Break-up and Freeze-up for the Beaufort and Chukchi Seas, Alaska OCS	Beaufort, Chukchi	2014	
Fates and Effects				
AK-13-03-06	Crude Oil Infiltration and Movement in First-year Sea Ice: Impacts on Ice-associated Biota and Physical Constraints	Beaufort, Chukchi	2014	CMI
Ak-13-03-10	Biodegradation and Transport of Crude Oil in Sand and Gravel Beaches of Arctic Alaska	Beaufort, Chukchi	2014	CMI
AK-14-02	Physical and Chemical Analyses of Crude and Refined Oils: Laboratory and Mesoscale Oil Weathering	Beaufort, Chukchi, Cook Inlet	2014	
Habitat and Ecology				
AK-13-03-08	Testing the Use of Unmanned Aircraft Systems for Intertidal Surveys – proof	Cook Inlet	2014	CMI
AK-14-03	Genomics of Arctic Cod: A Sentinel Species in a Changing Environment	Beaufort, Chukchi	2014	
Social Systems				
AK-14-01	Subsistence Mapping of Wainwright, Point Lay, and Point Hope	Chukchi	2014	
Information Management				
AK-14-04	Operation and Maintenance of BOEM Research Vessel Launch 1273 in Alaskan Waters	Beaufort, Chukchi	2014	
****Note: The procurement of any study is contingent upon availability of funding***				

ONGOING STUDIES				
Air Quality				
AK-13-01	Arctic Air Quality Impact Assessment Modeling	Beaufort, Chukchi	2013	
Physical Oceanography				
AK-08-12-08	Satellite-Tracked Drifter Measurements in the Northeast Chukchi Sea	Chukchi	2011	CMI
AK-09-02b	COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Biophysical Moorings and Climate Modeling	Chukchi	2010	PMEL
AK-12-03a	Characterization of the Circulation on the Continental Shelf Areas of the Northeast Chukchi and Western Beaufort Seas	Beaufort, Chukchi	2012	CESU-UAF
AK-12-03b	Arctic Tracer Release Experiment (ARCTREX): Applications for Mapping Spilled Oil in Arctic Waters	Chukchi	2013	UAF
AK-13-03-03	Development of an Accurate Model of the Beaufort and Chukchi Ice Drift and Dispersion for Forecasting Spill Trajectories and Providing Decision Support for Spill Response	Beaufort, Chukchi	2013	CMI
AK-13-x10	Cook Inlet Circulation Model Calculations	Cook Inlet	2013	CESU-UAF
Fates and Effects				
AK-08-12-12	Evaluating Chukchi Sea Trace Metals and Hydrocarbons Sourced from Nearby Coastal Rivers	Chukchi	2012	CMI
AK-11-01	Updates to the Fault Tree for Oil-Spill Occurrence Estimators Needed Under the Forthcoming BOEM 2012-2017, 5-Year Program	Beaufort, Chukchi	2011	
AK-11-12	Loss of Well Control Occurrence and Size Estimators for Alaska OCS	Beaufort, Chukchi	2012	
AK-11-14a	ANIMIDA III: Boulder Patch and Other Kelp Communities in the Development Area	Beaufort	2012	CESU-UT
AK-11-14b	ANIMIDA III: Contaminants, Sources, and Bioaccumulation	Beaufort	2013	
AK-13-03-04	Distribution and Abundance of Select Trace Metals in Chukchi and Beaufort Sea Ice	Beaufort, Chukchi	2013	CMI

Habitat and Ecology				
AK-07-05	Arctic Fish Ecology Catalogue	Beaufort, Chukchi	2009	USGS
AK-08-12-03	Biogeochemical Assessment of the OCS Arctic Waters: Current Status & Vulnerability to Climate Change	Chukchi	2008	CMI
AK-08-12-05	Trophic Links: Forage Fish, Their Prey, and Ice Seals in the Northeast Chukchi Sea	Chukchi	2009	CMI
AK-08-12-09	Population Assessment of Snow Crab, *Chionoecetes opilio*, in the Chukchi and Beaufort Seas Including Oil and Gas Lease Areas	Beaufort, Chukchi	2011	CMI
AK-08-12-11	Dispersal Patterns and Summer Ocean Distribution of Adult Dolly Varden from the Wulik River, Alaska, Evaluated Using Satellite Telemetry	Chukchi	2012	CMI
AK-10-06	Beaufort Sea Marine Fish Monitoring Survey in the Central Beaufort Sea	Beaufort	2010	NMFS
AK-10-09	Joint Funding Opportunities in Existing Marine Fish Studies	Beaufort, Chukchi	2010	University of Alaska
AK-10-10	Seabird Distribution and Abundance in the Offshore Environment	Beaufort, Chukchi	2010	USFWS
AK-11-03	Hanna Shoal Ecosystem Study	Chukchi	2011	CESU-UT
AK-11-08	Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area	Chukchi	2012	NOAA
AK-11-10a	Shorebirds and Infaunal Abundance and Distribution on Delta Mudflats along the Beaufort Sea	Beaufort	2011	USGS
AK-11-10b	Wading Shorebirds Habitats, Food Resources, Associated Infauna, Sediment Characteristics and Biomediation Potential of Resident Microbiota of Deltaic Mudflats	Beaufort	2011	CESU-UAF
AK-12-04	U.S.-Canada Transboundary Fish and Lower Trophic Communities	Beaufort	2012	UAF; DFO
AK-12-06	Distribution and Habitat Use of Fish in the Nearshore Ecosystem of the Beaufort and Chukchi Seas	Beaufort, Chukchi	2012	NOAA
AK-13-03-02	Sensitivity to Hydrocarbons and Baselines of Exposure in Marine Birds on the Chukchi and Beaufort Seas	Beaufort, Chukchi	2013	CMI
AK-13-03-05	Analysis of Benthic Communities on Weathervane Scallop Beds in Shelikof Strait	Cook Inlet	2014	CMI

Marine Mammals and Protected Species				
AK-08-12-10	A Year in the Life of a Bowhead Whale: An Animated Film	Beaufort, Chukchi	2012	CMI
AK-09-01	Pinniped Movements and Foraging: Walrus Habitat Use in the Potential Drilling Area	Chukchi	2009	ADF&G
AK-09-02a	COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic	Beaufort, Chukchi	2010	NMML
AK-09-03	Migration and Habitat Use by Threatened Spectacled Eiders in the Eastern Chukchi Near and Offshore Environment	Beaufort, Chukchi	2009	USGS
AK-09-05	Demography and Behavior of Polar Bears Summering on Shore in Alaska	Beaufort, Chukchi	2009	USGS, USFWS
AK-10-05	Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea – Personnel Needs	Beaufort, Chukchi	2011	NMML
AK-11-05	Synthesis of Arctic Research (SOAR): Physics to Marine Mammals in the Pacific Arctic	Beaufort, Chukchi	2011	PMEL
AK-11-06	Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea – Aircraft Needs	Beaufort, Chukchi	2011	
AK-12-02	Satellite Tracking of Bowhead Whales: Habitat Use, Passive Acoustic and Environmental Monitoring	Beaufort, Chukchi	2012	ADF&G
AK-12-05	Ice Seal Movements and Foraging: Village-based Satellite Tracking and Acoustic Monitoring of Ringed and Bearded Seals	Beaufort, Chukchi	2013	ADF&G
AK-12-07	Arctic Whale Ecology Study (ARCWEST): Use of the Chukchi Sea by Endangered Baleen and Other Whales	Beaufort, Chukchi	2012	NMML
AK-12-x10a	Abundance Estimates of Ice Associated Seals: Bering Sea Populations that Inhabit the Chukchi Sea – Aircraft Support	Chukchi	2012	

AK-12-x10b	Abundance Estimates of Ice Associated Seals: Bering Sea Populations that Inhabit the Chukchi Sea	Chukchi	2012	NMML
AK-13-02	Chukchi Acoustic, Oceanography and Zooplankton Study: Hanna Shoal (Extension of CHAOZ)	Chukchi	2013	NMML
AK-13-06	Walrus Seasonal Distribution and Habitat Use in the Eastern Chukchi Sea	Chukchi	2013	USGS
Social Systems				
AK-11-09	Social Indicators in Coastal Alaska: Arctic Communities	Beaufort, Chukchi	2011	
ArcSEES	WALRUS – Walrus Adaptability and Long-term Responses; Using multi-proxy data to project Sustainability	Chukchi	2013	NSF
ArcSEES	Cumulative Effects of Arctic Oil Development – planning and	Beaufort, Chukchi	2013	NSF
Information Management				
AK-10-03	Alaska Marine Science Symposium (co-sponsor)	Beaufort, Chukchi	2010	NPRB
AK-11-07	ShoreZone–Shoreline Mapping of the North Slope Alaska	Beaufort, Chukchi	2011	
AK-12-01	Conference Management and Reports on BOEM Results	Beaufort, Chukchi	2012	
AK-13-03	BOEM-University of Alaska-State of Alaska Coastal Marine Institute	Beaufort, Chukchi	2013	CMI
NT-12-01	Enhancement of the Environmental Studies Program Information System and the Multipurpose Marine Cadastre to Provide Environmental Studies Data	Beaufort, Chukchi	2012	NOAA
INTEGRATED STUDIES				
AK-08-12-03	Biogeochemical Assessment of the OCS Arctic Waters: Current Status & Vulnerability to Climate Change	Chukchi	2008	CMI
AK-09-02a	COMIDA: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic	Beaufort, Chukchi	2010	NMML
AK-09-02b	COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Biophysical Moorings and Climate Modeling	Chukchi	2010	PMEL

AK-11-03	Hanna Shoal Ecosystem Study	Chukchi	2011	CESU-UT
AK-11-05	Synthesis of Arctic Research (SOAR): Physics to Marine Mammals in the Pacific Arctic	Beaufort, Chukchi	2011	PMEL
AK-11-14a	ANIMIDA III: Boulder Patch and Other Kelp Communities in the Development Area	Beaufort	2012	CESU-UT
AK-11-14b	ANIMIDA III: Contaminants, Sources, and Bioaccumulation	Beaufort	2013	
AK-12-04	U.S.-Canada Transboundary Fish and Lower Trophic Communities	Beaufort	2012	DFO
AK-12-07	Arctic Whale Ecology Study (ARCWEST): Use of the Chukchi Sea by Endangered Baleen and Other Whales	Beaufort, Chukchi	2012	NMML
AK-13-02	Chukchi Acoustic, Oceanography and Zooplankton Study: Hanna Shoal (Extension of CHAOZ)	Chukchi	2013	NMML

Partner Codes

ADF&G = Alaska Department of Fish and Game
ArcSEES = Arctic Science, Engineering, and Education for Sustainability
CESU = Cooperative Ecosystem Studies Unit
CMI = University of Alaska Coastal Marine Institute
DFO = Department of Fisheries and Oceans Canada
NMFS = National Marine Fisheries Service (NOAA)
NMML = National Marine Mammal Laboratory (NOAA)
NOAA = National Oceanic and Atmospheric Administration
NSF = National Science Foundation
NWS = National Weather Service (NOAA)
PMEL = Pacific Marine Environmental Laboratory (NOAA)
UAF = University of Alaska Fairbanks
USFWS = U. S. Fish and Wildlife Service
USGS = U. S. Geological Survey
UT = University of Texas

SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

The BOEM Alaska OCS Region proposes 12 new studies for FY 2014. The proposed studies focus on the Beaufort and Chukchi seas, as well as Cook Inlet.

The Alaska OCS Region actively seeks cost-sharing opportunities with other study partners, both federal and non-federal. These ongoing cost-sharing opportunities may affect the budget estimates for FY 2015 proposed new starts.

Profiles of ongoing studies can be found at: http://www.boem.gov/akstudies/.

This website is updated three times each year and includes:

An updated status of each study.

Report due dates.

Related publications.

Affiliated websites.

For all completed ESP Studies, go to:
http://www.data.boem.gov/homepg/data_center/other/espis/espisfront.asp.

2.2 Profiles of Studies Proposed for FY 2015 NSL

Table 2. BOEM Alaska OCS Region Studies Proposed for the FY 2015 NSL

Page Number	Discipline	Ranking	Study Title
231	PO	1	Development of a Very High-resolution Regional Circulation Model of Beaufort Sea Nearshore Areas
233	IM	2	Coastal Habitat Maps: Closing Spatial Gaps in ShoreZone Imagery and Data for the Cook Inlet Area
235	PO / SE	3	Synthesis of Sub-Sea Physical Environmental Data for the Beaufort and Chukchi Seas
237	IM	4	Support for the Canada-United States Northern Oil and Gas Research Forum, 2014
239	SE	5	Traditional Knowledge Implementation: Accessing Arctic Community Panels of Subject Matter
241	HE	6	Monitoring Fish in Chukchi and Beaufort Sea Lagoons and Nearshore Zones
243	MM	7	Estimation of Abundance and Demographic Rates of Pacific Walruses Using a Genetics-based Mark-Recapture Approach
245	MM	8	Field Evaluation of an Unmanned Aircraft System (UAS) for Studying Cetacean Distribution, Density, and Habitat Use in the Arctic
247	HE	9	Subtidal and Intertidal Habitats and Invertebrate Biota in Lower Cook Inlet, Alaska
249	MM	10	Cetacean Distribution, Abundance, and Ecology in Cook Inlet
253	IM	11	Alternative Energy Capacity Inventory in Coastal Alaska
255	MM	12	Habitat Use, Ecology, and Population Status of Polar Bears in the Chukchi Sea
Discipline Codes			
AQ = Air Quality IM = Information Management PO = Physical Oceanography			FE = Fates & Effects HE = Habitat & Ecology MM = Marine Mammals & Protected Species SE = Social & Economic Sciences

Environmental Studies Program: **Studies Development Plan FY 2015-2017**

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Development of a Very High-Resolution Regional Circulation Model of Beaufort Sea Nearshore Areas

BOEM Information Need(s) to be Addressed: BOEM uses coupled ice-ocean circulation model results as input to oil-spill trajectory analysis. Results with higher spatial resolution are needed to more fully represent nearshore circulation processes, particularly those near rivers, barrier islands and coastal lagoons within the nearshore Beaufort Sea. Development and application of state-of the-art circulation models are essential to future OSRA-based EIS analyses for Development and Production Plans within Stefansson Sound and the nearshore Beaufort Sea.

Approx. Cost: (in thousands) $490 **Period of Performance:** FY 2015-2017

Description:

Background: Offshore barrier islands, coastal features, and freshwater river outflow are known to affect the fine-scale ocean circulation in nearshore areas. Previous oil spill trajectory analyses, conducted by BOEM, in Stefansson Sound used both nearshore 2-D circulation and offshore 3-D coupled ice-ocean circulation model results. The spatial resolution of the current Arctic Circulation Model study is too coarse to adequately resolve the barrier islands within Stefansson Sound and the lagoons and other coastal features along the Beaufort Sea coast and produce high-quality simulations of the associated fine-scale circulation processes.

Objectives:

- Adapt and maximize the utility of an existing regional 3-D coupled ice-ocean circulation hindcast model to obtain high-resolution model fields that represent fine-scale processes associated with barrier islands and coastal features in the Beaufort Sea nearshore areas.
- Provide BOEM with ten to twenty years of relevant modeled fields, such as gridded wind, surface water and ice velocity, ice cover, and limited other modeled fields as agreed to between the contractor and BOEM.
- Evaluate the modeled under-ice currents in consideration of information derived from the study Idealized Process Model Studies of Circulation in the Landfast Ice Zone of the Alaskan Beaufort Sea (OCS Study BOEMRE 2011-056).

Methods: A coupled ice-ocean model will be modified to maximize utility in the Beaufort Sea nearshore areas. The model will possess sufficient spatial resolution to accurately represent circulation processes associated with barrier islands and coastal features. Conduct the standard suite of sensitivity testing and validation of the model and results.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Cook Inlet

Title: Coastal Habitat Maps: Closing Spatial Gaps in ShoreZone Imagery and Data for the Cook Inlet Area

BOEM Information Need(s) to be Addressed: The BOEM *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017* includes a lease sale in the Cook Inlet Planning Area in 2016 and recent expansions of on-shore and off-shore exploration efforts in state lands and waters in the region demonstrate increased industry interest in Cook Inlet oil and gas development. ShoreZone mapping is a technique that will provide BOEM with the most comprehensive biological, physical, and geomorphologic data of the Alaska coastal areas. The BOEM analysts and decision makers will use shoreline mapping information for identifying high priority fish and wildlife habitats in NEPA and ESA analyses and documentation for lease sales, EPPs and DPPs, and in post-sale and post-exploration decision making.

Approx. Cost: (in thousands) $450 **Period of Performance:** FY 2015-2016

Description:

Background: The spatial distribution of nearshore habitats is important information for resource managers and coastal decision-makers, and numerous shoreline classification methods have been applied to our coasts. Recent efforts, however, have focused on a partnership of numerous scientists, GIS and web specialists, non-government organizations, and local, state, and federal agencies. This partnership is applying ShoreZone protocols to build a contiguous, integrated dataset of coastal habitats and imagery for Alaska's coast.

In 2001, the Cook Inlet Regional Citizens' Advisory Council (CIRCAC) began a program to apply the ShoreZone mapping protocols to Cook Inlet and led the development of the first web-based access to the data and imagery. This program was later expanded to include the outer Kenai Peninsula coast, Kodiak Island, and the Alaska Peninsula. CIRCAC also initiated an Alaska ground-station program that has now expanded to include hundreds of stations throughout the Gulf of Alaska and North Slope. By 2005, NOAA's National Marine Fisheries Service stepped forward to provide web-site and data support and currently provides the necessary personnel to manage, update, and serve the data to the public and has also led efforts to map southeast Alaska and develop a larger statewide partnership. By 2012, the program had expanded to the Alaskan Arctic with BOEM-sponsored aerial and on-the-ground surveys.

Despite the successful expansion of the ShoreZone program to include much of Alaska's coast, there are still several significant spatial gaps, including portions of the coastline within or adjacent to the Cook Inlet Planning Area. These areas include the Alaska Peninsula coastline from the Katmai National Park boundary to the Cold Bay area. Also, the Barren Islands were not attempted during earlier surveys in the Cook Inlet area and

are an obvious spatial gap to the contiguous, continuous habitat data and imagery for the Gulf of Alaska. A survey along these coastlines would also provide the opportunity to re-survey sections of the Katmai National Park coastline to conduct a project for assessing ShoreZone's applicability for detecting large-scale changes to some biological or geomorphic classifications. Recent studies by the NPS along this coast have shown large-scale loss of mussel bed habitats along portions of the coast. Since ShoreZone maps mussel beds as an along-shore and across-shore bioband, it would be an opportunity to assess whether ShoreZone data (and imagery) can provide a baseline for detecting or illustrating significant changes between periodic surveys in areas determined to be of high interest or sensitivity.

These proposed surveys would close a spatial gap in the Gulf of Alaska ShoreZone data and imagery that has precluded queries of coastal habitat data in areas downstream of existing and potential future oil exploration, development, and production activities.

Objectives:

- Map the along-shore and across-shore geomorphic and biological habitat features using the aerial survey imagery and narration by a biologist and a geomorphologist utilizing the most recent ShoreZone protocols.
- Ground-truth aerial survey results through shore-station surveys along this coast to verify geomorphic features and to describe invertebrate and seaweed assemblages.
- Publicly disseminate all data and imagery via the ShoreZone website, and Cook Inlet Response Tool.
- Assess whether ShoreZone imagery and mapped data can capture some of the larger-scale changes that have been observed in some areas along the Katmai National Park shoreline since the original ShoreZone surveys were conducted in the area in 2003.

Methods: Conduct ShoreZone aerial surveys of the Barren Islands and along the Alaska Peninsula coastline from the northern border of the Katmai National Park coastline to the Cold Bay area where the 2011 Alaska Peninsula surveys ended. The aerial surveys and mapping would take place according to the ShoreZone Coastal Habitat Mapping Protocol for Alaska. Shore-stations surveys should take place at a series of stations over a range of habitat types known to occur along these shorelines (e.g. exposed rocky, rock platforms, exposed boulder beaches, semi-exposed and semi-protected cobble beaches, salt marshes, eelgrass beds). The compiled data and imagery will be posted to the existing ShoreZone website and shore-station data would be collected and disseminated in the same manner as for other locations in Alaska. Data would be also archived at NODC.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Synthesis of Sub-Seabed Physical Environmental Data for the Beaufort and Chukchi Seas

BOEM Information Need(s) to be Addressed: Industrial oil and gas exploration is occurring in specific prospects and potential pipeline routes are under consideration in the Beaufort and Chukchi seas. Regional information for integrative marine spatial planning is needed for evaluation of any proposed Development and Production Plans (DPPs) and for development of mitigation and monitoring strategies to avoid irreparable impacts on nonrenewable resources and costly pipeline construction errors. This project would update the results of the previous study, incorporating additional data from a variety of sources and expanding coverage to the Chukchi Sea to support analyses under NEPA and the National Historic Preservation Act (NHPA).

Approx. Cost: (in thousands) $500 **Period of Performance:** FY 2015-2017

Description:

Background: Shallow geological and geophysical (G&G) data on the shelves of the Beaufort and Chukchi seas are used to map and interpret current geological processes (sedimentation, ice gouging, current scour, faulting, gas, etc.), soil engineering properties (permafrost and methane hydrate distribution, oil seeps) and the Cenozoic geologic history. These data also provide information about the potential for finding submerged and buried landforms that may contain cultural resources or shipwrecks. To use these data effectively, there is a need to consolidate the various data holdings of BOEM and BSEE, including Chukchi Sea data, into an accessible interactive database that will allow user-friendly interactions and user input of new data sources as they become available.

This project would build upon the study *Evaluation of Sub-Sea Physical Environmental Data for the Beaufort Sea Alaska OCS and Incorporation into a Geographic Information System (GIS) Database* (OCS Study MMS 2002-017). This study has provided valuable information on the shallow geology, potential geologic hazards, recent geologic history, soil engineering properties, paleo-sea levels, and seafloor environmental conditions in the Beaufort Sea.

There are very limited information currently available in the Chukchi Sea regarding potential submerged cultural resources in areas of potential future industry activity, even though there is high potential that archaeological sites exist in these locations. Alaska has unique importance in the study of prehistoric archaeology since it has long been believed that a Pleistocene land bridge linking Alaska with Siberia served as a major corridor for human entry into the New World. Beringia extended as far east as the Beaufort Sea and drowned features were identified in the study *Review of Geological/Geophysical Data and Core Analysis to Determine Archeological Potential*

of Buried Landforms, Beaufort Sea Shelf, Alaska (OCS Study MMS 2007-004). These landforms date between 1600 and 8600 years old, and they may have been occupied by humans. There is also the potential for shipwrecks associated with commercial whaling during the nineteenth century. This proposed study will include identification of sub-bottom landforms that might contain prehistoric sites. Historic shipwreck site locations will not be made available to the public. The study will add to our understanding of potential geologic hazards and regional soil engineering conditions and has aided the Bureau's assessment of potential archaeological resources required under the NHPA.

Objectives:

Compile BOEM and BSEE holdings of industry permit surveys and other data sources, including public data from USGS and academia, and add the data to the BOEM Geohazard Database.

Update the database and underlying metadata to link to scanned records and provide search capability for shallow G&G information on various subjects, including: sediment thickness and distribution, stratigraphy, seafloor anomalies, buried or drowned landforms, shallow geologic hazards, core cryology, geochemistry, lithology, etc.

Examine the updated data to assess whether evidence of archaeological potential can be seen, particularly in areas of active and potential industry activity in the Beaufort and Chukchi seas.

Synthesize existing geologic, paleoenvironmental, archaeological and historical data to support assessments of the relationship of prehistoric human populations to the prehistoric landscape for the Chukchi and Beaufort seas.

Ensure that results are reported in conformance federal historic preservation laws.

Methods: The existing database would be upgraded with new code and data loading capabilities. The researchers will evaluate existing BOEM and BSEE holdings, as well as public sources containing shallow G&G data, and merge or integrate these into the upgraded database. The researchers will develop an interface to allow viewing and downloading of digital images of seismic and core data and to allow updating and adding as new data become available.

The researchers will interpret the compiled information and provide a written assessment of the shallow stratigraphy and archaeological and shipwreck potential, faulting, shallow gas occurrence, ice gouging, and other seabed and shallow sub-seabed features. The report will include a list of geomorphological features tagged as potential areas of interest that may be considered for future assessments.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): All Alaska OCS Planning Areas

Title: Support for the Canada-United States Northern Oil and Gas Research Forum, 2014

BOEM Information Need(s) to be Addressed: This Forum provides BOEM's scientists and Principal Investigators a unique bi-lateral forum to share their research findings on the Arctic Alaska marine environment with U.S. and Canadian decision makers and stakeholders, and an opportunity to network with other scientists from around Alaska, the U.S., and Canada. The forum offers marine scientists with the opportunity to gather information on related research and fosters important future collaborative efforts. The bi-lateral nature of the Forum recognizes the shared natural resources of the two countries and the need to share research goals and results between Canada and the United States in the Beaufort and Chukchi seas. This Forum is complementary to the function and intent of the Alaska Marine Science Symposium and widens the scientific, decision-maker and stakeholder audience for BOEM Environmental Studies, thus improving the understanding of the full spectrum of research and research needs in western Arctic North America for oil and gas activity management.

Approx. Cost: (in thousands) $20 **Period of Performance:** FY 2015

Description:

Background: The purpose of this procurement is to help fund the ongoing research forum which provides an opportunity for U.S. and Canadian scientists, regulators, northern community representatives, and industry, to share information about research programs in the Beaufort Sea, Chukchi Sea, the North Slope, and Mackenzie Valley and to discuss future directions for research required to manage northern oil and gas development. The forum provides an important communication tool for participants to become better informed about existing research, how information is used in decision-making, and to discuss future directions.

Each of the previous three Forums (alternating in location between the Alaska and Canada in 2008, 2010, and 2012) attracted more than 200 participants and featured over 20 poster sessions, panel discussions, and over 50 oral presentations evenly divided between U.S. and Canadian authors. Broad topics covered included technical-engineering; socio-cultural/socio-economic issues; improved communication and collaboration; improved data gathering; decision support tools; emergency response; scenario planning; research challenges; long-term monitoring; use of traditional knowledge; adapting to a changing environment; biological sciences; and physical sciences.

The Fourth Canada-US Northern Oil and Gas Research Forum will take place in Canada in a northern city to be determined.

Objectives: The purpose of this study is to provide support for the Canada-U.S. Northern Oil and Gas Research Forum. The fourth Forum will:

- Showcase current research programs, demonstrating contributions to decision-making through environmental assessments and the regulatory process and highlighting the involvement of indigenous people in research programs;
- Identify how to move research findings into decision-making fora; and
- Discuss future oil and gas research needs, including synergies and partnerships, for the Beaufort and Chukchi seas, Mackenzie Delta and North Slope.

Methods: BOEM will provide a financial contribution to support the logistical and programmatic functions for the fourth Canada-U.S. Northern Oil and Gas Research Forum.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Traditional Knowledge Implementation: Accessing Arctic Community Panels of Subject Matter Experts

BOEM Information Need(s) to be Addressed: This project aims to identify and organize Local and Traditional Ecological Knowledge (TK) subject matter experts from Arctic communities into recognized panels of paid consultants so they may become more widely accessible to function with authority on TK domains. By facilitating the creation of these institutional arrangements, this project will actively advance prospects for TK integration into scientific research sponsored by BOEM and other federal agencies. The full range of BOEM-funded studies, including physical oceanography, biology, and social systems would benefit from more direct consultation and collaboration with local TK subject matter experts.

Approx. Cost: (in thousands) $490 **Period of Performance:** FY 2015-2020

Description:

Background: Government dialogue about TK is often preoccupied with integration of TK data rather than with integration of TK experts into a meaningful resource management process. This study will identify key individuals in North Slope communities who are locally recognized for subject matter expertise on specific resources and available to serve on one or more "community of practice" TK panels. The TK panels would be consulted by external scientists working on BOEM-funded projects and would be pre-authorized locally to speak with authority on specific resource management topics of interest including: (1) ocean currents; (2) ice movement and behavior; (3) subsistence harvest of marine mammals; (4) subsistence harvest of seabirds and waterfowl; (5) subsistence sea-run fish; and (6) subsistence terrestrial species and nearshore use. With the exception of some active commissions already in place, formalized local panels do not yet exist to serve in this capacity. TK interaction will meet mutual concerns of all involved parties.

Objectives: The successful integration of TK into decision-making processes requires intensive collaboration between scientists and local communities. This will be achieved by the following:

- Enhance TK authority and integration of TK with science by promoting its dissemination to external scientists through consistent methods and directly involving local subject matter experts.
- Provide a roster and orientation information for use by external scientists about how to access and integrate TK on a more systematic basis for projects undertaken on the North Slope. This information would be accessible to scientists of all disciplines, from physical oceanography to sociocultural studies, and funded by a

variety of sources, including federal and state agencies, National Science Foundation (NSF), and academia.

Enhance dialogue about science through exchange of information between external scientists and the communities.

Integrate the traditional Iñupiat model of linking youth with elders.

Achieve more efficient research project timelines. Currently, studies may be delayed as long as a year so that a community can achieve review consensus.

Methods: All eight North Slope communities would be involved, and panels in each would augment local capacity building. Up to three TK panels may be created in each North Slope coastal community, depending upon the primary interests of each village. For example, the inland communities of Atqusuk and Anaktuvak would likely have no need for a panel on marine processes. Social network methods will be used to identify knowledgeable subject matter experts to participate on each panel through a reliable and credible process using referral techniques. Village tribal leaders will be asked to review the generated list of nominees to recommend finalists who might serve on each TK panel. It is possible that one individual could be a member of more than one TK panel, depending upon community referrals. Panel members will receive honoraria stipends in recognition of their service. Barrow will be the lead community to develop a charter that could serve as a template for other communities. The process will likely replicate social network methodology as described in *Variation in the Abundance of Arctic Cisco in the Colville River* (OCS Study MMS 2007-0042).

The study will develop protocols to facilitate engagement of pre-authorized TK panels and promote dissemination of TK to external scientists with consistent methods. Scientists would initiate dialogue through describing information about their project goals, methods, objectives and findings with the TK panel. Panel engagement and comprehension may lead to suggestions, guidance, and other forms of support, such as annual observations of ongoing environmental change. Scientists will be informed about the use of TK and panel involvement in decision-making to encourage a respectful dialogue between the local experts and external scientists. The study will also explore ways to engage the North Slope Borough School District or other appropriate entity to collaborate with youth involvement on TK panels as ex-officio delegates. Involvement of youth would facilitate cross-generational transfer of TK and promote local institutional capacity. BOEM will seek to establish partnerships in this work with other organizations and agencies, including NSF, the North Slope Borough Department of Wildlife Management, and NSSI.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Monitoring Fish in Chukchi and Beaufort Sea Lagoons and Nearshore Zones

BOEM Information Need(s) to be Addressed: This project will monitor fish in lagoons of the northeast Chukchi and western Beaufort seas that are vital resources to residents of the North Slope and important prey to other animals including some sea birds, beluga whales and seals. BOEM analysts and decision makers will use this information in NEPA analysis and documentation for Lease Sales, EPs and DPPs. This project will facilitate a more in depth analysis of Chukchi Sea fish ecology because it ties directly to other projects in the adjacent nearshore and offshore areas within the Chukchi Sea Lease Area.

Approx. Cost: (in thousands) $250 **Period of Performance:** FY 2015-2018

Description:

Background: This study would tie in with efforts made by the North Slope Borough's Department of Wildlife Management (NSB-DWM) and NPRB's Alaska Coastal Ecosystem Survey (ACES), which is conducted in collaboration with BOEM's "Distribution and Habitat Use of Fish in the Nearshore Ecosystem of the Beaufort and Chukchi Seas" (AK-12-06). This study will provide a more robust examination of fisheries ecology in the Chukchi Sea from the lagoon systems and nearshore areas to the offshore areas sampled in the study "Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area" (AK-11-08a/b, also known as "Arctic Ecosystem Integrated Survey" or Arctic EIS). In 1996 and 2008-present, the NSB-DWM has used a Fyke net in Elson Lagoon and North Salt Lagoon, near Barrow, to monitor fish presence and abundance. Monitoring of subsistence gill net catches also occurred. The use of the Fyke net has been invaluable to understanding the importance of the lagoon systems which contain approximately 15 species of fish ranging from salmonids and whitefishes to cod and herring and has also revealed that both small (early age classes-adults) as well as large adult fish routinely utilize the nearshore-lagoon systems. Since 2008, the NSB-DWM has also collected genetic samples from subsistence fishers for the Alaska Department of Fish and Game (ADF&G). Genetic samples continue to be collected by ADF&G for their project entitled "Salmon Resources for the Northern Area." This study will continue to collect genetic samples for that program.

In 2012 and 2013, NSB-DWM assisted with the ACES project in performing surveys of nearshore habitats along the Chukchi and Beaufort Seas and lagoons near Barrow, Alaska. A beach seine was employed for this project, and in the first year report it was noted that salmon smolt were collected. These smolt are the furthest northern salmon smolt collected in Alaska. In 2013, salmon smolts again were collected but in North Salt Lagoon. These examples represent opportunistic collection of data. Finally, and most

recently, the NSB-DWM has teamed up with Battelle Memorial Institute to develop and verify molecular methods such as environmental DNA (eDNA) by evaluating seasonal presence and absence of fish in Elson Lagoon (Barrow, Alaska) in conjunction with local subsistence fishermen catch records.

Objectives:

Enumerate species, quantify numbers of individuals, record timing of fish entering and exiting lagoons on the North Slope, and samples for genetic analyses of selected stocks.

Identify areas to be considered for long term monitoring.

Methods: Fish sampling using Fyke nets and beach seines will be conducted during open water periods in Elson Lagoon, near Barrow, and Kuuk Lagoons, near Wainwright. Basic fish data will be collected including relative abundance by species, age/weight, age structure, and age at maturity data for non-salmon species encountered in large enough numbers to produce reliable data. All data will be collected using easily repeatable methods such that all metrics are easily comparable to future data collection. Basic water chemistry data will be collected at each fish sampling site during each net check (water temperature, conductivity/salinity). This project would be conducted in collaboration with ACES and BOEM's "Distribution and Habitat Use of Fish in the Nearshore Ecosystem of the Beaufort and Chukchi Seas" (AK-12-06) and would utilize the existing data standards.

Relevant data from this study and a wide range of projects conducted by BOEM, NOAA, NPRB and NSB-DWM will be coordinated through a data management plan. Project data for nearshore fish in lagoons (NSB-DWM), ecology of nearshore forage fish (NSB/NOAA), ACES (BOEM/NOAA/NPRB/NSB), "Shelf Habitat and Ecology of Fish and Zooplankton" (SHELFZ) (NSB/NOAA) and Arctic EIS (AK-11-08a/b) will be initially deposited on a password-protected site hosted by AOOS (Ocean Workspace) to allow easy data sharing among all investigators for a synoptic examination of Chukchi Sea fish ecology from the lagoons systems and nearshore areas to the offshore. Metadata will be submitted to OBIS-USA according to the most current protocols and will be linked to all other project data at NODC. In addition, all data and metadata will be deposited at AOOS and will eventually be made available to the public and decision makers via the AOOS Arctic Portal, a set of coastal and marine planning visualization tools for Alaska and the U.S. Arctic.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Estimation of Abundance and Demographic Rates of Pacific Walruses Using a Genetics-based Mark-Recapture Approach

BOEM Information Need(s) to be Addressed: Large numbers of Pacific walruses (*Odobenus rosmarus divergens)* utilize areas of high oil and gas resource potential in OCS waters of the northeast Chukchi Sea. BOEM needs reliable estimates of abundance and demographic rates of Pacific walruses for use in sound planning, management, and mitigation of potential environmental impacts from oil and gas activities and climate change. Abundance and demographic rates of walruses are also important for NEPA analyses, stock assessments under the Marine Mammal Protection Act (MMPA) and for extinction risk assessment under the Endangered Species Act (ESA). Results from this study will be used for future Chukchi Sea lease sales as well as in post-sale and post-exploration BOEM decision making and mitigation.

Approx. Cost: (in thousands) $150 plus joint funding **Period of Performance:** FY 2015-2019

Description:

Background: Walruses are a protected species under the MMPA and are listed as warranted but precluded under the ESA. As part of a 2011 Multi-District Settlement Agreement (United States District Court Docket No. 2165), the U.S. Fish and Wildlife Service must make a decision by September 2017 on whether to propose the walrus for listing under the Endangered Species Act or remove it as a candidate species. Information on abundance and demographic rates will be an important contribution to the relisting decision, which will impact how BOEM manages overlap between oil and gas exploration and development and walrus activity.

Furthermore, oil and gas activities in the OCS areas of the Chukchi Sea have increased dramatically in the last 5 years and this trend is expected to continue. Permitting of these activities relies on a small numbers determination and combining estimates of regional abundance. Current BOEM-funded walrus studies examine distribution and habitat patterns in the Chukchi Sea, as outlined in the studies “Walrus Seasonal Distribution and Habitat Use in the Eastern Chukchi Sea” (AK-13-06), and “Walrus Habitat Use in Drilling Area” (AK-09-01). The results from these studies, combined with a better population estimate of Pacific walrus, would allow managers at BOEM and U.S. Fish and Wildlife Service (USFWS) to determine the proportion of the population that could potentially interact with these activities. Therefore, comprehensive estimates of global abundance and demographic rates for walruses are important for regulatory and mitigation activities associated with oil and gas development in the northeast Chukchi Sea.

Past efforts to estimate abundance of walruses were based on aerial surveys. The study "Development of Airborne Remote Sensing Methods for Surveys of Pacific Walrus" (OCS Study MMS 2006-003) identified a number of drawbacks to the use of this technique for measuring abundance with sufficient precision to monitor population trends. Therefore, the USFWS, in collaboration with the Alaska Department of Fish and Game, ChukotTINRO, the Association of Traditional Marine Mammal Hunters of Chukotka, and the Eskimo Walrus Commission, secured funds to initiate a genetics-based mark-recapture project for estimation of abundance and demographic rates of walruses in FY 2013.

Objectives: The objective of this study is to partner with USFWS to support the laboratory testing component of a project that uses a genetics-based mark-recapture approach to achieve the following goals:

- Estimate annual abundance of walruses for evaluation of population status and trends.
- Assess demographic rates of walruses including age and sex specific survival and fecundity for validation and parameterization of population models.
- Compare the estimates of abundance produced from this study with those produced from the BOEM study "Walrus Seasonal Distribution and Habitat Use in the Eastern Chukchi Sea" (AK-13-06) that estimates the abundance of walruses in the OCS areas of the northeast Chukchi Sea for assessment of the proportion of the population potentially exposed to oil and gas activities in the region.

Methods: Genetics testing will be conducted on up to 2000 walrus biopsy samples per year (different age/sex classes). In addition to existing samples, skin biopsy samples will be collected from live walruses hauled out on sea ice during their northward migration from 2015 through 2018. Researchers will utilize the expertise of subsistence hunting communities in both the U.S. and Russia for sample collection. Individual walruses will be identified using single-nucleotide polymorphism markers which are currently being developed by the USFWS. Interim results will be made available to the USFWS to help inform decisions regarding listing of walrus. Results of mark-recapture analyses will be used to estimate population size, population growth rate, age and sex specific survival rates, and recruitment of walruses starting in 2016 and continuing through 2018.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Field Evaluation of an Unmanned Aircraft System (UAS) for Studying Cetacean Distribution, Density, and Habitat Use in the Arctic

BOEM Information Need(s) to be Addressed: Gray whale, bowhead whales, and belugas are seasonal residents of the northeastern Chukchi Sea and western Beaufort Sea, regions that provide important feeding grounds and migration pathways for all three species. While all three species are protected under the Marine Mammal Protection Act, the bowhead whale is given added protection as an endangered species under the Endangered Species Act (ESA), and bowhead whales and belugas are granted additional management consideration as the targets of subsistence hunts by Alaska Natives. Under the National Environmental Policy Act (NEPA) and the ESA, BOEM is required to evaluate if and how federal actions associated with oil and gas exploration and development may affect these species. Aerial surveys are one standard methodology for conducting studies of cetacean distribution required to understand the effects of oil and gas exploration. In recent years, there has been increasing interest in using Unmanned Aircraft Systems (UAS) to survey cetaceans in the Arctic to decrease risk to personnel, increase survey efficiency, reduce survey costs, and minimize disturbance of marine wildlife. The performance of UAS relative to human observers in manned aircraft is not well understood and must be more thoroughly investigated prior to accepting UAS as an alternative to manned aircraft for conducting these investigations.

Approx. Cost: (in thousands) $1,000 plus joint funding **Period of Performance:** FY 2015-2018

Description:

Background: Manned aircraft are a common platform for studying wildlife because they are relatively cost-effective for surveying large geographic areas and take advantage of humans' ability to quickly integrate sensory information on the biological and physical environment in order to detect, identify, and count species of interest. In recent years, there has been increasing interest in using UAS to study wildlife populations. In particular, UAS have been suggested as an alternate survey platform for studying the distribution and density of the Bering-Chukchi-Beaufort stock of bowhead whales in the western Arctic, which has been investigated using manned aircraft since 1979. The primary advantage of using UAS to survey marine wildlife in the Arctic is the elimination of the risks associated with sending humans far from shore on small aircraft in areas prone to extreme weather. Furthermore, UAS have the potential to be cheaper to operate than conventional aircraft and some have the advantage of prolonged flight times. Finally, field work conducted by NMML in the Arctic has shown that UAS are less likely to disturb pinnipeds than conventional aircraft.

The FAA's Reauthorization Act of 2012 designated airspace for UAS operations in the Arctic, making UAS a more viable platform for use in marine mammal monitoring by the oil and gas industry. For surveying cetaceans, the ability of UAS methodology to detect cetaceans, identify individuals to species, estimate group size, identify sensitive age classes, and estimate density must be understood relative to the proven capabilities of human observers in conventional aircraft. A small number of limited field tests have been conducted to assess the effectiveness of UAS for surveying cetaceans in the Arctic, the results of which warrant further investigation. Additional insight will be gained only through direct comparisons of UAS and human observers in the field, with cetaceans (bowhead whales, gray whales, and belugas) as the primary targets.

Objectives:

- Evaluate the ability of UAS methodology to detect cetaceans and compare encounter rates, identify individuals to species, estimate group size, identify calves, and estimate density in arctic waters relative to conventional aerial surveys.
- Describe improvements needed in UAS technology (e.g., payloads, cameras, environmental sensors) to operate in Arctic conditions for a large-scale survey program.
- Provide recommendations for the types of monitoring or mitigation requirements that can likely be met using UAS.

Methods: Joint-funding opportunities may be available for this project (e.g. ONR and NSB). Planning and permit application will occur during the first year. Fine-scale aerial line-transect surveys will occur in the second year in the northeastern Chukchi and western Beaufort seas during the open water season, when bowhead whales, gray whales, and belugas have reliably been found feeding in and migrating through the region. Marine mammal observers will conduct a line-transect survey from an aircraft flying between 1000-1500 ft. A ship-based or land-based UAS will operate concurrently in the same area, with a marine mammal observer on the UAS team, viewing digital video in real-time to detect, identify, and count cetaceans visible in the video feed. Because the effective strip width for the UAS will be narrower than that of human observers in the aircraft, UAS transects will be placed closer together than those for the conventional aircraft. Digital video footage and digital photographs from the UAS will be archived to enable post-flight analyses into UAS performance. Metrics that will be used to compare performance between platforms may include: 1) encounter rates made by each platform; 2) precision of the resulting density estimates; 3) relative efficiency of each platform, measured by length of trackline and duration of survey effort required to achieve a target precision in the density estimate; 4) cost to conduct the survey; and 5) fuel consumption. This study will be integrated with other ongoing BOEM studies in the region, including the "Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea" (AK-11-06, also known as "Aerial Surveys of Arctic Marine Mammals" or ASAMM) studying the distribution, density, and behavior of marine mammals.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Cook Inlet

Title: Subtidal and Intertidal Habitats and Invertebrate Biota in Lower Cook Inlet, Alaska

BOEM Information Need(s) to be Addressed: The BOEM *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017* includes a lease sale in the Cook Inlet Planning Area in 2016. Updated and readily accessible subtidal habitat information is needed to conduct environmental analyses for offshore continental shelf development in Cook Inlet, as well as for ongoing spill response planning. The subtidal and intertidal areas are home to many grazing invertebrates which provide an important source of prey for marine and terrestrial mammals, birds, other invertebrates and humans and is particularly susceptible to oil spills. Updated information from this study will be important to understanding and assessing potential impacts of an oil spill in Cook Inlet.

Approx. Cost: (in thousands) $600 **Period of Performance:** FY 2015-2019

Description:

Background: Benthic invertebrates and their habitats are susceptible to effects from industry exploration and development activities. The subtidal invertebrates and habitats adjacent to the OCS are particularly susceptible to oil spills and updated information is needed to assess impacts from a potential large oil spill in Cook Inlet. Previous research on intertidal and subtidal habitats in Cook Inlet includes the Outer Continental Shelf Environmental Assessment Program (OCSEAP) begun in 1975, as well as work done by the Cook Inlet Regional Citizens Advisory Council (CIRCAC) in 2000.

Subtidal and intertidal communities are also an important conduit of energy, nutrients, and pollutants between terrestrial and marine environments; provide resources for subsistence, sport, and commercial harvests; and are important for recreational activities such as wildlife viewing and fishing. Changes in the structure of the intertidal community serve as valuable indicators of disturbance, both natural and human induced. Further, changes in overall and relative abundance of intertidal species may have serious consequences for the bird and mammal species that forage in nearshore areas.

Marine bivalves (clams, mussels, and chitons [badarkis]) in particular are subsistence species for Alaska residents. Native communities in Port Graham and Nanwalek have noted a substantial decline in shellfish populations and have expressed concern over the potential loss or contamination of subsistence resources. Bivalves are ubiquitous and critical components of the nearshore intertidal environment, and have been used widely as sentinels in monitoring programs. Community monitoring for bivalves for potential contaminants would be an important component to address concerns about release of contaminants, most notably polycyclic aromatic hydrocarbons (PAH), into the

environment. It is important to improve our understanding of the following: the extent and details of benthic habitat that support subsistence resources, hydrocarbon loads in these resources, as well as the sources and extent of local contamination, particularly those where subsistence harvest continues.

This study would be conducted with a collaborative approach between communities and Federal agencies and will provide a better understanding of invertebrate biota including distribution, habitat, densities, productivity and larval transport of marine bivalves. A subset of the species will be used as sentinel species to assess the vulnerability of marine ecosystems to the effects of oil contamination. Hydrocarbon work would also leverage previous surveys by CIRCAC and NOAA-NOS. Potential cooperators would include NPS, USGS, CIRCAC, NOAA, USFWS, Gulf Watch Alaska, Kenai Peninsula Watershed Forum, and the Port Graham Tribe and Chugach Regional Resources.

Objectives:

- Examine variability in habitat and invertebrate abundance of invertebrate communities using existing ShoreZone imagery, and previous sampling programs to view, assess, and quantify various habitat strata in lower Cook Inlet.
- Develop and facilitate a monitoring program with local communities for hydrocarbon sampling near Port Graham and Nanwalek in Kachemak Bay with bivalves as a sentinel species (i.e. mussels, chitons (badarkis), and clams).
- Evaluate the current status of hydrocarbon presence in nearshore areas and archive hydrocarbon analyses in an Alaska hydrocarbon dataset for the public.
- Conduct subtidal sampling covering habitat strata the intertidal, rock ramps, and reefs for vegetation and invertebrate biota including areas: Tuxedni, Chinitna Kamishak Bays, Nordyk Island, Tignagvik Pt. and St. Augustine
- Incorporate the existing spatial habitat data with the new information from biological monitoring to create digital and web based synoptic maps to better portray ecological information to support resource management decisions.

Methods: This study will identify and collate important historical and ongoing temporal and geospatial habitat and benthic data. The data will quantify various habitat strata for monitoring and sampling. Areas for community monitoring of PAH with accessible marine bivalves will be selected near two communities in Kachemak Bay. Researchers will conduct targeted sub tidal benthic surveys across an area of habitat types and areas using existing protocols from the BOEM-MARINe, Census of Marine Life/NaGISA (Natural Geography In-Shore Areas), Exxon Valdez Oil Spill Trustee Council-Gulf Watch Alaska and National Park Service Inventory programs will be utilized for subtidal sampling. Researchers will apply an analytical approach to utilize existing habitat data with collected biological data to better document ecological processes in nearshore areas by producing derived geographical datasets and maps to help inform resource managers, stakeholders, and decision makers.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Cook Inlet

Title: Cetacean Distribution, Abundance, and Ecology in Cook Inlet

BOEM Information Need(s) to be Addressed: Information gained from this study is needed to establish spatial and temporal distribution and abundance of several species of whales, including multiple endangered species, that may be potentially affected by pre- and post-lease oil and gas activities, potential response to oil spills or other anthropogenic impacts of oil/gas production and transportation in the Proposed 2016 Lease Sale 244 area and the lower Cook Inlet/northeast entrance of Shelikof Strait areas. This study will provide year-round documentation of temporal and spatial distribution, relative abundance, and functional areas for cetaceans. Findings from this study will provide for informed evaluations of the potential effects of activities on whales, including listed species and designated critical habitat required under NEPA, Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA). Increased understanding of the seasonal distribution and habitat use of the cetacean species will assist BOEM in pre- and post-lease NEPA assessment, design of temporal and spatial mitigation, monitoring of effects of activities, estimating take (under the MMPA and ESA), and long-term efforts to apply the best available science to adaptively manage potential effects of oil and gas on cetaceans to reduce impacts to the lowest practicable level. Results will support future Section 7 ESA consultations and preparation of future Biological Evaluations and Biological Opinions.

Approx. Cost: (in thousands) $2,500 **Period of Performance:** FY 2015-2018

Description:

Background: There are numerous species of whales that occur within or near the proposed Lease Sale 244 and Lower Cook Inlet/entrance of Shelikof Strait areas. Research directed at the population dynamics, habitat use and foraging ecology of humpback, fin and killer whales has occurred near Kodiak Island and in Prince William Sound, however there has been little direct effort within the study area, including the Barren Islands and Shuyak Island. Fin and humpback whales, which are endangered species, are known to be present in significant numbers year-round and seasonally feed intensively within and downstream of this area. Humpback whales are known to feed seasonally in the area near the Barren Islands, and occur seasonally in southern Cook Inlet and Shelikof Strait. Currently available data is insufficient to describe abundance, seasonal use patterns or feeding habits of cetaceans in these areas, and ongoing monitoring efforts are aimed at beluga whales in upper Cook Inlet and sea otters in the mid-portion of the Inlet. Recent detection of two other species of concern, belugas and North Pacific right whales, in the bays of western Kodiak demonstrate their presence and potential for interactions with oil and gas development in the Cook Inlet area. The presence of several other cetacean species in the area, including sei, blue, gray, killer, and minke whales, as well as harbor and Dall's porpoise, is known but their seasonal

distribution, relative abundance, and feeding hotspots are poorly documented. The spring and fall migration routes for most of the Eastern North Pacific gray whale stock are not well-defined at present, but likely occur fairly near to the planned sale area.

The pattern of use by individual whales and populations in or near Cook Inlet is not well-defined. Endangered sei whales have been rarely sighted in Shelikof Strait, though current studies are inadequate to define their use of these areas. The Eastern Pacific stock of the North Pacific right whales, the most endangered large cetacean population in the world, has been sighted in the Gulf of Alaska, outside of the Kenai Peninsula and off of Kodiak Island. Critical habitat has been designated in this area for this species. Previous studies are inadequate to determine if North Pacific right whales occur in lower Cook Inlet, Shelikof Strait, or near the Barren Islands. However, on the outer coast of Kodiak Island, this species has been sighted in areas in which humpback whales also feed. Blue whales are resident in the deeper waters of the Gulf of Alaska and may occasionally pass through the deeper portions of lower Cook Inlet and Shelikof Strait.

Some species of cetaceans may be adversely affected by routine and accidental operations associated with OCS oil and gas activities. For example, the acoustic environment used by many species of whales is notably altered by industry activities, including seismic surveys, shipping, drilling, construction, etc. There are potential effects on their ability to use sound to communicate, detect predators, find prey, and navigate. Data indicate that underwater noise associated with high energy seismic exploration may cause some whale species or stock segments to avoid areas where seismic exploration is occurring. For example, it is known that female humpbacks with calves are, in some situations, sensitive to noise from seismic exploration. Other types of activity associated with oil and gas development may disturb and modify the behavior of whales or put them at risk from boat strikes.

Objectives:

- Document the relative abundance, spatial, temporal, and functional use patterns of individuals and populations of cetacean species from the Forelands in the central Inlet south to the Barren Islands and Shuyak Island and the northern portion of Shelikof Strait.
- Investigate the ecological factors responsible for the distribution of whales in the study area with emphasis on the relationships between whale occurrence, distribution of potential prey, and oceanographic conditions, to assess the foraging habits and trophic roles of key whale species within the planned sale area and adjacent waters.
- Estimate the degree of overlap and exchange between the Cook Inlet Planning Area and other known feeding areas within Alaska (i.e. Kodiak Island, Shumagin Islands, Prince William Sound, and Southeast Alaska) for humpback whales.

Methods: This study will provide three years of year-round documentation on temporal, spatial, and functional use patterns through periodic aircraft and vessel-based surveys, and deployment of continuous passive acoustic vertical recorder arrays with tracking capabilities (bearing and distance) to detect seasonal presence of marine mammals in

the waters of lower Cook Inlet, the entrance to Shelikof Strait, and nearby and downstream areas of the Gulf of Alaska. Autonomous acoustic recorders have been deployed in upper Cook Inlet, which also features heavy fishing activity and strong currents. Local knowledge from the fishing fleet will be used to deploy and recover long-term passive acoustic vertical arrays in areas of known marine mammal diversity and abundance, and to ensure recovery of the arrays from this challenging environment. The array will detect a frequency range that is sufficient for all known vocalizations for marine mammals which occur in the Cook Inlet area. Aerial, shipboard, tagging and acoustic data will be integrated to fulfill the study objectives. Presence of pinnipeds and sea otters will be recorded when observed, though the survey design is geared toward identifying cetaceans.

Sonobuoys will be used to assist aircraft and vessels in locating individual whales for detailed study and tagging. Satellite-linked transmitters will be deployed on individuals of select species for year-round monitoring of movements and short-term recoverable archival tags will be used to explore fine-scale movements and feeding behavior in relation to the acoustic environment. Periodic ship-based and/or aerial surveys will obtain information on temporal, spatial, and functional use patterns. Appropriate oceanographic methodologies will be applied to examine prey and habitat relationships related to whale habitat usage.

Biopsy samples of individual whales will be collected for genetic, stable isotope and fatty acid analyses to investigate trophic relationships. Results from these surveys will provide information on the seasonal and inter-annual distribution of whales within these regions, as well as document interchange between these regions and other foraging areas throughout Alaska. Biochemical analyses (stable isotope ratios and fatty acids) will improve our understanding of the foraging habits and trophic roles of these whales. Finally, analysis of mitochondrial DNA haplotypes will provided needed information on the genetic structure of these whales as it relates to the populations as a whole.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): All Alaska Planning Areas

Title: Alternative Energy Capacity Inventory in Coastal Alaska

BOEM Information Need(s) to be Addressed: The Energy Act of 2005 delegated regulatory authority to MMS (now BOEM) over renewable energy resources on the OCS. The new mandate requires fresh research about the range of opportunities, environmental implications, and potential social effects of renewable energy projects on a national, regional, and local scale. This study is designed to provide an initial inventory of plausible development opportunities and potential socio-economic consequences for residents of Alaska and select coastal communities. The information is needed for timely agency planning of the new regulatory authority.

Approx. Cost: (in thousands) $450 **Period of Performance:** FY 2015-2017

Description:

Background: Renewable energy resources, such as solar, wind, tidal and geothermal power, are gaining credence as a viable means to offset the nation's dependence upon fossil fuels and reduce pollution emissions, as well as a means to reduce large international trade deficits, to improve national security, and to stimulate new prospects for economic expansion. Alternative renewable energy supplies convey great promise for the future, but they must be imagined within the context of existing and developing socio-economic and political relations, with a watchful eye upon the potential environmental, social and cultural consequences of a significant technological transformation.

Some of the paramount initial social questions must consider optimal opportunity for alternative energy development. Which regions of coastal Alaska are best poised to capitalize on opportunities from new technologies in the development of renewable energy? What are the predictable implications of tidal energy production in a specific region, such as Cook Inlet? What are the major parameters that will determine the economic feasibility of alternative energy projects in various regions of coastal Alaska? Will alternative energy technologies provide a wide range of socially desirable benefits to match the presumed environmental benefits? In what specific ways should government regulatory authorities attempt to manage a nascent development project in order to optimize positive social impacts and minimize any adverse implications?

The State of Alaska has leased land for geothermal exploration on Saint Augustine Island on the west side of Cook Inlet. In addition, the Federal Energy Regulatory Commission recently approved a preliminary permit for a tidal energy project in upper Cook Inlet. Building on these emerging capacities, this study will focus primarily on geothermal and wave/tidal energy.

Objectives: The objectives of this study are to: 1) establish firm intellectual understanding over the range of options, processes, economic feasibility, and potential management strategies that are relevant to development prospects for renewable energy sources on the OCS of Alaska and 2) systematically collect a variety of technical and socio-economic data to produce a resource inventory dataset about the realistic prospects and related social impacts of specific alternative energy development scenarios for the Alaska region.

Methods: In coordination with the State of Alaska, conduct a systematic review of feasibility studies and project proposal scenarios for development of alternative energy resources in Alaska. Conduct a literature review on social implications of alternative energy development. Identify and interview key experts from industry to document relevant technical details about the minimum thresholds necessary to achieve economic feasibility for specific project scenarios. Conduct a series of focus group sessions with relevant stakeholder representatives to explore and document the range of social perspectives about various alternative energy development scenarios and anticipated benefits and impacts. Produce a realistic development model and summary report to demonstrate lessons learned from the study.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Habitat Use, Ecology, and Population Status of Polar Bears in the Chukchi Sea

BOEM Information Need(s) to be Addressed: This study will identify important polar bear habitat and patterns of habitat use, targeting bears in the Chukchi Sea Program area; and examining relationships between inter-annual variation in sea ice conditions and polar bear distribution, habitat use, and ecology. Information on feeding ecology, nutritional status, and reproduction in relation to inter-annual and long-term environmental variation, will be used to establish measures for monitoring polar bear status as oil and gas industry exploration and future lease sales occur in the Chukchi Sea OCS. Results will be used by BOEM in Section 7 consultations under the Endangered Species Act (ESA) for polar bear and their critical habitat, as well as in NEPA analyses of Chukchi Sea lease sales, EPs, and DPPs. Data on patterns of polar bear habitat use provided by this study will be used to improve NEPA analysis of potential oil spill effects on polar bears. This study will also provide information to improve mitigation measures and monitoring efforts required under BOEM plan approvals and MMPA take authorizations.

Approx. Cost: (in thousands) $400 plus joint funding **Period of Performance:** FY 2015-2020

Description:

Background: Recent declines in sea ice habitat are exposing polar bears (*Ursus maritimus*) in the Chukchi Sea to human-caused removal and expanding industrial exploration and development. The declining sea ice is exposing bears to increased open water conditions and longer swims with impacts to both fitness and recruitment, and interaction with open water exploration activities. Exploration drilling operations in the Chukchi Sea in 2012 reported numerous bears approaching vessels in open water. To effectively monitor and mitigate potential impacts to this population, accurate and up-to-date biological information is needed. Research conducted by the U.S. Fish and Wildlife Service (USFWS) in the Chukchi Sea during 2008–2011 focused on obtaining preliminary information on the ecological status and distribution of bears, and targeted bears in the core range of the Chukchi Sea subpopulation by sampling over a limited geographic distribution in the U.S. Habitat use and indices of population growth (e.g., reproduction) varied greatly among years, resulting in the need for longer-term studies to understand demographics.

This study builds upon the results of a previous BOEM-USGS-USFWS collaborative Chukchi Sea study to examine relationships between annual variations in sea ice conditions and bear habitat use, distribution, and ecology; and to estimate survival rates and population size. Sampling will target bears on the eastern peripheries of the subpopulation range to provide better information on the seasonal distribution of bears

that use areas of industry interest within the Chukchi Sea. This information will lead to improved mitigation and monitoring measures by providing habitat use data in the area of overlap between the U.S. and Russian Chukchi Sea and Southern Beaufort Sea subpopulations.

Objectives:

- Evaluate distribution and population delineation of polar bears in relation to harvest and industrial development to improve oil-spill risk assessment.
- Relate habitat use, including the seasonal use of land and ice as a resting and denning platform, to individual fitness using individual-based models.
- Assess changing habitat use through comparison of current resource selection data with historic data collected in the late 1980s and early 1990s.
- Evaluate foraging ecology, nutritional status, and indices of polar bear reproduction in relation to inter-annual variation in environmental conditions and a potentially changing prey base.
- Estimate population size and growth rate of the Chukchi Sea polar bear subpopulation using capture-recapture methods and distribution information.
- Evaluate population persistence under forecasted sea ice scenarios incorporating human-caused removals, and other management scenarios.

Methods: This study will expand sampling locations north and east of Point Hope, Alaska and possibly into areas of the Chukotkan coast, expanding the study area in order to obtain a representative sample of the entire population. Data collection in the U.S. will consist of the live-capture and release of 50-150 polar bears by helicopter each spring. Captures will occur on the sea ice to ensure representation of habitat use offshore, including the current OCS lease areas. Potential logistical bases could include the Red Dog Mine port facility and communities to the north. Field researchers will apply individual marks and obtain physical measurements and a suite of biological samples (e.g., hair, fat, and blood) from all captured polar bears. Radio-telemetry tags will be placed on adult females and analyses of the tracking data as well as the biological samples will be conducted to meet the above objectives.

The Chukchi Sea subpopulation of polar bears moves freely between the U.S. and Russian coasts, and most Chukchi Sea females are believed to den on Wrangel Island, which has implications for management and for oil spill analysis. Given the importance for this population of this Russian island, data collection will include genetic samples on Wrangel Island and the Chukotkan coast using hair snares, biopsy darting, and opportunistic collection at den sites. Additionally, field efforts will seek to complement radio-telemetry data obtained in the U.S. via the live-capture and release of bears in Russia in autumn. The autumn timing of fieldwork will provide key information on the nutritional cycle of polar bears in relation to reproduction and survival.

Revised Date: April 2014

2.3 Profiles of Studies Proposed for FY 2016 NSL

Table 3. BOEM Alaska OCS Region Studies Proposed for the FY 2016 NSL

Page Number	Discipline	Study Title
259	IM	Collaboration with North Pacific Research Board (NPRB) Arctic Marine Research Program
261	PO	Assessment of Multiple Ocean Circulation Models to Support Ensemble OSRA Experiments
263	HE	Temporal and Spatial Variation in Arctic Cod Habitat Use of the Nearshore Beaufort Sea in Summer
265	HE	Status of Marine and Coastal Birds in Lower Cook Inlet
267	MM	Analysis of Historical Acoustic to Quantify Bowhead Acoustic Occurrence, Bioacoustic Ecology and Ambient Noise Across the Chukchi and Beaufort Seas
269	SE	Impact Assessment for Cross Island Whaling Activities
271	SE	The Beluga Hunts in Point Lay and Wainwright, Alaska

Discipline Codes		
AQ = Air Quality	FE = Fates & Effects	HE = Habitat & Ecology
IM = Information Management	MM = Marine Mammals & Protected Species	
PO = Physical Oceanography	SE = Social & Economic Sciences	

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Collaboration with North Pacific Research Board (NPRB) Arctic Marine Research Program

BOEM Information Need(s) to be Addressed: The National Science Foundation and the North Pacific Research Board have worked together programmatically and scientifically through the Bering Sea Project (http://bsierp.nprb.org) since 2007. Based on this successful collaboration, BOEM and NPRB are intending to partner on new collaborative research in the Arctic, leveraging expertise across several partners and funding sources, including BOEM, NSF, NPRB, NOAA, AOOS, USGS, ONR, NASA, NSB, NWA, industry and others, specifically in the Chukchi and Beaufort Seas, on mutually identified information needs.

Approx. Cost: (in thousands) $1,000 **Period of Performance:** FY 2016-2021

Description:

Background: The Alaska OCS Region has a long history of supporting multidisciplinary research, beginning with the "Outer Continental Shelf Environmental Assessment Program" (OCSEAP) surveys conducted between the 1970s and early 1990s and the "Beaufort Sea Monitoring Program" (BSMP) in the 1980s. The "Arctic Nearshore Impact Monitoring in Development Area" (ANIMIDA) program and its continuation (cANIMIDA) started in 1999 to provide baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. This work continues today with the studies "ANIMIDA III: Boulder Patch and Other Kelp Communities in the Development Area," begun in 2012, and the recently awarded "ANIMIDA III: Contaminants, Sources, and Bioaccumulation," which has been expanded to include Camden Bay.

Since 2007, the Alaska OCS Region has also developed a new suite of studies in the Chukchi Sea, leveraging more than $65 million (through FY 2013) to conduct interim baseline research and monitoring in all the following fields of interest: meteorology, ice dynamics and basic oceanography, benthic fauna and sedimentation, marine mammals (including whales, walrus, seals, and polar bear), fish, birds, and social systems. Most of the projects exhibit complex, multilateral collaborations, with explicit inter-disciplinary linkages between the physical and biological sciences, and many of them also provide a role for active participation by Alaska Native residents and input from sources of traditional knowledge. Most of them pursue multi-year data collection efforts on a regional scale, with careful attention to inter-annual variability and ecosystem processes.

Objectives: BOEM would build upon existing working relationships with NPRB, NOAA, USGS, AOOS, industry and others by establishing financial cooperation, coordinated Request for Proposals, data sharing agreements, and logistical support agreements. The

foundation for such partnerships remains based on our Annual Studies Planning Process. The new collaboration will involve established funding partners and existing research implementation strategies (e.g. IARPC, Arctic Council, Distributed Biological Observatories) to form interdependent but linked studies to examine physical, biological and social processes.

Methods: BOEM, NPRB and other funding partners will build upon newly available synthesis projects (such as Synthesis of Arctic Research [SOAR] and Pacific Marine Arctic Regional Synthesis [PacMARS]) to examine areas where collaborative studies could help enhance informed decision-making on the sustainable use of resources. This study will be guided by an oversight committee formed of senior scientists and accomplished through an annual RFP process. Recommendations for select studies would be based on program development goals. After BOEM review and approval, subgroups of interdisciplinary scientists will work together with NPRB and NSF to select specific task orders for funding. There will be a specific implementation plan developed to prepare data for integration and conduct appropriate statistical analyses or modeling to identify interdisciplinary relationships and/or test hypotheses previously identified. Topics for studies include, but are not limited to, inter- and intra-relationships of oceanographic circulation, sea ice, hydrography, fisheries and lower-trophic abundance and distribution, and marine mammal and seabird distributions and behavior. Deliverables from this study will include multiple workshop proceedings and summary recommendation reports, as well as multiple peer-review journal publications.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea, Cook Inlet

Title: Assessment of Multiple Ocean Circulation Models to Support Ensemble OSRA Experiments

BOEM Information Need(s) to be Addressed: Oil-Spill-Risk Analysis (OSRA) is a cornerstone foundation for evaluating alternatives in OCS oil and gas leasing NEPA analyses and oil spill response plans. This study would support continuing improvement of the BOEM oil-spill trajectory model and its application in the Arctic and provide additional baseline information for NEPA analyses. Oil-spill issues constitute a significant portion of public comments submitted on NEPA documents related to proposed lease sales, EPs, and DPPs in the Alaska OCS Region.

Approx. Cost: (in thousands) $450 **Period of Performance:** FY 2016-2018

Description:

Background: To assess potential changes in the marine and coastal environment associated with offshore oil and gas development activity, it is important to understand how key environmental variables (e.g., surface winds, oceanography, and sea ice) fluctuated in the past and are predicted to act in the future in association with climate variations. To maintain its state-of-the-art in oil-spill-trajectory analysis, BOEM seeks to take advantage through time of the increasing skill of circulation models supported by more and better data. Over the past decades, BOEM and other federal and state agencies have invested a significant amount of resources to measure and model the circulation and variability in the Alaska coastal waters. It has been an ongoing challenge to converge on a well-validated and finer-scale ocean circulation model. Modeling the coastal circulation around Alaska is particularly challenging given its complex coastline, rapidly changing weather conditions and the relative large freshwater input from river discharge and melting ice. Thus, any single model hindcast likely has large uncertainties, and a systematic effort is required to validate these hindcast model simulations against available measurements. A multi-model ensemble is the ultimate approach to providing retrospective analyses and estimating model uncertainties for surface wind, ocean currents and waves, and sea ice in Alaska coastal waters.

Objectives:

- Assess the performance and estimate the uncertainty of simulations of ocean currents and sea ice in Alaska coastal waters from multiple ocean circulation models.
- Apply short-term surface fields from multiple ocean circulation models for the Arctic to identify the physical processes most important to oil-spill trajectory analysis and evaluate sensitivities of the various models to relevant parameters.

Methods: This study will assemble model simulations for ocean currents and sea ice from multiple ocean circulation models to support ensemble and intercomparison OSRA experiments. Observational data sets will be assembled and aggregated from a variety of sources to facilitate data-model comparisons. Local observations include flow measurements from acoustic Doppler current profilers and drifters and water mass data from conductivity-temperature-depth (CTD) profilers. Deliverables would include a report outlining the strengths and weaknesses of each model in relation to processes relevant to oil-spill trajectory analysis, as well as short-term (five years) surface circulation fields from the suite of models.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Temporal and Spatial Variation in Arctic Cod Habitat Use of the Nearshore Beaufort Sea in Summer

BOEM Information Need(s) to be Addressed: Arctic Cod (*Boreogadus saida*) is the primary forage fish in BOEM's Beaufort and Chukchi Sea Planning Areas and the majority of the Arctic Basin and it is the principal avenue by which lower level trophic production is transferred to upper trophic level marine birds and mammals. Additional information on the species distribution, habitat use and basic natural history is needed for post-sale NEPA analysis, review of EPs, DPPs and other reviews for post-sale and post-exploration BOEM decision making and mitigation. Since Arctic Cod is a keystone species in arctic marine food webs, knowledge of seasonal and annual variation in its abundance, availability and habitat use is essential for accurate assessments of temporal variation in the large and diverse populations of upper trophic level marine predators dependent on Arctic Cod such as birds, seals, polar bears, beluga whales, and humans. Evaluation of the factors causing changes in Arctic Cod distribution and availability is needed to distinguish between changes due to anthropogenic and natural effects in all the marine species that utilize Arctic Cod as their primary food source.

In addition, the Magnuson Fishery Conservation and Management Act, requires that Essential Fish Habitat (EFH) be identified and described and agencies must act to encourage conservation and enhancement of EFH. Knowledge of the seasonal use of under-ice, water column and benthic habitats by Arctic Cod in the Beaufort Sea is needed to assess the species' seasonal dependencies and vulnerabilities.

Approx. Cost: (in thousands) $660 **Period of Performance:** FY 2016-2018

Description:

Background: Arctic cod are considered a sentinel and keystone species in arctic marine ecosystems but their close association with sea ice combined with the logistical obstacles associated with sampling in remote ice-covered waters has limited our knowledge of the species. The relatively short summer season when Alaska's arctic waters are navigable further limits the utility of traditional biological oceanographic methods for sampling and studying Arctic Cod. This paucity of knowledge for the primary forage fish in arctic marine food webs will hinder predevelopment assessments of ecosystem vulnerability as well as post-development assessments of natural and anthropogenic factors affecting Arctic Cod and all the upper trophic levels dependent on Arctic Cod.

The information available on Arctic Cod in Alaska's nearshore waters in summer was primarily gathered before the recent major summer ice retreats that have caused a regime shift in the nearshore marine ecosystem. Our proposed determination of the depth, habitats and water temperatures occupied by Arctic Cod over an extended summer period would be a major contribution to our understanding of this little-known

species during the period of ice retreat. Observations at the proposed study site in the last decade have documented the seasonal disappearance of Arctic Cod from the Black Guillemot's diet with increasing SST. The data provided through the proposed work would facilitate assessment of the potential effects of predicted increases in sea ice retreat and SST in future years.

The information provided by the proposed work would assist with two ongoing BOEM projects: "Beaufort Sea Marine Fish Monitoring Survey in the Central Beaufort Sea" (AK-10-06) and "Distribution and Habitat Use of Fish in the Nearshore Ecosystem of the Beaufort and Chukchi Seas" (AK-12-06), and the planned "Genomics of Arctic Cod: A Sentinel Species in a Changing Environment" (AK-14-03). Arctic Cod obtained at Cooper Island in past years have been provided to BOEM projects needing fish for analysis. This project will complement this work by expanding forage fish collections across a broader season. Preliminary results from indicates that a seasonal approach for sampling is important for quantifying the variability in abundance of forage species in the nearshore habitats.

Objectives:

- Document the habitat use of Arctic Cod in the nearshore Beaufort Sea during the period of sea ice decomposition and retreat (early June to early September) with analysis of seasonal and annual variation in depth, sea surface temperature and habitat (under-ice, water column and benthic). This will include identifying the oceanographic conditions that lead to an upper trophic level predator undergoing a seasonal shift from Arctic Cod to lower quality demersal fish species.
- Evaluate temporal variation by age class (adult and first-year) in Arctic Cod utilization of the nearshore habitats during the late summer period of sea ice retreat through observations of and images of guillemot parents provisioning young with prey.
- Obtain a seasonal time-series (from July-September) of Arctic Cod specimens of different age-classes to be provided to other BOEM investigators examining the stable isotope signatures, caloric value, and genomics of Arctic Cod.

Methods: This study will utilize an upper trophic level marine predator, the Black Guillemot, which specializes in Arctic Cod. Temperature/depth recorders (TDRs) will be attached to the tarsi of guillemots breeding on Cooper Island (35 km east of Point Barrow) and collect continuous data on dive depth, dive profiles (under-ice, water column or benthic), and water temperature. During the period when guillemots provision nestlings (late July through early September) the dive information will be supplemented by observations and images of prey using motion-sensitive cameras at nest sites with birds outfitted with TDRs. This allows individual prey items (taken to species, age-class and size) to be associated with specific dives and dive bouts. Preliminary work with TDR deployment and concurrent fish image acquisition was conducted on Cooper Island in 2012 and 2013 and the dive logs obtained are currently being analyzed with a dive analysis program.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Cook Inlet

Title: Status of Marine and Coastal Birds in Lower Cook Inlet

BOEM Information Need(s) to be Addressed: The BOEM Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017 includes a lease sale in the Cook Inlet Planning Area in 2016 and recent expansions of on-shore and off-shore exploration efforts in state lands and waters in the region demonstrate increased industry interest in Cook Inlet oil and gas development. Information on the distribution and timing of use by marine birds, including ESA-protected species (Steller's eiders, Kittlitz's murrelets, Yellow-billed loons), is necessary to assess potential impacts of oil and gas exploration and development in the Lower Cook Inlet Planning Area. Data on the distribution and abundance of marine birds is needed for ESA Section 7 consultations and NEPA analyses. The information obtained from these surveys will assist in development of mitigation measures and strategies to reduce potential impacts on marine and coastal bird populations in the Cook Inlet Planning Area.

Approx. Cost: (in thousands) $600 **Period of Performance:** FY 2016-2019

Description:

Background: The waters, shorelines, and wetlands of lower Cook Inlet support abundant marine bird populations throughout the year. Recent efforts to estimate the abundance of these species was conducted in 1996-1999 and largely focused on the northwestern and southeastern side of the inlet, with little or no coverage of the central and western portions. The 1996-1999 surveys were only conducted during summer, but earlier USFWS 1992/1993 surveys showed quite different marine bird communities between summer and winter in lower Cook Inlet, with seaducks (including Steller's eiders) using the area in winter. The US Fish and Wildlife Service conducted limited marine bird surveys in Kachemak Bay during summers of 2005-2007 and 2010. Updating and expanding the dataset regarding marine and coastal birds will provide valuable information for NEPA analysis and Section 7 consultation.

Additionally, pursuant to Section 388 of the Energy Policy Act of 2005, BOEM has discretionary authority on leasing, easements or rights-of-way on the Outer Continental Shelf (OCS) for alternative energy projects, such as wind, wave, or ocean current facilities. The Cook Inlet Planning Area holds promising alternative energy resources, thus understanding marine bird distribution and abundance will be necessary for environmental analyses in the Cook Inlet Planning Area.

Objectives: The overall purpose of this study is to obtain seasonal abundance and distribution data on marine and coastal birds in the lower Cook Inlet Planning Area with aerial surveys. The primary objectives are to:

- Document the seasonal distribution and abundance species composition for marine and coastal birds in the Cook Inlet Planning Area. Aerial Surveys would occur off of marine, nearshore, inland and coastal wetland habitats.
- Evaluate utilizing small Unmanned Aerial Systems (UAS), such as the Aeryon Scout equipped with imagery systems to expand spatial coverage
- Process the data (GIS based maps and attribute tables) for entry into the North Pacific Pelagic Seabird Database for future accessibility and to facilitate new information for Oil-Spill-Risk-Analysis.
- Identify seasonal concentration locations to provide information for environmental assessments.
- Identify environmental drivers with high priority locations from the GulfWatch program (bathymetry, currents, temperature, salinity).

Methods: We propose a minimum of two complete spring, summer, fall, and winter aerial surveys of the lower CIPA during 2015 and 2016 to enable a better understanding of all marine and coastal bird use in the planning area. The basic study design for summer (June-July) will follow that used in 1996-1999, with the exception that the east-west systematically spaced transects will be extended to include the entire lower Cook Inlet region. Kachemak Bay will have more intensive coverage, using north-south systematically spaced transects that duplicate USFWS surveys in the bay between 2005 and 2010. The fall and winter surveys (March, October) will cover a reduced area to account for ice cover and accessibility. Information gathered from a small UAS will be assembled and analyzed through available software such as MosaicMill, EnsoMOSAIC, Icaros, or Photomodeler. Data will be entered into the North Pacific Pelagic Seabird Database (NPPSD) and made available for further NEPA and ESA analyses.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Analysis of Historical Acoustic to Quantify Bowhead Acoustic Occurrence, Bioacoustic Ecology and Ambient Noise Across the Chukchi and Beaufort Seas

BOEM Information Need(s) to be Addressed: As climatic conditions in the Arctic change and shipping and offshore energy activities increase, present environmental management plans designed to mitigate potential impacts on protected species and the environment may need to be modified for expected levels of future activities. An understanding of how bowhead whale occurrence and ambient noise conditions are changing, and the relationship to variations in environmental, biotic and anthropogenic conditions (*e.g.* ice melt primary productivity, ship traffic) can provide a basis for more effective and efficient management practices. This study will provide the data needed to address cumulative effects of noise from anthropogenic activities and environmental conditions and to assess the relative impact of oil and gas activities on bowhead whales in the Arctic. This information will enable informed regulatory decisions and policies regarding this endangered species as required under the Marine Mammal Protection Act and the Endangered Species Act. A quantitative analysis of the Arctic's acoustic environment can provide not only important and previously unavailable information on bowhead habitat use patterns, but also insights into arctic ecosystem dynamics. This information will be useful in pre- and post-lease NEPA assessments and in mitigation and monitoring effects of activities to potentially reduce impacts on the species, as well as on subsistence harvesting to the lowest level practical.

Approx. Cost: (in thousands) $750 **Period of Performance:** FY 2016-2018

Description:

Background: From the late 1970s to the present, acoustic recordings have been collected in areas inhabited by the Bering-Chukchi-Beaufort bowhead population to better understand this specie's distribution and trends. Recording efforts have broadened in recent years to include a diverse taxonomic suite of marine vertebrates, sampled throughout the year over a broad range from the Bering Sea to the Canadian Beaufort Sea. A review of all available acoustic recordings since 1978 by the ongoing study "Synthesis of Arctic Research (SOAR): Physics to Marine Mammals in the Pacific Arctic" (AK-11-05) indicates approximately 125 years of acoustic data have been collected in the Bering-Chukchi-Beaufort region. For the period summer 2009 through summer 2010 alone, a total of 69 autonomous seafloor recorders sampled the ocean acoustic environment over a 2,300 km transect from the Bering Sea (62.2°N, -174.6°W) to the Canadian Beaufort Sea (70.8°N, -136.4°W). An initial look at this data by the SOAR acoustic group indicates that holders of this data are amenable to its integration, and insights into relationships between wind, ice, ambient noise and bowhead whale acoustic activity can be obtained, demonstrating the ability to quantify the Arctic's

acoustic environment, bowhead whale occurrence patterns, and changing ecosystem dynamics.

The historical Arctic acoustic data sets have already been collected, but are distributed in multiple institutions, exist in different formats on different machines, and remain difficult to combine, though they are of sufficient quality and quantity to do so. Integration of these acoustic data with the broad range of Arctic data collected throughout the same region and years would provide insights into the seasonal and geographic patterns of bowhead, and potentially other marine mammal, occurrence, as well as the dynamics and patterns of ambient noise throughout the region over recent decades. Timely access to these acoustic data has been dramatically improved and efficient analyses of very large acoustic data are now readily possible as a result of today's technologies, so that the full value of these extensive data sets can be used to maximum benefit.

This study will improve understanding of historical bowhead whale occurrence patterns to quantify and explain the multiple factors influencing the dynamics of the Alaskan arctic acoustic ecosystem.

Objectives: The objectives of this study are to:

- Quantify the seasonal acoustic occurrence of bowhead whales (and bearded seals, beluga whales and walruses as available) along with spatio-temporal variability in the acoustic environment; and
- Test the hypothesis that the dynamics of certain factors (*e.g.* percent ice cover and ocean temperature) directly correlate with changes in bowhead whale occurrence patterns and features of the acoustic environment.

Methods: This study will develop a single database assembled from all available acoustic data and associated metadata collected from the Bering Sea to the Canadian Beaufort Sea regions from 1978 to the present. This will entail converting the acoustic data into a standardized digital format and establishing their metadata in a user-accessible (online), professionally managed database system. Advanced analytic and data visualization techniques will be used to quantify the seasonal acoustic occurrences of bowhead whales (and potentially other marine mammal species, such as bearded seals, beluga whales, walruses) and determine the spatio-temporal variability in the acoustic environment. A suite of advanced, user-friendly analytical and visualization tools will be developed to facilitate data access. Analyses may focus on the last decade initially, as it holds the greatest level of spatial and temporal acoustic sampling, and abuts the present conditions. Collaboration with experts in very large data systems and advanced data analytics is encouraged to develop capacity for open access to the data, analyses and visualization tools. This dataset will then be analyzed to assess whether there is a correlation between environmental (and if available anthropogenic) factors with bowhead whale (and if available other marine mammal species) acoustic occurrence, and to describe the spatial and temporal extent of existing patterns.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Impact Assessment for Cross Island Whaling Activities

BOEM Information Need(s) to be Addressed: Offshore production at the Northstar facility started in November 2001. The Liberty prospect continues to indicate promise of future production on the OCS. The Beaufort Sea, including Camden Bay, may experience exploratory drilling in 2014 and 2015. Long-term study efforts to monitor potential effects of such development activities have occurred through the ANIMIDA and cANIMIDA projects, 1999-2011. There remains a continuing, ongoing need to monitor Cross Island whaling activities for potential impacts with the potential development of Liberty and exploration in the vicinity of Cross Island. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Approx. Cost: (in thousands) $425 **Period of Performance:** FY 2016-2021

Description:

Background: The Northstar facility is in State waters, but includes production of some OCS oil through directional drilling. The Liberty prospect will access OCS oil deposits. Industrial exploration and associated drilling in the Beaufort Sea, including Camden Bay, is expected during the years of 2015 and 2020 open water seasons. Although operations would be likely be suspended and infrastructure moved from the vicinity during the bowhead whale hunts at Cross Island and Kaktovik, whalers have expressed concern that impact monitoring be continued to document any variation during this period. The last field season for previous ANIMIDA and cANIMIDA multi-disciplinary monitoring efforts in the near-shore Beaufort Sea environment was 2011. This proposed study, however, intends to renew the long-term ethnographic monitoring effort for subsistence whaling activities that occur from the base camp at Cross Island through 2020. Although 2011 was to be the final field season, BOEM, the Nuiqsut Whaling Association, the North Slope Borough, and industry all consider documentation of any associated effects on the subsistence bowhead whale hunt to be of primary importance. This is largely because proposed exploration and development will occur to the east of Cross Island, and bowhead whales migrate from east to west in the fall during the subsistence hunt. Interested parties are concerned about the effects of anthropogenic noise and other impacts to the subsistence hunt.

Objectives: This study will gather long-term monitoring data to help assess whether OCS oil development activities at Northstar and/or Liberty result in changes to bowhead whale subsistence hunting practices, or to hunting success at Cross Island. The first objective is to understand Cross Island subsistence whaling variation over time. The second objective is to evaluate the relationship of offshore oil and gas industrial activities to whaling variability.

Methods: This study continues the essential methods established during the ANIMIDA and cANIMIDA phases of research. It calls for systematic observational and interview data collection from local informants about the number of whales taken; Global Positioning System (GPS) location of whale sightings, strikes, and harvests with direction and distance from Cross Island; number of crews, composition of crews, demography of crew (age, sex, hometown, connection with Nuiqsut/Cross Island); total number of crew; periodic "census" of whaling participants on Cross Island, duration of whaling season by active days; timing of whaling; length of trips and area searched while whaling; 8) records of catch per unit effort; and 9) observations of whaling participants. The study will also record systematic and observational/interview data collection on non-whaling subsistence activities on and near Cross Island, and observations of local subsistence users. Hard copy maps will be appended as necessary for clarification of location information. The recorded data will be presented in annual reports using tabular information on harvest levels and locations of subsistence resources taken on or near Cross Island and a final report.

Revised Date: April 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Alaska

Planning Area(s): Chukchi Sea

Title: The Beluga Hunts in Point Lay and Wainwright, Alaska

BOEM Information Need(s) to be Addressed: Point Lay and Wainwright are proximate to OCS oil and gas exploration in the Chukchi Sea. This study seeks to document the annual beluga whale hunts at Point Lay and Wainwright and explore the reasons why the Iñupiat select beluga as a traditional food source. This information will provide important baseline information for NEPA documentation, planning, and policy.

Approx. Cost: (in thousands) $450 **Period of Performance:** FY 2016-2018

Description:

Background: Currently, little information exists about the annual Point Lay and Wainwright beluga hunts, other than they occurs every year and involve hunters herding the mammals. At Point Lay, the smallest of the Iñupiat communities on the North Slope coast, the belugas are herded into Kasegluk Lagoon to be dispatched near the village. The herding of beluga at Wainwright has not been described and is not understood. Studies of Traditional Knowledge (TK) have been oriented toward learning what the Iñupiat know about beluga whale behavior rather than Iñupiat behavior and practice toward beluga subsistence hunting. A review of the literature indicates that beluga oil and meat require a number of steps to process and preserve, and that while the *maktaaq* is considered desirable; the black meat (dried beluga meat) was used as dog food. Sled dog teams have been replaced by snow machines, and the question that comes to mind is why the people go to such lengths annually to herd and harvest beluga whales.

There is a need to document this poorly understood marine mammal subsistence use that endures among the Iñupiat and reaches an apogee at Point Lay. The objectives of this study are to address the following hypothesis:

H1: The annual Point Lay beluga hunt endures because beluga is considered to be a delicacy among the Iñupiat.

The study will answer questions such as these:

- Document the hunt – how is the hunt organized? Are there differences between the Point Lay and Wainwright beluga hunts? Are there formal boat crews? Is the captain an *umeliak* (head of a corporate group)? How fluid are the whaling crews? What is the crew demography? How do hunters communicate within and between crews? How do hunters communicate with the village? What sized boat and what type of boat is used? How do hunters know when the beluga whales are migrating in the vicinity of the outer banks of Kasegluk Lagoon? How do they know how to select the number of whales to herd into Kasegluk Lagoon? How do

they herd the belugas? What weapons are used to harvest belugas? Where are the whales harvested?

- How many beluga are considered enough? What constitutes a "share?" How is the beluga shared within and outside of the community? Are specific methods used to prepare the meat? Is the blubber rendered? Are produced shares (rendered oil; dried meat) or raw shares distributed within the community? What about distributions outside of the community? To whom is an exchange made and in return for what?
- How is the beluga carcass managed? Is it burned, buried, or disposed of in the sea? Are any body parts saved? If so, what, and why?
- What is the body of Traditional Knowledge about the belugas?? What are the specific nutritive qualities of beluga? Is this a species that people use on-ice because it provides extra warmth? Does it impart any special health properties? Why do people eat the beluga? Is beluga meat, oil, and/or *maktaaq* desirable and if so, why? Are specific persons associated with exemplary preparation techniques? What specific skills and talents do they bring to the job? Is there a feast to celebrate a successful hunt? Are there taboos associated with beluga whale hunting, food preparation, or consumption?

Methods: The Principal Investigator will obtain community and regional support and provide documentation to this effect to BOEM. The study will include discussions with active hunters through the use of conventional ethnographic participant-observation and snowball sampling techniques. Capacity building within the community will be encouraged through the hiring and training of local people to provide assistance. Determine the type of honoraria that would be most suitable for the project and the participants. Dialogue in advance of the hunt with the people of Point Lay about which questions are valid, what other questions or documentation they would like included for the benefit of future generations, potential key informants to initiate the snowball technique and the like. The researcher(s) will have established or will need to establish a trusting enough relationship with the citizens of Point Lay to obtain key elements for the study. Over two seasons, the study will provide key informants in each boat crew with GPS equipped with cameras to document sightings, strikes, and harvest waypoints and photographs of interest. Researchers will be present at Point Lay to document through notes, interviews, photographs, and videos the hunt, including butchering, secondary processing, TK, and distribution of beluga. Both men and women will be interviewed. Findings, maps, photographs, and geospatial data will be incorporated in a report.

Revised Date: April 2014

SECTION 3.0 TOPICAL AREAS FOR FUTURE RESEARCH

This section presents a general forecast of significant topical issues and concerns to be addressed by studies for FY 2017 and beyond. In general, these topics conform with the research themes of the ESP. Due to the great differences existing between Alaskan environments and other OCS areas, the uniqueness of issues in Alaska has dictated the need to anticipate new topical areas for implementation. These projects will focus on BOEM mission needs within the context of increasing offshore exploration and development, and potential trends in a changing climate.

Many of the studies proposed for FY 2015 and FY 2016 address the topical areas described below. These will be re-assessed as part of the FY 2016 planning process.

As noted in Section 1.2.1 of this document, the *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017* (USDOI, BOEM, 2012) pointed to a need for further development of scientific information prior to additional leasing. Particular topics include the sensitive habitats, unique conditions, and distinctive subsistence hunting and fishing activities found in the Arctic, as well as the oil and gas resource potential. Development of additional information for the Cook Inlet Planning Area is also needed to support updated analysis of the potential effects of OCS activities on its environment and uses in anticipation of proposed Lease Sale 244.

3.1 Climate Change

Climate change is accelerating in the Arctic, leading to a rare but true baseline environmental change. In recent years, the extent of summer ice cover is decreasing more rapidly than was predicted by most global change models. The extent, duration, and thickness of summer ice cover in the Arctic region have decreased to record historical lows. The loss of ice cover is causing changes to both physical oceanography and ecosystem productivity and has significant ramifications for marine mammals, bird and fish species that live on, below, or near the ice.

Climate change will also lead to altered water chemistry. In particular, the average pH of the surface ocean is projected to decrease by as much as 0.5 pH units by 2100 due to the uptake of excess carbon dioxide (Sigler et al., 2008). In addition, higher water temperatures can result in increased biological production and decomposition.

Oceanic current patterns in the Arctic, especially in nearshore regions, are strongly influenced by climatological factors such as winds, river runoff and sea ice coverage. The rapid changes in each of these factors that are now occurring could lead to drastic alterations of the surface current fields. Oil-spill trajectory analyses performed by BOEM are based on surface current data derived from ocean circulation hindcast models. As climate change continues, oil-spill trajectory modeling may need to be updated on a more frequent basis.

Climate change also entrains many socio-economic issues. Some immediate concerns include: increased shoreline erosion and permafrost melt that threatens arctic villages

and infrastructure; changes in distribution and availability of hunted subsistence species; and potential changes in commercial and subsistence fisheries as commercial species such as salmon move north. In consideration of such basic transition, scientists are challenged to project how climate change effects will interact with OCS activities in the Arctic over the next 25-50 years.

3.2 Air Quality

In December 2011, Congress transferred jurisdiction and authority for the control of air emissions on the OCS in the Beaufort and Chukchi seas from the EPA to BOEM. While implementing this authority, BOEM will need air quality monitoring information to assess the cumulative air quality impact of off-shore Arctic oil and gas activity and to support compliance with the Clean Air Act and environmental justice initiatives.

3.3 Physical Oceanography

An ongoing challenge in the Alaska OCS Region is the need for better, finer scale circulation and oil-spill models and higher resolution data. This need is underscored by the rapidly changing conditions in the Arctic. Continued development and application of state-of the-art circulation models is important for future OSRA-based EIS analyses.

Improvements are also needed in sea ice aspects of the modeling. The resolution of ice models and ice data needs to be increased to address the propagation of fine scale non-random interactions across hundreds of miles of pack ice in the case of ice leads, as evidenced by recent improvements in satellite oceanography.

A better understanding of the first order physics controlling regional circulation and ice conditions within the U.S. Beaufort and Chukchi seas, as well as interactions with the Arctic basin and Canadian Beaufort, would inform and improve regional EIS's, EA's, and oil-spill response planning. In particular, more information is needed to assess the impact of ice on the nature and amplitude of the upwelling/downwelling and to gain a better understanding of the dynamics associated with river outflow plumes, especially under ice.

3.4 Fate and Effects

The Region has collected baseline biological and chemical monitoring data in the vicinity of the Liberty Prospect and Northstar since 1999, as part of the studies "Arctic Nearshore Impact Monitoring in the Development Area (ANIMIDA)" and its continuation, cANIMIDA. The summer of 2007 was the last field season for the cANIMIDA project. ANIMIDA 3, which is a continuation of ANIMIDA/cANIMIDA sediment chemistry monitoring, has been expanded to include Camden Bay where drilling is planned to delineate discoveries in the Sivulliq and Torpedo prospects.

In addition to site-specific monitoring, ANIMIDA and cANIMIDA re-examined the regional sediment quality in the nearshore U.S. Beaufort Sea. The ESP set up the Beaufort Sea Monitoring Project (BSMP) in the 1980's to monitor sediment quality. The BSMP monitored trace metal and hydrocarbon levels in sediments and benthic biota at

specific locations on a regional basis. The ANIMIDA and cANIMIDA projects have resampled many of the BSMP stations from Harrison Bay to Camden Bay and Coastal Marine Institute studies resampled BSMP areas further west (Point Barrow) and east (Beaufort Lagoon).

The Chukchi Sea Ocean Monitoring in the Drilling Area (COMIDA): Chemistry and Benthos study and the Hanna Shoal Ecosystem Study have been collecting similar chemical and biological data within and downstream of the leased areas of the Chukchi Sea. The need for additional monitoring will continue to be re-evaluated as oil and gas development in the Alaska Region OCS evolves.

3.5 Endangered and Protected Species

Oil and gas-related activities, including production at the Northstar site and other potential sites, may lead to risks of oil spills from buried pipelines, other discharges, noise from various industrial and support activities and increased human interaction with arctic offshore species. Species protected under the ESA, MMPA and the Migratory Bird Treaty Act are of particular concern if impacted by such factors. Study of the effects of oil and gas-related activities on protected mammals and the need for monitoring of endangered species are expected to be continued. Related to this is the need for assessment of how any changes in the bowhead whale migration's distance from shore could relate to subsistence success (see below). Future bowhead studies are expected to continue to explore use of satellite tagging for information on bowhead whale residence times in development areas. BOEM anticipates pursuit of new opportunities to obtain and update information on bowhead behavior in response to industrial noise through the use of appropriate research partnerships.

Effects of construction activities on polar bears, especially on denning bears, and concerns about the adequacy of information about all age/sex categories of the bear population will need to be addressed by additional research. Several ongoing studies are expected to lead to recommendations for additional information regarding polar bears and continued study of the bear population's vulnerability to oil spills through improved models.

Other key subsistence species potentially exposed to short-term or cumulative impact factors for which behavioral or monitoring studies may be needed include beluga whales, walrus, ringed seals, ribbon seals and bearded seals.

3.6 Marine Fish Migrations, Recruitment and Essential Fish Habitat

BOEM needs information to assess and manage the potential environmental effects of offshore development on marine fish. More detailed information about the biology and ecology of many marine fish species inhabiting the Alaska lease areas would be especially useful. The highest priority BOEM information needs include species presence, distribution, abundance and potential effects of oil spills, particularly during periods when ice is present. As offshore oil development interest expands to deeper and more widespread areas, additional fisheries information is required.

As a result of the Magnuson Fishery Conservation and Management Act, effects on Essential Fish Habitat must be evaluated. In the Bering and Chukchi Seas, more information is needed to evaluate Essential Fish Habitats in the Chukchi Sea as commercial fish species move northward from the Bering Sea. Beaufort waters are also considered Essential Fish Habitat for salmon, and future research on salmonid reproduction in Beaufort Sea drainages is indicated to clarify environmental assessment and mitigation needs.

Seismic exploration and its effects on fish is a high-priority issue for Arctic residents. More information regarding the effects of seismic exploration on the health, behavior, distribution, and migration of the numerous important fish species of the Beaufort and Chukchi seas would be valuable for NEPA analyses.

Alaska Native villagers are concerned that OCS activities will affect subsistence fish populations and reduce availability for subsistence harvest. Thus, additional research on arctic fisheries and recruitment to nearshore feeding populations should be considered. Several fish species used for subsistence migrate through, or are found in, the Northstar and Liberty areas of the Beaufort Sea, including arctic and least cisco, Dolly Varden, arctic char, and humpback and broad whitefish. Intermittent occurrences of pink and chum salmon also take place in Beaufort coastal waters.

A need for more information on the forage fish resources and their relation to apex predators in the Bering, Chukchi and Beaufort seas is also indicated. A good understanding of the seasonal distribution, abundance and habitat use of forage fish, including key spawning and migration events that quickly transfer large amounts of energy to upper trophic levels, is fundamentally important to monitoring the potential environmental impacts associated with offshore development.

3.7 Subsistence

Residents of the North Slope coastal communities frequently express concern about cumulative impacts of offshore and onshore developments on their subsistence lifestyle. Some of the concerns of the Iñupiat include diminished access to hunting and fishing areas around oil industry infrastructure, reduced harvests, increased hunter efforts and increased hunter cost. How, and to what degree, subsistence activities have been affected by industry infrastructure and industry activity is a concern that may be further addressed by additional research. Consideration of cumulative impacts is an increasingly important issue for BOEM in preparing NEPA documents.

Aggregate effects research also encompasses a broader set of issues concerning how the Iñupiat society has been potentially affected. Relevant issues include a wide range of topics, such as the changing relationship between the cash economy and household subsistence activities, changing sources of anxiety and stress at multiple levels of organization, potential changes in sharing of subsistence resources and potential changes in the recruitment of youth into subsistence activities. Social indicators should be maintained to serve as a basis for estimating long-term aggregate impacts.

BOEM
Bureau of Ocean Energy Management

CHAPTER 5
ATLANTIC OCS REGION

U.S. Department of the Interior
Bureau of Ocean Energy Management
Herndon, VA
2014

SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

The Atlantic Outer Continental Shelf (OCS) extends from Maine to Florida and is divided into four planning areas (Figure 1). The OCS planning areas extend from the state/Federal boundary at 3 nautical miles (nm) out to the outer boundary of the Exclusive Economic Zone (EEZ) at approximately 200 nm. Although not by design, these planning areas roughly coincide with the Large Marine Ecosystems along the Atlantic as defined by the National Oceanic and Atmospheric Administration (NOAA) (see http://www.lme.noaa.gov/).

Initially, the regional focus was on the oil and gas potential of the Atlantic OCS. Seismic surveys were conducted from the 1960's to the 1980's to delineate the resource potential of the region. Lease sales occurred from the inception of the program through the 1980's and some exploratory wells were drilled in the areas of Georges Bank, off the coast of New Jersey, and in the Manteo formation off of North Carolina. The estimated reserves were not as large as other OCS regions and moratoria were put in place. The last oil and gas leases were relinquished in 2000. Some interest was rekindled and a sale was proposed off the coast of Virginia in the 2007-2012 OCS Oil and Gas Leasing Program. The moratoria (Presidential and Congressional) were lifted in 2008 and planning for the lease sale was initiated. A workshop was held in December 2008 to identify environmental information needs in the proposed lease sale area. The proposed sale was later cancelled. In March of 2010, the President proposed opening the Mid- and South Atlantic OCS Planning Areas for leasing. After the Macondo incident, the proposal was removed from consideration.

As the agency responsible for managing extraction of offshore minerals since 1992, BOEM has conveyed more than 77 million cubic feet of OCS sand for coastal restoration projects through the Marine Minerals Program. These projects have resulted in the restoration of hundreds of miles of the Nation's coastline, protecting billions of dollars of infrastructure as well as important ecological habitat. Some of these projects were done on an emergency basis, where imminent breaching of barrier islands was prevented by the rapid placement of OCS sand.

Recently, the Program is involved in the recovery efforts after Superstorm Sandy. Several Negotiated Noncompetitive Agreements have been completed on the Atlantic OCS offshore Virginia, Maryland, South Carolina and Florida. Marine Mineral Studies strive to fulfill the Bureau's environmental responsibilities which include: assessing the effects of OCS activities on natural, historical, and human resources and the appropriate monitoring and mitigating of those effects. The program is awarding cooperative agreements with each of the 13 Atlantic States to improve data management and data gathering from potential borrow areas within 8 miles from the coastline.

On August 8, 2005, Energy Policy Act of 2005 (P.L. 109-58) granted the Department of the Interior (DOI), which delegated to BOEM, authority to grant leases, easements, and rights-of-way (ROWs) for orderly, safe, and environmentally responsible renewable

energy development activities on the OCS. The Office of Renewable Energy Programs (OREP) is responsible for implementing and managing the offshore renewable energy program, including leasing, environmental programs, and the formation of inter-governmental task forces, state consultation, and post-lease permitting in Federal waters off the East Coast (Figure 1). The Environment Branch for Renewable Energy is responsible for coordinating the studies program for the Atlantic region for renewable energy projects, in addition to developing compliance documents for the National Environmental Policy Act (NEPA) and other environmental laws. The focus of the program, based on the state of technology, is on wind and marine hydrokinetic (wave, current) projects.

BOEM also has the authority to issue ROW grants, which would authorize the use of portions of the OCS for the construction and use of a cable or pipeline for the purpose of gathering, transmitting, distributing, or otherwise transporting electricity or other energy product generated or produced from renewable energy. In addition to standard radial transmission interconnection of projects to shore, developers are expressing interest in building large-scale regional transmission systems to support offshore renewable energy projects. Therefore, it is likely we may see an increased interest in these types of projects in the North and Mid-Atlantic OCS Planning Areas.

OREP has established inter-governmental task forces to coordinate and collaborate with affected state, local, and tribal governments and relevant Federal agencies concerning renewable energy commercial development activities along the Atlantic coast. These efforts enable BOEM to further identify and address any major challenges to issuing commercial leases for generation of renewable energy by increasing its visibility and accessibility to major stakeholders. Task forces have been formed in ten Atlantic coastal states. Task force meetings allow stakeholders early input into the planning process by identifying potential areas of space-use or environmental conflicts and to share their own research efforts related to renewable energy activities on the OCS. During the fall of 2013, BOEM reached out to this stakeholder community as well as a broader community for study suggestions to incorporate in this plan.

BOEM is coordinating with other Federal agencies responsible for permitting or authorizing portions of offshore renewable energy projects. Part of these efforts includes identifying information needs from these agencies for integration into the BOEM Environmental Studies Program. DOI has established memoranda of understanding (MOUs) with other Federal agencies to facilitate coordination on OCS renewable energy development, including the Department of Energy (DOE), U.S. Fish and Wildlife Service (USFWS), Federal Energy Regulatory Commission (FERC), and NOAA. An existing MOU with the U.S. Coast Guard (USCG) has been updated, and additional MOUs are in the process of being established with Department of Defense (DOD) and U.S. Army Corps of Engineers (USACE).

There are generally four phases of renewable energy development on the OCS: planning and analysis; lease issuance; site assessment; and construction, operation, and decommissioning of a renewable energy facility. In phase one, BOEM engages with inter-governmental task forces to identify areas suitable for leasing and conducts an environmental assessment (EA) for lease issuance. In phase two, a renewable energy

lease gives the lessee an exclusive right to apply for subsequent approvals that are necessary to advance to the next stage of the renewable energy development process. In the third phase, BOEM reviews and approves a site assessment plan (SAP) that allows the construction and operation of meteorological towers and/or buoys (see 30 CFR 585.600-.601; .605-.618). After the lessee has collected sufficient site characterization and assessment data, the lessee may submit a construction and operations plan (COP), approval of which would authorize the actual construction and operation of a renewable energy facility (see 30 CFR 585.620-.629). Although BOEM does not authorize site characterization activities (i.e., geological and geophysical surveys and core samples) associated with renewable energy activities, a lessee must submit the results of such surveys before BOEM can consider approving its SAP or COP (see 30 CFR 585.626). In addition, BOEM has a parallel process for granting a right of way that requires the submission of a general activities plan (see 30 CFR 30 CFR 585.645).

On February 7, 2011, Secretary of the Interior Ken Salazar and Secretary of Energy Steven Chu unveiled a coordinated strategic plan to accelerate the development of offshore wind energy, including funding to support offshore wind energy deployment to spur rapid, responsible development of this abundant renewable resource. As part of this plan, DOE announced funding for seven projects, two of which are located in Federal waters on the Atlantic OCS in the Gulf of Maine and off the Virginia coast. These projects provide opportunities to address important scientific questions about offshore wind development.

BOEM now has identified wind energy areas along the coasts of Rhode Island, Massachusetts, New Jersey, Maryland, Delaware, and Virginia (Figure 1). A non-competitive lease was issued for the Delaware wind energy area and competitive leases (i.e., auction process) were issued for the Rhode Island/Massachusetts and Virginia wind energy areas. Areas offshore North Carolina, Maryland, Massachusetts, and New Jersey are also under various stages in the planning and leasing phases. In addition, BOEM is considering research lease applications in Virginia, Georgia, and Florida. The Cape Wind Project, a commercial wind project in Nantucket Sound, continues to move forward. With this increased activity comes the need for additional environmental information on the potential impacts of offshore renewable energy development.

1.2 Map of the Planning Area

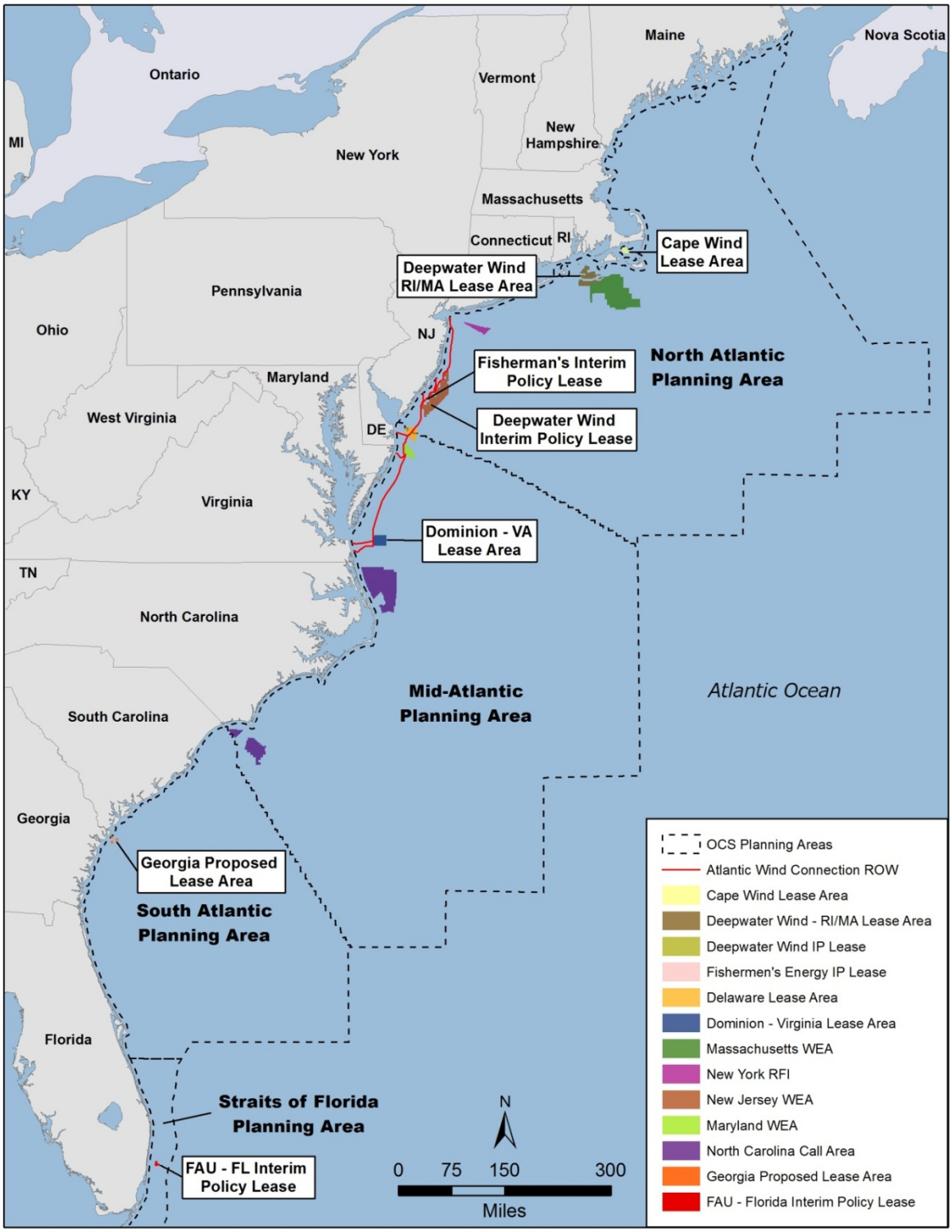


Figure 1. Atlantic OCS Region Planning Areas and Renewable Energy Planning and Lease Areas.

1.3 Projected OCS Activities

Following is an overview of OCS activities along the Atlantic that are expected over the next few years.

1.3.1 Oil and Gas Activities

No areas on the Atlantic OCS are included in the 2012-2017 OCS Oil and Gas Leasing Program. BOEM completed an environmental impact statement (EIS) for potential seismic studies in the Mid- and South Atlantic Planning Areas. This EIS also assesses surveys necessary for the siting of renewable energy facilities and delineation of sand resources.

1.3.2 Sand and Gravel Activities

As part of the Marine Minerals Program, removal of sand and gravel from areas on the OCS are evaluated for the potential environmental consequences. Over the next year several projects are expected to remove sand from nearby shoal areas to replenish local beaches. Additional areas may be identified in response to catastrophic events such as hurricanes. For FY 2014, funding for Superstorm Sandy recovery is being provided to all Atlantic coastal states to assimilate old data and collect new data about borrow areas within eight miles of the coast. More details are provided in the next section.

1.3.3 Marine Hydrokinetic Activities

Over the next few years, we are likely to see testing of marine hydrokinetic (MHK) devices offshore Florida. At this stage of development, commercial activity is not envisioned within the next few years. BOEM is continuing to work with FERC to refine procedures relating to commercial MHK projects under the existing MOU.

Florida Atlantic University (FAU) has submitted a final lease application for technology testing for three OCS lease blocks offshore Florida. Within these blocks, FAU is seeking to deploy three single-anchor mooring, with a mooring and telemetry buoy (similar to the Navy Oceanographic Meteorological Automatic Device weather buoys) for the purpose of testing equipment designed to use the Florida Current to generate electricity. In August 2013, BOEM published a revised EA that analyzed the potential impacts of proposed lease issuance, site characterization surveys, and technology testing activities. A lease is expected to be offered shortly.

1.3.4 Wind Energy Activities

For the near term, wind energy activities are primarily focused on site characterization and site assessment activities, however, three commercial leases and two research leases may lead to a construction and operations plan within the next few years. Four interim policy leases were issued in November 2009 with two projects "approved" for Fishermen's Energy and Deepwater Wind in 2012. The leases expire in November 2014. There are currently two buoys on the federal OCS that have been authorized under BOEM's jurisdiction located off the coast of New Jersey. The Delaware interim policy

lease was relinquished in 2012 and replaced with a commercial lease for the full wind energy area after there was a determination of no competitive interest.

The first offshore wind energy auction was held in July 2013 for the Rhode Island/Massachusetts wind energy area. Deepwater Wind New England, LLC won both lease areas and is now making plans for development.

Off the coast of Virginia, a commercial lease auction was held in September, 2013, with Dominion Virginia Power winning the lease. Virginia Department of Mines, Minerals and Energy is pursuing two research leases within and adjacent to the Virginia Wind Energy Area (WEA). One research lease request proposed to include meteorological towers within the WEA. The other proposes installation of two demonstration wind turbines adjacent to the WEA. Potential activities to occur may include the opportunity to evaluate various environmental technologies such as acoustic and thermography equipment for monitoring birds.

Southern Company submitted a lease application for three OCS blocks offshore Georgia for offshore wind energy resource assessment including the installation of a meteorological tower and/or buoy. BOEM published an EA for the project on April 2, 2014, for public comment.

During 2014, three lease sales are being considered for the Maryland, Massachusetts, and New Jersey wind energy areas.

1.3.5 Cape Wind Project

In October 2010, Cape Wind Associates, LLC signed the Nation's first lease for commercial wind energy development on the OCS. As part of the lease requirements, Cape Wind Associates has prepared an Avian and Bat Monitoring Plan (ABMP). As part of the ABMP, Cape Wind is monitoring birds using VHF tags and is working closely with a BOEM/USFWS joint study to evaluate the use of these tags on common terns. In addition, BOEM anticipates that post-construction studies on a variety of topics will be identified to inform future wind energy development.

1.3.6 Unsolicited Applications

The offshore renewable energy industry is nascent and as such, there is a broad spectrum of potential technologies as well as entrepreneurial spirit that results in proposals that are not necessarily commercially viable. Unsolicited applications for commercial wind energy leases have been received from Maine to Virginia. These applications offer conventional monopile technology as well as floating wind turbines. The proposals also range from a few turbines to a few hundred. BOEM evaluates these proposals and if no other interest in the proposed is expressed, processes the proposals.

Private companies have approached BOEM with wind power cable project proposals. On March 31, 2011, BOEM received an unsolicited ROW grant application from Atlantic Wind Connection (AWC) for a subsea backbone transmission system offshore New York, New Jersey, Delaware, Maryland, and Virginia. BOEM is reviewing a Right-of-Way

(ROW) application for renewable energy purposes on the OCS off the coast of Rhode Island in the area of the Deepwater Wind Block Island Transmission System proposal.

1.4 Identification of Information Needs

The information needs for the Atlantic Region are primarily focused on the activities of offshore renewable energy with a limited focus on the oil and gas and marine minerals programs. The basis of BOEM's renewable energy research program was built from information needs identified in the 2007 Worldwide Synthesis and Analysis of Existing Information Regarding Environmental Effects of Alternative Energy Uses on the OCS and Workshop (Michel et al. 2007; Michel and Burkhard, 2007) and the OCS Alternative Energy and Alternate Use Programmatic Environmental Impact Statement (MMS, 2007). The 2011 Atlantic Wind Energy Workshop identified additional needs. BOEM requested study ideas from the Task Force members in the fall of 2012 and expanded this request to other stakeholders with interests along the Atlantic coast in the fall of 2014. Several study ideas currently proposed were submitted through this process.

1.4.1 Ecosystem-Based Management

The National Policy for the Stewardship of the Ocean, our Coasts, and the Great Lakes calls for ecosystem-based management as the foundation for future Federal management decisions. Marine planning is a process for implementing ecosystem-based management. As defined in the policy, marine planning is "a comprehensive, adaptive, integrated, ecosystem-based, and transparent spatial planning process, based on sound science, for analyzing current and anticipated uses of ocean and coastal areas. Marine planning identifies areas most suitable for various types or classes of activities in order to reduce conflicts among uses, reduce environmental impacts, facilitate compatible uses, and preserve critical ecosystem services to meet economic, environmental, security, and social objectives."

Many of the studies discussed below support ecosystem-based management by increasing our understanding of ecological processes and human use of the coastal and marine environment. This information, in turn, feeds into the management decision process through environmental documents with the goal of improved decisions made within the context of the entire ecosystem rather than species or sector. As the program continues to support renewable energy development, the information gathered will be woven together to create a foundation that describes the environment accurately and can be used for predictions of the consequences of future activities. We are proposing to support an ongoing study of the ecosystem in the Gulf of Maine (GoM). DOE funded the collection of aerial and boat surveys along the Mid-Atlantic. There is value in continuing these surveys for several additional years to add to the baseline understanding of the distribution of sea turtles, seabirds, and marine mammals.

1.4.2 Distribution and Abundance of Avian Fauna

The potential effects of offshore wind development on avian species and the overall negative impacts on avian populations have been a concern since the first proposal to

build an offshore wind facility. Although an individual project may trigger many environmental concerns, most concerns related to avian resources tend to extend beyond the relatively small foot print of an individual project. For this reason, BOEM's avian research efforts for the Atlantic OCS are focused on identifying areas where Atlantic offshore wind energy development is least likely to negatively impact avian populations at the regional scale. In addition, information obtained from implementing this strategy will be used to inform BOEM's NEPA process, provide pre-construction baseline data for post-construction impact assessments, and provide information for the design of future studies and guideline development.

BOEM's avian research strategy centers on developing a regional understanding of the distribution and abundance of avian species that are potentially vulnerable to offshore wind energy development on the OCS. BOEM's avian research strategy also includes the identification of the migratory corridors used by vulnerable avian species that may intersect with potential wind energy areas.

Implementation:

1. Identify areas where avian species may be vulnerable to renewable energy development:

    a. The Compendium of Avian Occurrence (IA with USGS). A compilation of bird observations dating back to 1907 to document historic distribution patterns of birds on the Atlantic OCS. This effort is ongoing with new datasets including the data from the New Jersey Ecological Baseline Study, Rhode Island Special Area Management Plan, Atlantic Marine Assessment Program for Protected Species, and others. We propose to continue this effort for the next five years, including developing a website for data discovery and access.

    b. Recent (since 2005) and current avian survey locations on the OCS (BOEM). (http://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/Mapping_and_Data/ATL_WILDLIFE_SURVEYS.zip) On-going data collection efforts include Surveying for Marine Birds in the Northwest Atlantic (IA with USFWS), AMAPPS (IA with NOAA), the Biodiversity Research Institute (BRI) Baseline Ecological Survey of the Mid-Atlantic (DOE funded study developed with BOEM), plus efforts conducted by different states that are funded in part with cooperative agreements with BOEM. These efforts use a combination of survey methodologies including boat surveys and traditional and hi-definition aerial surveys. The surveys will be extended into the South Atlantic during FY 2014.

    c. Predictive Mapping of Seabird Distribution and Abundance on the Atlantic OCS (IA with NOAA started in 2013). Development of statistical models using data from Compendium of Avian Occurrence and environmental variable to create continuous maps that predict avian occurrence and

abundance on the OCS. The seabird distributions will be compared to the movements of fishing vessels and commercial ships.

d. Statistical Analysis to Support Guidelines for Marine Avian Sampling (IA with NOAA completed in 2012). A general method for estimating the number of avian surveys needed to detect avian hot and cold spots on the Atlantic OCS.

e. Assess Relative Vulnerability of Migratory Bird Species to Offshore Renewable Energy. This study compiles species-specific data, calculates vulnerability indices to collision and displacement for some 200 avian species that use the Atlantic OCS.

f. Developing new technologies for surveying on the OCS including hi-definition aerial imagery and acoustic/thermographic systems.

2. Identify migratory corridors that may intersect potential wind development sites:

a. Offshore Use of Diving Marine Birds Using Satellite Telemetry (IA with USFWS). Birds that are being studied include long-tailed ducks, northern gannets, surf scoters, and red-throated loons. We propose to extend this effort to the South Atlantic.

b. Tracking Offshore Occurrence of Common Terns and American Oystercatchers (IA with USFWS). The study completed the first year (2013) with successful results for terns and oystercatchers. The study will continue in 2014, focusing on common terns and extending the area of evaluation to include Long Island Sound and comparisons with gps tags.

Adding to this baseline knowledge may be accomplished through various tagging techniques. Several studies are proposed to extend tagging and tracking of migratory species.

1.4.3 Fish and Fisheries

The effects of renewable energy development on fish and fisheries range from displacement of fisheries from the site of a wind facility to the impacts of sound on fish during pile driving. The effects of sound on fish was the topic of a BOEM funded workshop: *Sound Workshop to Identify Information Needs and Data Gaps on the Effects to Fish, Fisheries, and Invertebrates.* One identified need is the creation of a database of fish sounds. Fundamental to protecting fish species and fisheries is an understanding of the habitat, particularly on the scales of the wind facility and the wind energy areas identified for leasing. BOEM is collecting baseline information about seafloor habitats and creating maps from these collections along the Mid-Atlantic. We are proposing to extend this mapping into the south Atlantic, once wind energy call areas are identified. Detailed seafloor mapping is expensive and may require interpolation using models. We are proposing model validation in an area of interest in New York that has already been modeled.

Evaluating the economic effects of displacement of fisheries by wind facilities is currently underway through an interagency agreement with NOAA. The study is taking an initial look at the potential economic consequences of offshore wind development on fisheries. An additional evaluation is proposed that would look at the effects on bycatch and protected species.

Of critical importance is the effect of wind facilities on listed species such as the Atlantic sturgeon. Tagging sturgeon and using an existing network of receivers is a first step in understanding the interactions of this protected species with wind facility development.

1.4.4 Socio-Economic Studies

The social values attached to affected places by localized publics or particular stakeholder groups can pose a major challenge to siting renewable energy projects. Identifying and understanding the nature and intensity of place-based values in our nation's seascapes, and their relationship to social action, will help developers and agencies better understand and plan for stakeholder support or opposition during renewable energy development. Value suitability analysis, or VSA, can help developers and project managers meet informational needs related to quantifying, anticipating and successfully managing stakeholder engagement in marine renewable energy projects. A pilot study using this methodology is proposed for the Mid-Atlantic.

The USDOE is providing funding to three offshore demonstration projects with the requirement that the project is producing electricity by 2017. These projects provide an opportunity to evaluate community perceptions of wind facilities before and after construction. Currently, BOEM can only speculate about the potential socioeconomic impacts on local communities.

1.4.5 Cultural Resources

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to consider the effects of their activities on historic properties. Historic properties are defined as any site, building, structure or object, included in, or eligible for listing in, the National Register of Historic Places, including properties of traditional religious and cultural importance to Indian tribes.

Renewable energy activities have the potential to affect historic properties through the destruction or alteration of properties that are located on or below the seafloor or below ground in areas where transmission components come ashore, and also through the introduction of visual elements that may impact onshore historic properties. OREP relies on the environmental studies program to provide research that directly and relevantly informs the Bureau's compliance responsibilities under the NHPA for renewable energy activities on the Atlantic OCS.

Studies do not replace the compliance process, rather they are developed to fill data gaps or provide additional information that is applied to how the Bureau conducts its compliance with the NHPA and how this process is efficiently coordinated with the

Agency's regulatory functions. To that end, cultural resource studies are organized around the following framework that is keyed to the steps of the Section 106 process:

Consultation: These are studies that provide additional tools or opportunities for engagement and information sharing with academics, stakeholders, and others.

Identification of historic properties: These include studies designed to test the effectiveness of existing identification methods, studies that are designed to test new approaches to identification efforts, studies that provide baseline information, and studies that provide tools for managing information related to the identification of historic properties. These studies all provide feedback into the guidance BOEM provides to developers.

Vibracore collection is a method that is unique with respect to its utility to assist in the identification of submerged archaeological sites on the OCS that once existed as dry land but are now submerged as a result of sea level rise. Application of this technology to identifying these archaeological sites is still in its infancy. BOEM has a need for standards and best practices regarding the adequate collection and appropriate laboratory analysis of vibracores as a method for aiding in the identification of historic properties offshore the Atlantic.

Considering impacts: These include studies to better understand the impacts renewable energy projects may have on historic properties and studies that consider approaches to mitigate or avoid these effects.

1.4.6 Physical Environment

Effects of a commercial wind facility on the OCS on the environment not only include interactions with the biological life but also effects on the physical environment. The ocean observing system administered by NOAA uses HF radar to measure surface currents. The observing community has expressed concern that HF radar may be affected by the rotating blades of wind turbines. An initial evaluation of this potential problem is needed using model calculations and followed up with field evaluations once turbines are in place.

1.4.7 Marine Mammals

Distribution and abundance information about marine mammals is critical to evaluating the potential take of these species as part of the biological assessment required by the Endangered Species Act. BOEM continues to support surveys for marine mammals in collaboration with NOAA. Besides traditional boat and aerial surveys, BOEM is supporting passive acoustic monitoring studies, which have the ability to collect data continuously. Recently, an independent study off the coast of Virginia was conducted by Cornell. Continuation of this effort, in conjunction with data collection in the Maryland WEA will provide a more detailed picture of migration activities of marine species, particularly the North Atlantic Right Whale.

New methods for aerial surveys include the use of vertical photography. While this method has advantages over human observations, it yields high volumes of images that must be evaluated by individuals. Software to scan the images exists, but still needs to be refined. Developing the software will enhance the ability to use this new technology.

Along with the Atlantic Marine Assessment Program for Protected Species, there are some concerns about the potential effects of energy development activities on Harbor Seals and Gray Seals that may swim to feeding grounds and therefore be at risk. The use of satellite tags will allow for a greater understanding of their movements offshore and identification of any areas that may be used regularly and should have extra precautions applied.

1.5 New Starts for FY 2014 and Ongoing Studies Table

Table 1 lists new studies planned to start in FY 2014 and ongoing studies, categorized by discipline. Profiles for the ongoing studies can be found at: http://www.boem.gov/Renewable-Energy-Ongoing-Studies/

Completed studies can be found at: http://www.boem.gov/Renewable-Energy-Completed-Studies/

Table 1. New Starts for FY 2014 and Ongoing Studies

NSL #	Study Title	Planning Area(s)	Start FY	Partners
New Starts				
Habitat & Ecology				
At-14-04	Information Management of Marine Bird Data for Offshore Renewable Energy Decision Making	N.-, Mid.-, S. ATL	2104	USFWS
Social Sciences				
AT-14-02	Wind Energy Development on the Atlantic OCS: The Identification of Port Modifications and their Environmental and Socioeconomic Consequences	N.-, Mid.-, S. ATL	2104	
Fates and Effects				
AT-14-01	Real-time Opportunity for Development Environmental Observations (RODEO)	N.-, Mid.-, S. ATL	2104	DOE
AT-14-06	EMF (Electromagnetic Field) Impacts on Elasmobranch (sharks, rays and skates) and American Lobster Movement and Migration	N.-, Mid.-ATL	2104	
Marine Mammals and Protected Species				
AT-14-03	Atlantic Marine Assessment Program for Protected Species	N.-, Mid.-, S. ATL	2104	NOAA, FWS, Navy
AT-14-05	Determining Offshore Use by Marine Mammals and Ambient Noise Levels Using Passive Acoustic Monitoring	Mid.-ATL	2104	Maryland
*Note: The procurement of any study is contingent upon availability of funding				

Ongoing Studies				
Fates and Effects				
AT-10-x13	Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the OCS (II)	N.-, Mid.-, S. ATL	2010	NOPP
AT-12-02	Determining Offshore Use by Diving Marine Birds Using Satellite Telemetry	N. ATL	2012	USFWS
Habitat & Ecology				
AT-10-01	Acoustic Monitoring of Temporal and Spatial Abundance of Birds Near Structures on the OCS of the Atlantic and Gulf of Mexico	ATL, GOM	2010	
AT-10-03	Exploration and Research of Mid-Atlantic Deepwater Hard Bottom Habitats and Shipwrecks with Emphasis on Canyons and Coral Communities	Mid.-ATL	2010	NOPP
AT-13-01	Pilot Study: Tracking Offshore Occurrence of Common Terns and American Oystercatchers with VHF Arrays	N. - ATL	2013	USFWS
AT-13-02	Fishery Physical Habitat and Epibenthic Invertebrate Baseline Data Collection	N.-, Mid.-, ATL	2013	NOAA
AT-13-03	Integrative Statistical Modeling and Predictive Mapping of Seabird Distribution and Abundance on the Atlantic Outer Continental Shelf	N.-, Mid.-, S. ATL	2013	NOAA
Marine Mammals and Protected Species				
AT-10-x11	Atlantic Marine Assessment Program for Protected Species (AMAPPS)	Mid.-, S. ATL	2010	NOAA, USFWS, Navy
AT-10-x15	Evaluating Acoustic Technologies to Monitor Aquatic Organisms at Renewable Energy Sites	N.-, Mid.-, S. ATL	2010	NOPP
Social Sciences				
AT-10-04	Battle of the Atlantic Expedition 2010-2015	S.- ATL	2010	NOAA
AT-11-01	The Socioeconomic Impact of OCS Wind Development on Fishing	N. ATL	2012	
AT-12-01	Developing Protocols for Reconstructing Submerged Paleocultural Landscapes and Identifying Ancient Native	N. ATL	2012	

	American Archaeological Sites in Submerged Environments			
AT-12-04	Atlantic Offshore Wind Development: Public Attitudes, Values, and Implications for Recreation and Tourism	N.-, Mid.-, S. ATL	2012	
AT-12-x10	Atlantic OCS Cultural Resources Survey and Archaeological Inventory Geographic Information System	N.-, Mid.-, S. ATL	2013	

Planning Area Codes

ATL = Atlantic
N. ATL = North Atlantic Planning Area
Mid. ATL = Mid-Atlantic Planning Area
S. ATL = South Atlantic Planning Area
GOM = Gulf of Mexico
PAC – Pacific

Partner Codes

USFWS = U.S. Fish and Wildlife Service
DOE = Department of Energy
NOAA = National Oceanic and Atmospheric Administration
NOPP = National Oceanographic Partnership Program

SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

A list of recently completed studies that support the Office of Renewable Energy Programs can be here. The following sections focus on the proposed studies for FY 2015 and FY 2016.

2.2 Profiles of Studies Proposed for FY 2015 NSL

Table 2. Atlantic OCS Region Studies Proposed for the FY 2015 NSL

SDP Page Number	Discipline	Regional Ranking	Study Title
297	MM	1	Endangered Atlantic Sturgeon Habitat Use in Mid-Atlantic Wind Energy Areas
301	HE	2	Tracking Movements of Endangered Roseate Terns and Threatened Piping Plovers in the NW Atlantic
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Discipline Codes

AQ = Air Quality FE = Fates & Effects HE = Habitat & Ecology
PO = Physical Oceanography SE= Social & Economic Sciences
MM = Marine Mammals & Protected Species

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): North, Mid-, and South Atlantic

Title: Endangered Atlantic Sturgeon Habitat Use in Mid-Atlantic Wind Energy Areas

BOEM Information Need(s) to be Addressed: Atlantic sturgeon were listed under the auspices of the Endangered Species Act in 2012. Limited information shows that Atlantic sturgeon occupy offshore waters (marine zone) up to at least 40m in depth during the winter. However, there is little data regarding their seasonal patterns of distribution and abundance in and around the proposed offshore wind energy areas (WEAs) and sand borrow sites. This information is necessary for BOEM's Office of Renewable Energy Programs and Marine Minerals Program to meet its obligations under the National Environmental Policy Act, the Endangered Species Act, and the Magnuson-Stevens Fishery Conservation and Management Act. Baseline data on Atlantic sturgeon will allow their seasonal presence/absence, habitat use, and any migration corridors to be identified and used to inform environmental impact assessments for offshore renewable energy as well as for marine minerals. Atlantic sturgeon could potentially be negatively impacted by offshore wind energy development through noise disturbance and displacement from feeding grounds, masking of their communication calls, and disruption of their migration pathways, as well as through changes to their benthic prey species. Impacts from sand extraction include dredge entrainment and habitat alternation.

Approximate Cost: (in thousands) $2,500 **Period of Performance:** FY 2015-2019

Description:

Background: Atlantic sturgeon experienced severe declines due to habitat destruction and overfishing beginning in the late 19th century. Lack of recovery coupled with concerns over continued loss/degradation of habitat, ship strikes, and bycatch in commercial fisheries resulted in NOAA-NMFS listing five Distinct Population Segments under provisions of the Endangered Species Act in 2012 (NOAA-NMFS, 2012). The Mid-Atlantic, which includes the Delaware and Hudson Rivers, historically supported the largest populations of Atlantic sturgeon ((Secor, 1999). However, presence in the offshore environment from Massachusetts to North Carolina is not well understood. While there is a growing body of information on the riverine habitat requirements for this species, information on their marine habitats is severely lacking (Dunton, Jordaan, Mckown, Conover, & Frisk, 2010) (Erickson, et al., 2011). This lack of information on marine habitat use is of particular concern given the fact that Atlantic sturgeon spend the vast majority (>90%) of their adult lives in the coastal and offshore waters and are completely dependent on this region for food resources. Atlantic sturgeon are a large (max weight > 400kg) and highly mobile species, as a result they are not commonly encountered in traditional gillnet or trawl surveys due to issues surrounding gear selectivity (Dunton, Jordaan, Mckown, Conover, & Frisk, 2010). Telemetry is therefore

a much more effective technique for understanding the seasonal presence, habitat use and movement pathways of sturgeon.

Objectives: The objective of this study is to provide information on the seasonal patterns of occurrence and habitat use as well as explore the underlying causal mechanisms for Atlantic sturgeon habitat selection in and around WEAs, sand borrow sites, and other leased areas in the North and Mid-Atlantic Planning Areas.

Methods: The approach would be to leverage large numbers (>900 at present) of telemetered Atlantic sturgeon in the Mid-Atlantic, which have been tagged through a number of research programs and form part of the Atlantic Cooperative Telemetry Network and supplement these tags to ensure sampling is sufficient across the target DPSs. Existing studies with acoustic receivers have primarily been in freshwater, estuarine, and nearshore (<8km) marine habitats. Consequently, very little is known about their offshore marine habitats and feeding grounds, and how these may overlap with the proposed WEAs and adjacent nearshore areas. The approach will provide a robust estimate of Atlantic sturgeon distribution and habitat use in the WEAs and sand borrow areas in the Mid-Atlantic through the use of cutting edge technology that has recently moved beyond the proof-of-concept stage. The methods would follow BOEM guidelines for providing information on fisheries for Atlantic renewable energy development (version August 13, 2013), this study will:

1. Determine the seasonal presence/absence of endangered Atlantic sturgeon in and around the project areas in the North and Mid-Atlantic Planning Areas.
2. Characterize the habitat use (including habitat type including biological and physical characteristics) and feeding grounds of Atlantic sturgeon.
3. Identify any migration corridors for Atlantic sturgeon.

The first three years of the study would be focused on field work and data collection while the fourth and final year of the project will focus on data synthesis, model development, and interpretation. Atlantic sturgeon will be implanted with long-life acoustic transmitters to provide two years of baseline information on their occurrence, distribution and movements. Through the Atlantic Cooperative Telemetry Network, previous efforts will be leveraged representing >900 telemetered Atlantic sturgeon at present, allowing population level inferences to be made about their distribution and habitat use. Additional tags may be purchased to ensure proper representation of the different DPS as identified by NMFS. To develop seasonal models of presence/absence in Mid-Atlantic project areas a combination of fixed and mobile listening platforms would be used. Passive acoustic receivers would be anchored within each project areas approximately 5-6 km intervals and also towards the coast to include the entire area of potential effect. Data from the fixed arrays will be supplemented with mobile surveys conducted by autonomous underwater vehicles (AUVs). Real-time satellite data streams (Ocean color and sea surface temperature) would be provided through the MARACOOS ocean observatory system to provide the broad scale environmental context for understanding sturgeon distribution. This provides a much more integrated means of identifying habitat associations between sturgeon and the dynamic marine environment. The use of three complementary techniques, fixed receiver and mobile

AUV detections, and satellites would allow the development and evaluation spatially-explicit habitat-based models of occurrence for Atlantic sturgeon. These can be used to inform environmental impact assessments for offshore wind energy and to assess potential effects of any changes to the spatial distribution of fisheries effort.

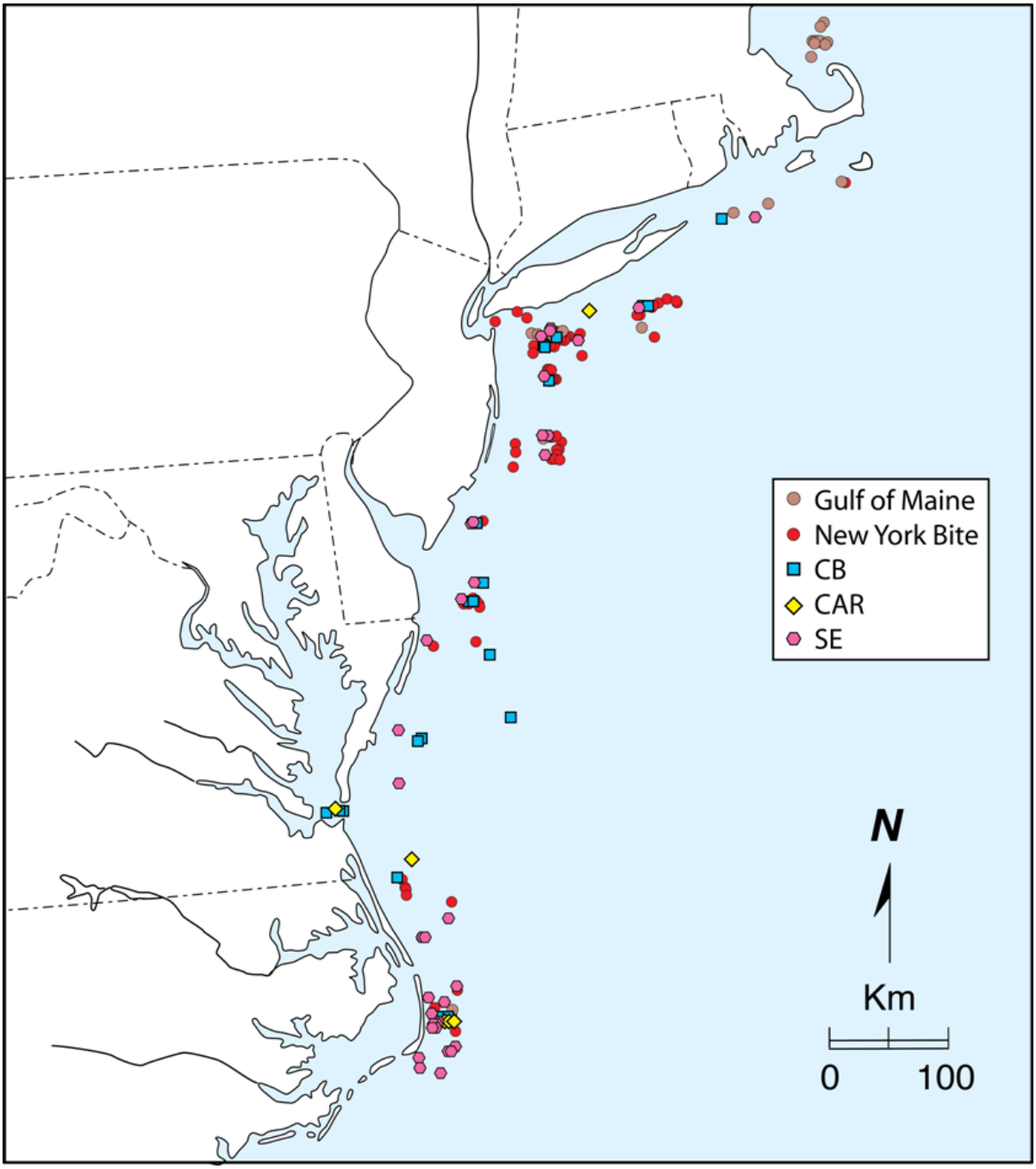


Figure 2. Northeast Fisheries Observer Program Distinct Population Segment of Origin Assignments for Observer Program Specimens (n=173) (Map provided by Dr. Isaac Wirgin via (Damon-Randall, 2013).

Revised Date: March 25, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): North Atlantic

Title: Tracking Movements of Endangered Roseate Terns and Threatened Piping Plovers in the NW Atlantic

BOEM Information Need(s) to be Addressed: Roseate Terns and Piping Plovers are the listed species of concern along the Northeast Atlantic coast. This study will allow scientists to assess the degree to which these species use offshore Federal waters during foraging flights to/from their nests, and also when departing in fall migration. The information is essential for understanding the potential for these species to encounter conflicts with renewable energy development in these areas, for NEPA assessments, and for Section 7 Consultations with the U.S. Fish and Wildlife Service.

Approximate Cost: (in thousands) $450 **Period of Performance:** FY 2015-2016

Description:

Background: Since FY 2013, BOEM and USFWS have been collaborating on a project which verified a new technology for tracking movements of coastal birds. This project used common terns as surrogates for roseate terns, since the two species are commonly found together in mixed flocks and appear to be behaviorally similar. In FY 2013 and FY 2014, approximately 100 common terns were captured each year and nanotags were attached. Nanotags are relatively new and allow multiple birds to be tracked on the same VHF frequency. Receiving units were mounted on towers at locations along the east side of Nantucket Sound, and thousands of signals were tracked from these stations, including signals from other species of birds tagged in the Canadian Maritimes. The technology proved to be spectacularly successful, and it has been demonstrated that hundreds of common terns were captured, handled, and tagged successfully without harm to the birds or their nests. The purpose of this study is to use this new and successful technology to track movements of endangered roseate terns and threatened piping plovers, to move the study from surrogate species to the real species of highest concern. This study will provide the first documentation of movements of the endangered roseate terns and threatened piping plovers during foraging flights from their nest colonies from eastern Massachusetts, Rhode Island and Long Island. It will also permit the gathering of information on flight behavior of these birds at night and during inclement weather conditions, data which has heretofore been unattainable.

Objectives: The objective of the study is to better assess the interactions between endangered roseate terns and threatened piping plovers and offshore renewable energy facilities.

Methods: The study will document movements to/from nesting sites to foraging sites of endangered roseate terns and threatened piping plovers, as well as their movements when departing for fall migration, and to determine if and to what extent they fly over federal waters where potential exists for renewable energy development projects.

Net traps will be used to capture 50-100 common terns, 50-100 roseate terns, and 25-50 piping plovers. All birds will be tagged using Nanotags. Signals from Nanotags will be picked up from automated receiver towers stationed on Monomoy Island and selected islands off Rhode Island and Long Island, NY. These receivers will be located so that signals can be received simultaneously from a minimum of two towers, allowing precise location of the birds detected. The data will then be used to construct the pattern of use of offshore waters.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): Mid-Atlantic

Title: Understanding Whale Presence in the Virginia Offshore Wind Energy Area

BOEM Information Need(s) to be Addressed: The Federal waters off the coast of Virginia are of tremendous interest for offshore wind development and potential oil and gas exploration. However, there are few datasets in this area that provide for a long-term, complete seasonal understanding of the occurrence of marine protected species in these planning areas. Currently there is no sound source verification data for High Resolution Geophysical (HRG) equipment use in the Virginia Offshore Wind Energy Area (WEA). The existing data gaps present regulators and industry with risk due to potential conflicts with the Endangered Species Act, Marine Mammal Protection Act, and the National Environmental Policy Act. This study will assist in BOEM's fulfillment of its requirements to address these statutes.

Approximate Cost: (in thousands) $1,500 **Period of Performance:** FY 2015-2017

Description:

Background: The coastal Mid-Atlantic waters are part of the home range or migratory corridor of several baleen whale species, including the critically endangered North Atlantic right whale (NARW). The seasonal usage of this area by different whale species is unclear; existing sources suggest that right whale occurrence around Virginia is limited to nearshore locations around the mouth of the Chesapeake Bay during winter months (December-March).

Results from a recent 1-year passive acoustic monitoring pilot study by Cornell University demonstrated year-round occurrence of NARWs within state and federal waters off of Virginia in June 2012- June 2013, a second year of data (June 2013-May 2014) will also become available. Right whales were not confined to nearshore waters, but occurred out to the edge of the outer continental shelf (OCS). Right whales also occurred throughout the year, with peak occurrence in February and March.

Other whale species (humpbacks, fin whales and minke whales), and potentially some fish species, were also acoustically detected, but their seasonal occurrence within Virginia waters was not analyzed. These new data suggest that right and other whale species may be present in the energy exploration and development areas with greater frequency than previous studies indicate, and the current environmental mitigation for energy development may be improved with more complete information about the actual frequency and duration of protected species occurrence in these areas.

During the June 2012-June 2013 acoustic monitoring period, independent HRG surveys were conducted in the area. Analysis of all the acoustic data would provide the first

empirical sound source verification data for HRG equipment in a WEA and further the clarification of the occurrence of various protected whale species in and around the Virginia WEA.

Considering the high degree of variability in the seasonal distribution of NARWs, humpback and fin whales along the Atlantic coastline, a longer term study off the Virginia coast, in addition to other current PAM studies along the Atlantic coastline, i.e. Massachusetts CEC and State of Maryland, will begin to provide a much needed, comprehensive dataset describing the migratory corridor for the highly endangered North Atlantic right whale, and other baleen whale species, in relation to BOEM's areas of interest for offshore renewable energy development.

Objectives: This study will clarify when baleen whales (primarily NARW, humpback and fin whales) are occurring in the area, where, specifically, they are occurring, how much time the whales are spending in the area, their approximate numbers as they are moving through, and what the ambient noise environment is that they are exposed to. Analyze the existing data in order to obtain real-time, site specific sound source verification levels for HRG equipment.

Methods: This study will use a passive acoustic recording localization array of approximately 10 recording units, to conduct year-round recording of baleen whale species off the coast of Virginia, from nearshore areas, through the wind energy area, to the continental shelf edge. From the perspective of seasonal surveys to document year-round occurrence, passive acoustic recording provides a higher detection probability for baleen whales than visual surveys alone. This is particularly useful during winter months or at night, when aerial surveys are not possible. Data will be analyzed using a suite of detector algorithms (supported by varying amounts of human verification), run on a high performance computing system, to determine seasonal trends and abundance (relative abundance or using point-count data), as well as ambient noise and sound source levels.

Data collected will be used to:

1) Establish a multi-year record of baleen whale occurrence in the Virginia wind area lease blocks. It is difficult to assess whether the data collected from June 2012-June 2013 is part of a regular pattern of right whale movements, or represents an anomaly of right whale activity based on above average ocean temperatures.

2) Determine spatial and temporal patterns of habitat usage of at least 3 baleen whale species in the area.

3) Estimate density and abundance of at least 3 baleen whale species in this area.

4) Collect baseline data on the ambient noise of these areas for use of environmental assessment of anthropogenic noise levels from either wind turbine construction or seismic surveys.

5) Potentially provide the first empirical data on HRG sound source levels in the Virginia wind area planning area.

A network of recorders extending to the shelf edge in two configurations will be deployed. The configuration will allow for triangulating on the location of whales. Recording devices would collect passive acoustic data continuously for two full years. Acoustic data would be analyzed for the occurrence of selected baleen whale (and potentially fish) species of interest as well as ambient noise levels and sources. Data products will consist of time-series graphs showing occurrence of the focal species, and maps showing their location.

Revised Date: March 28, 2014

Region: Atlantic

Planning Area(s): North and Mid-Atlantic

Title: Advancing the use of Acoustic and Thermographic Observations of Marine Birds to Support Post-Construction Evaluations

BOEM Information Need(s) to be Addressed: BOEM is considering post-construction monitoring that can address key questions about the interaction between marine birds and wind turbines. Of particular interest are movement patterns at night and during inclement weather. The use of acoustic and thermographic techniques may provide insights into these activities.

Cost Estimate: (in thousands) $800K **Period of Performance:** FY 2016-2018

Description:

Background: As construction of the first offshore wind turbines off the coast of the United States nears, the questions being asked about the potential effects are shifting. Careful siting that takes into consideration the distribution of marine birds reduces the risk of birds being killed or displaced by facilities. Now, it is time to prepare for post-construction considerations. Key questions include the behavior of migratory birds at night or in inclement weather. Acoustic/thermographic devices could monitor vocalizations of birds both day and night at all seasons of the year and in any weather conditions, including periods of low visibility that would prevent effective visual monitoring. BOEM funded the study "*Acoustic Monitoring of Temporal and Spatial Abundance of Birds Near Structures on the OCS of the Atlantic and Gulf of Mexico*" to develop and test the effectiveness of this type of monitoring equipment for offshore use and can be used to estimate bird flight heights - information which is critical to the assessment of risk to birds from wind turbines. If these instruments are used post-construction, they may be used on the service platforms, meteorological towers or wind turbine towers. This technique can monitor birds on the OCS during both daytime and night and in both good and poor visibility conditions, but only at point locations where offshore structures are available. Thermographic and conventional cameras positioned to obtain stereoscopic images will aid in the identification of species and calculation of flight height and vulnerability.

While each of these systems provides data on only a single point in a large ocean, it can provide data continuously all year. Used in conjunction with high-definition aerial surveys, which provide wide area survey data but only on a single day for each flight, the combination would contribute substantially to our understanding of bird and bat use of the OCS. However, further development of the methodologies based on lessons learned is needed. This study will extend the acoustic study to further refine the methodology with the intent to uses the devices post-construction to address key questions.

Objectives: Increase our understanding of the movements of marine birds around offshore wind structures.

Methods: The advancements this study will focus on include miniaturization, such that the system can be deployed on more types of structures, including buoys. The limiting factor in size is the solar panels, which must be large enough to produce the power needed, so reducing power demand will be a priority, as well as the ability to switch certain functions off and on remotely, thus further reducing the power needed at any given time. Duty cycles for different pieces of equipment will be determined for optimal data gathering while reducing power usage and data storage needs. There will be an emphasis on the use of cell phone technology to transmit data to shore, either directly or via satellite. This will depend on how far offshore cell phone capability extends; from the previous study, we know it did not extend 29 miles offshore to the Frying Pan Shoals Lighthouse.

In addition, cost reduction for these devices will be pursued. Ideally, 20-30 of these devices would be deployed simultaneously around a wind farm, or on buoys around a proposed wind farm, or just scattered over a broad area along a coast. The cost for this type of deployment needs to be reasonable.

The use of ambient light cameras in addition to thermal cameras will be explored, since bird activity in the pilot study was greater in daytime than at night. Ambient light cameras would increase the ability to obtain accurate species identifications during daytime.

Revised Date: March 21, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): Mid-Atlantic

Title: Quantitative Assessment of Spatially-Explicit Social Values Relative to Wind Energy Areas

BOEM Information Need(s) to be Addressed: While national polls generally indicate public support for renewable energy development, the social values attached to affected places by localized publics or particular stakeholder groups can pose a major challenge to siting such projects. Identifying and understanding the nature and intensity of place-based values in our nation's seascapes, and their relationship to social action, will help developers and agencies anticipate and plan for stakeholder support or opposition during renewable energy development. Value suitability analysis can help developers and project managers meet informational needs related to quantifying, anticipating and successfully managing stakeholder engagement in marine renewable energy projects.

Approximate Cost: (in thousands) $400 **Period of Performance:** FY 2015-2018

Description:

Background: Baseline information on the spatial footprint of human activities in our nation's coastal and marine environments is increasingly available. For example, the recently completed studies, "Identification of Outer Continental Shelf Renewable Energy Space-Use Conflicts and Analysis of Potential Mitigation Measures" and "Bayesian Analysis for Spatial Siting (BASS)," document the spatial footprint of ocean uses and, in the case of the BASS project, use this data to inform siting of renewable energy projects. Findings from these and other studies have bolstered our ability to identify potential human use conflicts and mitigation measures. However, such studies remain focused on a limited range of stakeholder groups (e.g., scientists, commercial fishers, shippers, etc.), relying heavily on experts from these groups to contribute data or subjective assessments about the uses of and values for contested marine spaces. Members of smaller stakeholder groups and the general public have not been routinely or systematically engaged in the collection of human use and value data in an renewable energy context, despite the fact that these groups may also benefit or bear the externalities of such projects. Further, research to date has narrowly operationalized "value" in a spatial planning context. Objectively, value has generally been operationalized as the presence/frequency or economic value of a particular marine activity. More commonly, value has been subjectively operationalized relying on the opinion of "key" stakeholders, informants or experts. Objective data that allow for the assessment of spatially relevant, place-based social values, collected from a scientifically drawn sample of stakeholders or the public, are lacking. The proposed study would fill this gap.

For this study, the term "values" represents the moral orientation or philosophical framework that shapes a person's ideals and attitudes and, more importantly, motivates

behavior or action. Environmental sociologists have found that people generally fall into one of a few environmental value orientations. Knowing these moral, value and attitudinal orientations has helped researchers and resource managers anticipate the likelihood of persons to engage in individual or collective pro-environmental behaviors. In an energy context, presence of particular patterns of social values, specifically values associated with place-based attachment, have been noted as an important factor in motivating local action to oppose renewable energy projects.

The present study proposes collection of spatially-explicit, value orientation data that is relevant to areas planned for alternative energy development. Specifically, it is proposed for states with Wind Energy Areas (WEAs) in the Mid-Atlantic region, although the approach could be used in all regions, at multiple spatial scales, or with particular stakeholder groups. The goal of the project is to learn which value orientations are most highly correlated with particular geographies and to develop models to predict who is more likely to support and oppose renewable energy projects in the region. The data required to conduct such an analysis are:

- value profiles—identification of the moral frameworks and environmental belief/attitude orientations of focal stakeholders or publics, as well as indicators of place-based identity and attachment in a renewable energy development context;

- behavior/action profiles—identification of reported pro-environmental behavioral profiles and social action orientation relevant to stakeholders or publics in a renewable energy context;

- contextual/situational profiles—collection of demographic and socioeconomic characteristics of focal communities or stakeholder groups;

- value profiles for spaces—documentation of the type and intensity of sociocultural attachment to particular areas within a given space;

- use patterns---the spatial and temporal characteristics of human usage of specific areas: purpose of use, frequency of use, timing of use, etc.

Objectives: The objective of the study would be to provide decision-makers with an enhanced understanding about the relationship between marine space use/non-use, the type and intensity of place-based attachments and value orientations in regions adjacent to WEAs, and the likelihood of local engagement in action to support or oppose renewable energy projects.

Methods: Data required for the proposed study would be collected using randomized social surveys, administered via mail, internet or in person/intercept, or some combination of these three approaches. Respondents would be asked a series questions used to identify their environmental value-attitude orientation, moral framework, and behavioral propensities/intentions. Researchers propose use of established social assessment scales (e.g., NEP, General Ecological Behavior, etc.) and/or development of new social assessment scales specific to a renewable energy context. In the latter case, principal components analysis, factor analysis or other statistical techniques could be

employed to build the scales. Contextual questions would also be included in the survey instrument, such as age, sex, educational attainment, zip code of residence, property tenure, etc. Regression analysis would be used to determine the primary predictors of relevant value-attitude orientations as well as behavior/action. Tabular data would be used to identify value and behavioral profiles, which would be analyzed in a spatially-relevant manner based on U.S. Census or alternative geographies. Respondents would also be asked to complete a mapping exercise during the survey to identify areas of use and/or value. Mapped data would be digitized and joined with tabular data and, where appropriate, combined with relevant ecological data. This approach would allow for multiple types of data display options and statistical analyses, such as the creation of indices for value frequency, density and diversity, as well as a number of different types of analysis (e.g., discriminant, compatibility, suitability and 'hot spot' identification).

The goals of the research would be:

1. Document the constellation of values and attitudes held by study populations and attributed by this population to spaces in proposed WMAs;

2. Identify the presence, density, frequency, intensity and diversity of place-based attachments and values for marine and coastal areas;

3. Identify the statistically significant relationships between social and environmental attributes of interest in a wind energy context;

4. Develop models to assess the likelihood of local action to support or oppose alternative energy development among stakeholders or the public based on value orientations; and

5. Identify potential conflicts related to the co-location of landscape values and place-based attachments, human use/activities, environmental characteristics, and proposed siting of wind energy arrays.

The products from the proposed project would include a standard report. Additionally, all data, including tabular datasets and a geodatabase, would be provided. The proposed study would help BOEM and developers understand and negotiate the broader cultural landscape of areas targeted for renewable energy projects.

Revised Date: March 27, 2014

Region: Atlantic

Planning Area(s): North, Mid-, and South Atlantic

Title: Impact Assessment of Offshore Wind Turbines on High Frequency Coastal Oceanographic Radar

BOEM Information Need(s) to be Addressed: With the advent of active leasing for offshore wind energy areas, BOEM must determine the impacts that wind turbines may have on the high frequency (HF) coastal oceanographic radar systems used operationally by the U.S. Coast Guard for search and rescue and by NOAA for oil spill monitoring and response, and BOEM must address appropriate mitigation strategies for wind turbine operation within HF radar networks. BOEM must assess as part of its NEPA analysis the effects of offshore wind turbine blade rotation on HF coastal radar signals and determine if wind turbine activity is a navigational and safety risk through radio frequency interference. This study proposes to perform simulations and in situ measurements to quantify the impacts of rotating wind turbines on HF radars currently deployed along the Atlantic coast.

Cost Estimate: (in thousands) $500 **Period of Performance:** FY 2015-2016

Description:

Background: HF radar data are used operationally by both the US Coast Guard for search and rescue and by NOAA for oil spill monitoring and response. A recent simulation study (Teague, 2012), presented at the Annual Marine Technology Society Conference (http://www.oceans12mtsieeehamptonroads.org/index.cfm), indicates that interference from the rotating turbine blades is likely to occur and will require some mitigation techniques. The signature and impact of the rotating blades on HF radar processing has not been sufficiently studied in real-world situations. Only recently, in 2012, has an adequate simulation been performed, referenced above. The details of real-world turbine construction materials and operating parameters need to be parameterized in a more detailed simulation. These simulations and real-world data will inform BOEM as to the extent that mitigation techniques will be required so HF radars can operate unimpeded for critical missions of safety and oil spill response as well as for research objectives.

Objectives: This study will achieve the following objectives:

1. Characterize the impacts of offshore wind turbines on HF radar current and wave processing from both simulated and in situ data, and

2. Determine the effectiveness of developed mitigation techniques, such as modifications to radar waveform, filtering and/or post-processing.

Methods: This study will conduct in-depth research into wind turbine operation, with data collection of the specific operating parameters, e.g., turbine blade rotation rates

and construction materials and sizes of turbines and blades. In order to better simulate offshore wind turbine operations, IOOS HF radar technical staff and regional representatives will exchange information directly with wind turbine industry engineers in order to improve or refine simulations using currently existing tools and methods. BOEM will work directly with the IOOS HF radar technical staff to define the field program and needed mitigation measures.

The previously developed Numerical Electromagnetic Code (NEC) will be expanded to reflect real-world parameters for simulations of wind turbine rotation effects, including frequencies other than the 13.5 MHz already used in recent simulations. These improved and expanded simulations will inform any field tests or interference mitigation methods to be proposed.

This study will conduct field tests of HF radar in the vicinity of offshore wind turbines in Europe, unless wind turbines are operational in U.S. Atlantic waters in FY 2015. The HF radar systems used for this study will be installed if not currently operating near active European offshore wind facilities. The length of time needed for adequate characterization of the varying conditions that may exist is 3 – 4 weeks. Sufficient time must account for variations in wind conditions responsible for changes in turbine blade speed, pitch, and orientation to the radar; variations in wave and ocean current conditions for examination of differences in Bragg echo characteristics in the presence of radar interference; and changes in system configurations. All levels of data products from HF radar will be kept for analysis during the entire study.

Based on the findings of the field tests, this study would develop interference mitigation techniques that could be run in real time on HF radar systems. One example of a mitigation technique that has been hypothesized is a "digital filter" that could track the turbine blade rotation rate in real time and subsequently determine turbine blade rotation sideband positions. Specific mitigation techniques will need to be tested and proposed following the analysis of the field-test data. Any developed mitigation techniques would be tested on systems that are processing data in real time in the vicinity of wind turbines.

Revised Date: March 18, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): South Atlantic

Title: Describing Marine Wildlife Distribution and Movement Patterns on the South Atlantic OCS

BOEM Information Need(s) to be Addressed: Initial renewable energy leasing activities focused on areas along the Atlantic Coast that were ready for such development. As leasing progresses, the potential for additional areas in the South Atlantic is becoming apparent. Baseline information is needed on the distribution and abundance of marine mammal, bird, and turtle species to assist in the environmental review of wind energy areas and in the evaluation of sites in the South Atlantic. BOEM will use this study to begin addressing identified information gaps.

Approximate Cost: (in thousands) $4,500 **Period of Performance:** FY 2015-2018

Description:

Background: BOEM is responsible for assessing offshore renewable energy projects in the Atlantic planning region, yet recent data is scarce for the South Atlantic OCS. Relatively little known about the distribution and abundance of marine mammals, birds and turtles in the south Atlantic OCS compared to what is known in other regions like the Northeastern Atlantic. This observation is supported by BOEM funded study "*The Compendium of Avian Occurrence Information for the Continental Shelf Waters along the Atlantic Coast of the United States*" and was discussed at length during the FWS "Marine Bird Science and Offshore Wind Workshop" and the BOEM "Atlantic Wind Energy Workshop" in 2011. It is now time for a multi-year comprehensive baseline ecological study that includes collection of field data, predictive modeling and mapping to build the knowledge necessary for the effective and efficient permitting of offshore wind facilities on the South Atlantic OCS from the Virginia-North Carolina border to Florida.

Given the vastness of the Atlantic OCS and variability in marine wildlife distributions, comprehensive baseline surveys like the one being conducted in the Mid-Atlantic by DOE (http://www.briloon.org/MABS) are critical to improving our understanding of current distributions of seabirds, marine mammals, and turtles on the OCS. These surveys would augment ongoing BOEM efforts including the *Atlantic Marine Assessment Program for Protected Species* (AMAPPS). This study would provide data that will be added into the Compendium of Avian Occurrence Information database and Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP). The data then could be used to update avian and other distributional maps on the Atlantic OCS like those currently be developed through BOEM's interagency agreement with NOAA (*Integrative Statistical Modeling and Predictive Mapping of Seabird Distribution and Abundance on the OCS*).

Objectives: A multi-season, three-year baseline characterization of marine wildlife in the South Atlantic OCS.

Methods: The general survey approach is similar to the one described in DOE's "*A Mid-Atlantic Ecological Baseline Studies and Modeling*" that includes a series of boat and high definition aerial video surveys. In all, there will be 24 boat surveys and 24 high definition aerial surveys within three years. The study will build on existing (but not duplicate) efforts such as the interagency *Atlantic Marine Assessment Program for Protected Species* (AMAPPS) which uses conventional aerial surveys. The field data collection effort will include species that are federally or state listed as threatened or endangered as well as any other species of concern and will also include observations of marine mammals and turtles. The general survey design will span three years of observation, with sampling at intervals sufficient to capture seasonal variations in species density and abundance, and cover an area from the federal-state boundary (3 nautical miles) to the 45 meter isobath from the Virginia-North Carolina border to Florida. The effort will be limited to a total area of more than 3,000 square nautical miles in areas where leasing is most likely to occur. Processed survey data will be sent annually to the Compendium of Avian Occurrence Information database and to OBIS-SEAMAP.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): Mid-Atlantic

Title: Comprehensive Seafloor Substrate Mapping and Model Validation in the Atlantic

BOEM Information Need(s) to be Addressed: The Atlantic region is in need of high quality information on the composition of seafloor substrate and sediments for BOEM to accurately assess the effects of renewable energy development. This is particularly important for offshore wind development with respect to turbines that are anchored into the seafloor and the potentially high levels of benthic disturbance that will occur during construction and operation. Direct on-the-ground documentation of the makeup of the seafloor could prevent the inadvertent destruction of marine habitats and shipwrecks. The results would also enhance NEPA documentation which requires an evaluation of the effects of proposed actions with consideration of numerous categories including: ecological, cultural, historic, aesthetic, economic, social, and health. One of the primary impacts of offshore wind development will be ecological effects on the substrate. The results of this study will allow for more successful and appropriate planning for the development of renewable energy on the Atlantic OCS inappropriate project siting.

Approximate Cost: (in thousands) $1,500 **Period of Performance:** FY 2015-2017

Description:

Background: There have been several recent efforts to better describe the ocean floor. For example, as part of the New York Department of State's renewable energy planning efforts and its Offshore Atlantic Ocean Study, released in July 2013, NOAA's National Centers for Coastal Ocean Science (NCCOS) developed a biogeographic assessment with maps and spatial information on bathymetry, surficial sediments, deep sea corals, oceanographic habitat variables, and seabirds offshore New York. BOEM has also partnered with NOAA's Northeast Fisheries Science Center to conduct a benthic habitat assessment in several offshore wind energy areas. Additionally, The Nature Conservancy has also partnered with the University of Massachusetts at Dartmouth to further analyze their seafloor imagery database. Each of these efforts uses relatively sparsely distributed data and statistical interpolation to create maps of habitats. Given the high cost of vessel time to conduct full multi-beam echosounder surveys, there will continue to be only broadscale sampling within potential lease areas and the need for predictive models.

The predictive models of seafloor substrate and sediment composition that have recently been developed for New York, and are under development for the other Mid-Atlantic states, need groundtruthing and model validation to assess the model predictions and ensure reliability. Obtaining this baseline information is a necessary precursor for evaluation of the potential impacts of offshore wind development upon the substrate and to inform siting decisions. NCCOS currently is undertaking similar work

to expand these modeling efforts to the entire Mid-Atlantic Region through a contract with the Mid-Atlantic Regional Council on the Ocean (MARCO).

Objectives: The study will validate the existing substrate and sediment models, and provide finer-resolution substrate and habitat data in areas selected for groundtruthing.

Methods: The study will obtain baseline seafloor data and groundtruth the predictive seafloor substrate and sediment models developed by NCCOS for the Mid-Atlantic Region. The study area will focus, but not be limited to, areas identified or likely to be identified as renewable energy planning sites. This study will take advantage of all available sensors and collectors to include multi-beam surveys and core sampling to support model validation. The study will test the efficacy/accuracy of an emerging technology in marine waters - airborne lidar bathymetry (ALB). ALB has proven a more cost effective technology than ship based multi-beam echo sounders while meeting NOAA nautical charting specifications in nearshore coastal waters, although has not been tested offshore of the Atlantic coast. The study will include comparisons of ALB, compact airborne spectrographic imager, and laser line scan technologies for effectiveness in depths of up to approximately 50m. ALB will be used in areas where seasonal variation of water turbidity and approximate depths can be validated to maximize the survey efficiency.

The study will include iterative updating of the predictive models and corresponding uncertainty estimates as fieldwork is completed, and the final models will include uncertainty thresholds that are scientifically acceptable to ensure mapping accuracy and model reliability. This data would be validated against existing or new bathymetric data collected using various sensors including side scan sonar, and singlebeam and multibeam acoustic depth sounders. Seafloor substrate point data may be acquired through co-processing or post-processing of depth sounder data, from reflected acoustic or optical backscatter intensity values, or from airborne imagery. Multi-sensor bathymetry acquisition minimizes cost while retaining accuracy. Field survey techniques to groundtruth models may include in situ direct sampling of seafloor substrate and sediment and should include one or a combination of the following: bottom grabs; core sampling; scuba; video; ROVs and submersibles; etc. Different techniques should be used for different locations as deemed appropriate given the predicted substrate type and other considerations. Appropriate levels of reviews under Section 106 of the National Historic Preservation Act will be conducted prior to the ground disturbing activities mentioned as bottom grab samples and core sampling have the potential to affect previously undiscovered submerged archaeological properties.

Revised Date: April 17, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): North, Mid-, and South Atlantic

Title: Detection of Marine Species from High Resolution Aerial Vertical Photography using Automated Anomaly Detection Software

BOEM Information Need(s) to be Addressed: Multiple ongoing aerial surveys are being employed to collect data on the distribution and abundance of endangered species and seabirds in the wind energy areas off the east coast of the U.S. A recently completed BOEM study, *Pilot Study of Aerial High-Definition Video Surveys for Seabirds, Marine Mammals, and Sea Turtles on the Atlantic OCS*, is advancing this capability, however, there are still challenges with processing the large volume of images in an efficient and cost effective manner. Such data will improve density estimates and baseline assessments of sea turtles and smaller marine mammals, providing managers with better information to make decisions. This technology is also a first step toward automated survey technology using unmanned aircraft.

Approximate Cost: (in thousands) $400 **Period of Performance:** FY 2015-2017

Description:

Background: This study would improve anomaly detection capabilities to detect marine species from high resolution aerial survey imagery. The study would apply an innovative anomaly detection software program to process existing aerial survey imagery from the Massachusetts Wind Energy Area dataset, and train the system to detect marine mammals, sea turtles, and sharks. The study would compare automated vs. observer detection capabilities, and evaluate these technologies for their potential use in semi-automated survey strategies. If effective, these technologies could be adopted by existing aerial surveys at little extra operational cost, and provide high-quality data to complement a wide range of research interests.

Aerial surveys are widely used to assess the distribution and abundance of marine life in order to comply with a variety of regulatory requirements. Their effectiveness is dependent upon the methods used to detect, identify, count, and monitor species of interest. Recent advances in both still and video camera high-resolution image collection, makes a variety of image based platforms attractive for both assessment and mitigation surveys around offshore energy sites. However, the analysis of such imagery is challenging. Trained photo-analysts can be employed, but the work is time consuming and tedious, with the potential for analyst fatigue and bias. Anomaly detection software has been tried, but different methods have produced either excessive “false positives” (sighting detections where there are none) or false negatives (missed sightings of animals clearly in the images). Recent work on this problem has identified the need for further testing and development of this software to reduce these problems. Preliminary tests have been conducted to assess the ability of the software to detect anomalous characteristics when marine species were sub-surface, which demonstrated the

capability of the software to detect a range of different sized species at depth. Additional work is needed to make adjustments to the software to accept images of a larger size, eliminate interference from bright sun glares by using a special filter, and reduce the number of false-positives by training the classification algorithm to recognize and eliminate them.

Objectives: Using an already collected extensive aerial survey image dataset, the objectives would be to:

1. Determine the effectiveness of new multi-layer anomaly detection software to identify the presence or absence of animals in vertical photographs with natural "clutter" (glare, whitecaps, wave patterns).

2. Refine and "train" the anomaly detection software to detect turtles, marine mammals, and sharks from "cluttered" images. This methodology may be extended to include birds.

3. Provide comparisons of automated versus observer detection capabilities.

4. Optimize the software so that it can function in near-real time.

Methods: The project is proposed to occur in two phases.

Phase 1: Collection of the vertical photography database for use in this project is already being supported through a Massachusetts Clean Energy Center (MassCEC) and BOEM funded contract: *Field Studies of Whales and Sea Turtles for Offshore Alternative Energy Planning in Massachusetts*. MassCEC has agreed to make the database available for this proposed work. The vertical image database contains over 100,000 high-resolution digital still images totaling 850 GB. This database has been manually analyzed by observers, and all sightings of fish, sharks, turtles, marine mammals and fishing gear have been recorded. Occurrences of false/true positives, and false/true negatives of detected anomalous sightings will be recorded to test the strength of the detection software. In order to compare automated vs. manual detection rates of vertical images for potential independent measures of distribution and abundance, we will test the software's ability to detect anomalies, distinguish between positive and negative anomalies, 'learn' detection skills by training the software, and distinguish between marine biota.

Phase 2: To further enhance the processing speed to be able to accommodate very high resolution (> 10 Mp) imagery in a real-time fashion, the core components of the algorithm (so-called inner loops) would need to be further optimized to take advantage of the latest image/graphics processing hardware technologies, for example the highly parallelized general purpose graphics processing units (GP-GPUs). For processing speed in the marine environment, the parameters and the classification database need to be re-tuned and optimized.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): North, Mid-, and South Atlantic

Title: A Database and Acoustic Reference Catalog of Marine Fish Sounds

BOEM Information Need(s) to be Addressed: Passive acoustic monitoring has been demonstrated to be a highly efficient survey method for understanding wildlife occurrence in BOEM areas of interest. While the focus has been on marine mammals, sounds from other marine life are also recorded. These sounds, particularly form fish, may be used to further evaluate fish behavior and effects from sound made by human activities. This was identified as a data gap in the BOEM's recent Sound Workshop to Identify Information Needs and Data Gaps on the Effects to Fish, Fisheries, and Invertebrates.

Approximate Cost: (in thousands) $900 **Period of Performance:** FY 2015-2017

Description:

Background: Ocean passive acoustic recording has primarily focused on marine mammals, due to their broadly protected status. Acoustic recording has been demonstrated to be effective on acoustically monitoring fish populations as well. However, those species of fish that have been identified to produce sounds have not been well documented, and on many long-term marine acoustic recordings, many sounds are recorded that are likely produced by fishes, but the species identity is unclear. As many as 50-70% of the fish species along the U.S. Atlantic coast are potentially capable of producing sounds, but only a small number have been well-documented. Fish sounds that emerge during these recordings create undefined additional ambient noise when trying to identify marine mammal sounds, but the lack of species-specific identity limits their utility in terms of understanding the biology of fish populations, as well accounting for their occurrence in whale surveys.

Many fish species produce species-specific acoustic calls in courtship and aggression that are strongly tied to seasonal patterns of movement and reproduction. The ability to remotely monitor changes in their normal behaviors allows them to serve as bioindicators of anthropogenic impacts and environmental changes. Understanding (1) which species of fishes are producing sounds and (2) the time of year that they vocalize, allows for passive recording of fish bioacoustics to serve as a mechanism to detect changes in nearshore marine ecosystems. Fish behavior is strongly affected by anthropogenic noise, including seismic air guns and ship traffic. Additionally, the frequency range of ship propeller noise overlaps with the fundamental frequency component of many fish sounds, creating a masking effect of fish calls. Once a baseline pattern of fish calling is established, effects of human activities such as the construction and operation of wind facilities may be evaluated.

Much of the foundational work in understanding the sounds produced by fishes was published in 1970 by Marie Poland Fish and William H. Mowbray in Sounds of Western North Atlantic Fishes. Despite being over 40 years old, and the sounds recorded under laboratory conditions on analog equipment, this work is largely still the key reference in this field. An updated, publically available compendium of fish sound identification and reference would allow the public and private research community use of fish sounds to further understand the context of their acoustic recordings and examine the dynamics of fish populations across broad spatial scale. Sounds identified over the course of the project would be described in peer-reviewed publications, as well as made freely available as online multi-media references.

Objectives: This study would provide a library of fish sounds for reference.

Methods: A team of fish sound experts would be assembled to survey the research community for which species have been recorded, as many fish species sounds exist in personal research collections. The list of acoustically-active or hypothesized focal Atlantic fish species would be identified, and sounds would be collected through a combination of in-situ observations or captive recordings in different locations. The species of interest would be targeted on the basis of their known or hypothesized degree of acoustic activity (e.g., drumfish, toadfish), geographical occurrence, economic value (e.g., cod, haddock), or population vulnerability (e.g., sturgeon). Recording efforts would focus on known spawning or aggregation sites of different species, and local marine laboratories with appropriate facilities for recording fish in captivity. All sounds would be digitally recorded to maintain high-quality audio standards. Sounds from different behavioral contexts (spawning, aggression, feeding) would also be collected and identified.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): North Atlantic

Title: Gray Seal and Harbor Seal Telemetry Studies

BOEM Information Need(s) to be Addressed: Gray and Harbor Seals resident in the northwest Atlantic utilize coastal and offshore waters and thus are vulnerable to activities associated with offshore energy projects, such as ship strikes, risks of entrainment in dynamic positioning systems, pollutant spill contact, industrial sounds, etc.. This study will provide critical information on the at-sea distribution, habitat use, and behavioral ecology of seals to assist BOEM with its decision making, including statutory and regulatory compliance, associated with renewable energy projects and, possible oil and gas development, in the western North Atlantic.

Approximate Cost: (in thousands) $500 **Period of Performance:** FY 2015-2019

Description:

Background: Grey and Harbor Seals have been studied by several investigators over past decades. Recently, NOAA's Northeast Fisheries Science Center (NEFSC), Protected Species Branch Seal Research Program formed a collaborative network of seal researchers including university investigators, NGOs, and federal and state government agencies throughout the northeast region (North Carolina to Atlantic Canada). Their research is conducted under a National Marine Fisheries Service (NMFS) scientific research permit and Fish and Wildlife Service special use permits issued to NEFSC. The synergy of this approach greatly enhances the capabilities of seal field teams, thus supporting multi-disciplinary research (e.g., population trends, distribution, stock structure, movements, habitat use, diet, contaminants, health assessment, disease, etc.).

BOEM's Atlantic Marine Assessment Program for Protected Species (AMAPPS), funded harbor seal live capture and telemetry work in the spring of 2011 and 2012 required to obtain an aerial survey correction factor (NMFS unpublished data). AMAPPS also supported the June 2013 pilot project to do gray seal live capture/tagging work in Chatham, MA. The latter is providing the first ever information on seasonal movements, habitat use, and dive behavior for gray seals in US Atlantic waters. From June through early autumn, the tagged seals exhibited site fidelity to Chatham Harbor, with individual animals making excursions along the outer Cape, including Monomoy National Wildlife Refuge, and into Gulf of Maine waters. In late autumn, coincident with the approaching pupping/breeding period, the seals began ranging into Nantucket Sound as far west as Nomans Land, and into waters south of Nantucket Island and Martha's Vineyard. The latter encompassed the BOEM proposed renewable energy areas. The seasonal movements are consistent with patterns observed in NEFSC aerial survey data and studies in other regions that indicate gray seals forage widely and exhibit seasonal site fidelity. Similar ecological traits have been observed with New England harbor seals.

The project proposed herein seeks to improve our knowledge of gray seal and harbor seal ecology, including: habitat use, site fidelity, distribution, and behavior in New England and adjacent waters. This will be informative for siting decisions as well as mitigation of risks associated with offshore energy projects, such as pollutant spill contact, acoustical disturbances, ship strikes, and risks of entrainment in dynamic positioning systems, (see http://www.smru.st-and.ac.uk/documents/1619.pdf). The intended study area encompasses BOEM-proposed renewable energy areas (e.g., Nantucket Sound and nearshore waters south of Nantucket / Martha's Vineyard), and thus will contribute directly to environmental assessments pertaining to construction and operational phases of renewable energy platforms. The initial focus will be on gray seals for the following reasons: (1.) they are present year-round and are the most abundant seal species in southern New England (Massachusetts to New York); (2.) their largest haul-out sites are located very near the proposed renewable energy areas mentioned above; (3.) the NEFSC data set from the successful 2013 tagging project is available to guide successive investigations; and (4.) gray seal abundance and distribution have expanded over the past two decades, producing a dramatic shift in species composition from New England to maritime provinces of Canada, and they occupy some haul-out sites that were formerly occupied by harbor seals.

Objectives: The primary objective of this study is to improve our knowledge of gray seal and harbor seal habitat use, site fidelity, distribution, and migratory behavior in New England and adjacent waters in order to assess the vulnerability of the seals to offshore energy operations such as their risk to ship strikes. In the course of achieving the primary objective, information will be obtained that will be used to address other aspects of the seals' behavioral ecology that BOEM may be able to use in other, future impact assessments.

Methods: This study will conduct live capture, sampling, and telemetry (e.g., GPS cell phone or satellite) tagging 15-20 (number will be a function of price per unit) gray or harbor seals each year. Gray seal tagging would occur during June/July (i.e., within one month of the annual molt) at one or more haul-out sites in Cape Cod - Nantucket Sound region. Harbor seal tagging would occur in early autumn, within two months of the annual molt and when seals begin occupying seasonal haul-out sites in southern New England waters. Seal captures will be conducted using protocols employed in our prior harbor and gray seal research (Gilbert et al. 2005; Waring et al. 2006; NMFS unpublished data).

Revised Date April 2, 1 2014

2.3 Profiles of Studies Proposed for FY 2016 NSL

Table 3. Atlantic OCS Region Studies Proposed for Fiscal Year 2016 NSL

SDP Page Number	Discipline	Study Title
327	HE	Enhancing Existing Integrated, Ecosystem-scale At-sea Surveys in the Gulf of Maine to Support Ecologically Informed Offshore Development Decisions
329	HE	Assessing Temporal Shifts in Wildlife Distributions Using Current Survey Methodologies
331	HE	Acoustic Mapping and Characterization of Sensitive Hardground and Live Bottom Habitat on the Southeastern US Shelf
333	HE	Spatial Ecology, Movement Patterns, and at-Sea Habitat Use of Two Nearshore Seabirds: Brown Pelican and Royal Tern
335	FE	Commercial Shipping and Fishing Vessel Activity Effects on Seabird Distribution and Abundance on the Atlantic OCS
337	FE	Changes in Fishery Bycatch and Protected Species Incidents Resulting From Wind Development in the Atlantic
339	SE	Socioeconomic Impacts of Offshore Wind Projects: A Geographic and Temporal Comparative Analysis Given Experience
341	SE	Standards for the Collection and Analytical Processing of Subsurface Core Samples
Discipline Codes		
FE = Fates & Effects IM = Information Management SE= Social & Economic Sciences		HE = Habitat & Ecology MM = Marine Mammals & Protected Species

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): North Atlantic

Title: Enhancing Existing Integrated, Ecosystem-scale At-sea Surveys in the Gulf of Maine to Support Ecologically Informed Offshore Development Decisions

BOEM Information Need(s) to be Addressed: Making informed offshore development decisions requires a thorough understanding of the distribution and abundance of species, the relationships among species, and the relationships between species and the physical environment. Such information is needed to comply with U.S. environmental policies, including the National Environmental Policy Act (42 USC § 4321), the Endangered Species Act (16 USC §§ 1531-1544) and the Magnuson-Stevens Fishery Conservation and Management Act (16 USC §§ 1801-1884). Much of this information, however, is lacking for key species and critical habitats within the coastal and outer continental shelf waters of the Gulf of Maine. These knowledge gaps, in turn, create considerable management challenges for BOEM, which has regulatory authority over offshore developments within outer continental shelf waters.

Approximate Cost: (in thousands) $1,900 **Period of Performance:** FY 2016-2020

Description:

Background: The offshore waters of the Gulf of Maine (GoM), with some of the highest sustained wind energy potential in the U.S, have become the focus of offshore wind development planning efforts. The anticipated offshore structures may affect this ecologically rich ecosystem by changing habitat structure, altering ecosystem processes, or changing the amount of suitable habitat available to organisms. Avoiding, eliminating, minimizing, and monitoring these effects requires understanding (1) the current spatial distribution and abundance of marine habitats and organisms, (2) the relationships among organisms and the physical environment, and (3) how future climate conditions may alter ecosystem structure and dynamics.

Currently, there is only a very rudimentary understanding of such ecosystem processes in the GoM. Collecting the needed data requires an interdisciplinary, ecosystem-scale study. Specifically, there is little information on marine ecosystem dynamics in GoM coastal waters (2 – 120 m depth) and the habitat use of marine organisms in the region's deeper outer continental shelf waters during winter and summer months (June/July) when foraging marine birds may be most abundant. Of particular interest is the hypothesis that there are specific areas of high production and accumulation of energy-rich species of zooplankton in coastal and offshore waters of the GoM, attracting marine mammals, forage fish and marine birds to these spots.

This study will continue work of a diverse team of researchers brought together to fill these data needs in coastal waters and will expand the study to include Gulf of Maine offshore waters. Along with filling critical knowledge gaps, this interdisciplinary,

ecosystem-scale effort answers the call from regulatory agencies and conservation groups for marine spatial planning conservation efforts and ecosystem-based approaches to management. The proposed surveys, running concurrently with other GoM investigations, will provide an extraordinarily valuable opportunity to both expand the spatial and temporal scope of GoM studies and provide independently collected data for model validation efforts. Such work will greatly improve the ability to make inferences concerning GoM ecosystem dynamics.

Objectives: Provide the baseline information and understanding needed to support informed offshore development decisions as we transition away from traditional fossil fuel energy sources.

Methods: Conduct integrated, ecosystem-based surveys in the coastal and outer continental shelf waters of the Gulf of Maine, combined with a finer-scale investigation of patch use by foraging marine birds. BOEM will partner with an interdisciplinary team that has received a State Wildlife Grant to carry out similar surveys in coastal waters in summer and winter 2014 and 2015. BOEM will supplement this existing coastal snapshot with four additional years of data collection that includes offshore waters. Such a project extension would greatly enhance our understanding of interannual variation in ecosystem processes, while efficiently utilizing an interdisciplinary team and integrated project protocol that have already been assembled and tested. Together, the surveys will provide critical information to the BOEM that will improve its ability to assess future possible lease locations and also place any current or future site-specific information within the context of the whole ecosystem. The study will:

1. Document and map the distribution of benthic habitat types and the distribution and abundance of zooplankton, fish, marine birds, marine mammals and turtles.

2. Build spatially explicit distribution models for focal species, which account for imperfect detectability, and use environmental and biological predictor variables.

3. Investigate foraging movements of breeding marine birds using location tags.

4. Calculate and map biological hotspots within the GoM based on a representative suite of focal marine organisms.

5. Expand our ability to forecast changes in the distributions of marine organisms and biological hotspots in response to ecosystem changes.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): Mid-Atlantic

Title: Assessing Temporal Shifts in Wildlife Distributions Using Current Survey Methodologies

BOEM Information Need(s) to be Addressed: This study would collect and analyze additional survey data from Wind Energy Areas in the mid-Atlantic. Results of this study would be used to determine the utility of historical datasets for siting offshore renewables, and to examine the utility of short-term site-specific surveys for identifying long-term distribution patterns and trends. Results of this study would also be used in leasing and permitting decisions for offshore renewable projects in the Mid-Atlantic Planning Area, particularly for projects in the Mid-Atlantic Wind Energy Areas.

Approximate Cost: (in thousands) $3,300 **Period of Performance:** FY 2016-2018

Description:

Background: BOEM's determination of Wind Energy Areas (WEAs) is designed to have reduce wildlife conflicts than other areas of potential development. These areas were chosen, in part, using historical datasets on wildlife distributions on the Atlantic Outer Continental Shelf (OCS). Current and future surveys in these areas, funded by the National Oceanic and Atmospheric Administration, the Department of Energy, coastal states, and private developers, are gathering new data that can be used to further define areas of high wildlife abundance through time. However, direct comparisons between these new data and historical records from the Atlantic Seabird Compendium are difficult, due largely to changes in survey and analysis methodologies over time, as well as to inconsistencies in effort in historical datasets (Kinlan, Zipkin, O'Connell, & Caldow, 2012). Thus, it is difficult to assess the utility of historical datasets for predicting current distributions, and recent data may be of much greater utility in NEPA permitting processes for offshore development.

Given these limitations, there is value in continuing a subset of existing, high-density surveys through time in order to better develop our understanding of temporal changes in wildlife distributions and relative abundance in relation to climatic and oceanographic variables. This is particularly true in BOEM's WEAs, where such data can also be 1) directly applied towards site assessment and permitting needs, and 2) used alongside site-specific monitoring data to assess the utility of site-specific monitoring approaches for detecting regional-scale (e.g., WEA-scale) changes in wildlife distributions or relative abundance.

Objectives: Continue high-density, regional-scale surveys in WEAs to 1) examine changes in wildlife distributions through time in relation to environmental variables, 2) develop data that can be used by multiple private developers for site assessment and permitting processes, and 3) assess the utility of site-specific monitoring data for detecting changes in wildlife distributions and abundance.

Methods: Surveys would be continued according to the existing survey protocol (e.g., NOAA AMAPPS protocols, (Connelly, 2013) for two additional years. Statistical analysis approaches would combine approaches previously taken by Kinlan et al. (2012) and Gardner et al. (in prep.)

End products of this study would include a final report summarizing new survey results, and comparing those results to those of previous surveys conducted using the same methodologies; a final, georeferenced database of all new survey data; addition of all survey data to the Seabird Compendium; and statistical models describing wildlife distributions for the new time period, comparing them to previous models developed for NOAA, FWS, DOE, and other agencies, and comparing them to site-specific data collected by states and private developers.

Revised Date: March 27, 2014

Region: Atlantic

Planning Area(s): South Atlantic

Title: Acoustic Mapping and Characterization of Sensitive Hardground and Live Bottom Habitat on the Southeastern US Shelf

BOEM Information Need(s) to be Addressed: The presence or absence of sensitive hardground and live bottom habitat is critical information needed for any NEPA assessment of proposed offshore energy activities. A coarse-resolution assessment of the potential for live bottom has been conducted in the southeastern US continental shelf, but detailed knowledge of live bottom distributions does not exist. Detailed mapping in potential energy related corridors would provide the information needed to conduct energy related activities while minimizing potential impacts to these habitats.

Cost Estimate: (in thousands) $2,200 **Period of Performance:** FY 2016-2019

Description:

Background: Hardground and live bottom habitat are classified as Essential Fish Habitat within the Magnuson-Stevens Act and Habitats of Particular Concern within several fisheries management plans. These areas are important habitat, as they represent oases of biological productivity in the desert of the sandy continental shelf system. A coarse-resolution assessment of the potential for live bottom has been conducted by the SEAMAP program, on a 1 mile x 1 mile grid. These cells are coded, based on the evidence for hardground somewhere within that cell, as: hardground present (based on bottom video observations); hardground potentially present (based on vicarious collections of reef-associated fish or plant species); or no hardground present (based on lack of visual evidence for hardground). However, this dataset is not sufficiently detailed to guide the development of offshore activities without potentially impacting these critical habitats.

These proposed activities would complement significant existing efforts by in northern SC and at least two of the NC priority areas (north of Cape Fear) where extensive USGS-partnered geophysical mapping efforts are being carried out which extend from 0-5 miles offshore. These existing datasets would be highly valuable in leveraging our ability to expand energy corridors out into Federal waters in already defined priority areas.

Objectives: The objectives of this study are to map the distribution of hardground habitat within areas of interest as identified by each state and to document the benthic communities associated with the hardbottom types delineated. Knowledge of this distribution and character can later be used to inform permitting of energy-related activities on the OCS, as well as support ecosystem- based management of fisheries and other marine resources.

Methods: Benthic habitats would be delineated using state-of-the-art instrumentation and techniques. Bottom character, backscatter and detailed bathymetry would be determined using multibeam and bathymetric sidescan systems. High-resolution chirp reflection surveys would provide shallow subbottom structure, portraying the distribution of hardbottom above the shelf sands, as well as the thickness of sand cover in areas of buried hardbottom. These tools and data would also identify areas of geologic hazard to energy development (e.g., paleochannels and regions of large bedforms) on the shelf. Benthic geological and biological samples would be collected with photographic and grab sampling techniques to ground truth the remotely sensed data. Survey results will be submitted to the National Geophysical Data Center for archiving and public access. The location information of any discovered archaeology sites will be kept confidential within the Bureau and removed from any data distributed to the public.

To assist in identifying and prioritizing areas for surveys, a South Atlantic regional collaboration (North Carolina, South Carolina, Georgia, and Florida) to map benthic habitats in key priority areas on the continental shelves seaward of each state will be formed. The collaborative would include marine geologists and benthic biologists representing the Governor's South Atlantic Alliance partner states. Areas of focus would be determined by each state and could be based on strategic interest (e.g., areas of likely OCS energy development or infrastructure corridors, or of likely ecological sensitivity) or could be chosen to capture a range of representative shelf areas in a variety of water depths. Some of the states in the southeast (e.g., North Carolina) have potential Federal-State Wind Energy Areas already identified and South Carolina is the next state that will be involved in this process. Although Georgia and Florida are earlier in the planning stages with these activities, this project would enhance their ability to prioritize activity corridors. The advantage of the regional collaboration is that we can pool resources and expertise to study a wide range of habitat from common platforms. In addition, there is significant expertise in maritime archaeology in the region, which could be brought to bear in assessing cultural resources that might be impacted by energy-related activities.

Deliverables from this project would include, in addition to a report, georeferenced files and maps of hardbottom habitat distribution, bottom character, benthic ecological assemblages, and potentially the location of archaeological or maritime resources on the southeastern shelf. The location information of any discovered archaeology sites will be kept confidential within the Bureau and removed from any data distributed to the public.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): South Atlantic

Title: Spatial Ecology, Movement Patterns, and at-Sea Habitat Use of Two Nearshore Seabirds: Brown Pelican and Royal Tern

BOEM Information Need(s) to be Addressed: Information is needed to assess potential interactions between nearshore seabirds and renewable energy structures in the region. Data would support NEPA analyses and research needs identified at the BOEM sponsored Atlantic Wind Energy Workshop 2011 and avifauna chapter of the information synthesis developed for BOEM for the South Atlantic Planning area.

Cost Estimate: (in thousands) $2,000 **Period of Performance:** FY 2016-2019

Description:

Background: Two species that range widely in the region, are of conservation concern, and that would provide good models to assess such interactions are the Eastern Brown Pelican and Royal Tern. Both species breed throughout the region and have the capacity to forage out to 30 km from shore but to date there have been no studies on at-sea habitat use or seasonal movements of either species along the Atlantic coast. Therefore the opportunity to model potential interactions between these nearshore seabirds and structures deployed for renewable energy development is weak. The study would complement an ongoing study in the Gulf of Mexico (IAA no. M12PG00014; Eastern Brown Pelicans: Dispersal, Seasonal Movements, and Monitoring of PAHs and Other Contaminants in the Northern Gulf of Mexico).

The collision sensitivity rank for Brown Pelicans is high relative to other bird species on the Atlantic OCS, and its displacement rank is medium (Willmont et al., 2013). The collision sensitivity rank for Royal Terns is medium relative to other bird species on the Atlantic OCS, and its displacement rank is low (Willmont et al., 2013). However, our understanding of fine-scale habitat use is very limited and therefore we cannot readily determine the probability of actual exposure to structures at sea until we can assess foraging ranges, movement patterns, and migration paths. Nearshore seabirds that already occur within the macro-scale exposure zone may adjust their habitat use based on location of structures. For example, nearshore seabirds may be attracted to nearshore structures because fish also are attracted there or the structures may provide perching opportunities (Michel et al. 2007). In contrast, nearshore seabirds may avoid structures by deflecting their movements around areas of development or altering habitat use (Michel et al. 2007). Detailed habitat-use data are needed to conduct risk assessments. Similar data are being collected on pelagic and nearshore seabirds in other regions to address potential interactions with structures at sea (e.g. mid- and north Atlantic studies of loons, seaducks and gannets).

Objectives: Determine annual at-sea habitat use, movement patterns, and migration paths of breeding and non-breeding adult Brown Pelicans and Royal Terns throughout the South Atlantic.

Methods: 50 adults of each species will be captured and mark at nesting colonies in the South Atlantic. Satellite transmitters of appropriate size and type will be deployed on each bird that can transmit daily for up to two years.

Seasonal home range maps will be developed for each individual and core use areas also will be mapped for the population. Preferred habitats will be determined via standard statistical and geographical modeling approaches. Migration routes will also be mapped. Determine high, moderate and low use areas at sea throughout the year. Movement and use data will be layered with available marine habitat data, wind data and current data.

The research effort will likely be led by the USGS Cooperative Research Unit in South Carolina (SC CRU) with collaboration from USFWS, SC DNR, GA DNR, FL FWC, NC Wildlife Resources Commission and Clemson University. Other partners may be added as needed.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015–2016

Region: Atlantic

Planning Area(s): North, Mid-, and South Atlantic

Title: Commercial Shipping and Fishing Vessel Activity Effects on Seabird Distribution and Abundance on the Atlantic OCS

BOEM Information Need(s) to be Addressed: Understanding how anthropogenic factors may affect the distribution and abundance of seabirds will enable BOEM to refine its analyses of the impacts from activities related to renewable energy development.

Cost Estimate: (in thousands) $150 **Period of Performance:** FY 2016

Description:

Background: The process for identifying wind energy areas on the Atlantic OCS is aimed at facilitating the prioritization, rapid siting and leasing of new projects. Discussions during the Fish and Wildlife Service Marine Bird Science and Offshore Wind Workshop and the BOEM Atlantic Wind Energy Workshop in 2011 emphasized the importance of identifying bird "hot spots" and "cold spots." It is common knowledge that many seabird species follow fishing vessels to opportunistically feed on by-catch and this practice can influence many bird populations (e.g., Bicknell et al., 2013). It is also believed that these behaviors explain some of the observed avian hot spots on maps produced using data from the USGS Compendium of Avian Occurrence (BOEM 2012-026). In Europe, the development of offshore wind has led to a reduction of commercial fishing activity within the foot print of wind facilities (Scheidat et al., 2011). Therefore, within wind energy areas with a history of commercial fishing, it is reasonable to assume that there will be a reduction in seabird numbers once a wind facility becomes operational and commercial fishing vessel activity is reduced. On the other hand, it is well known that some bird species are disturbed by commercial shipping traffic (Schwemmer et al., 2011). However, a formal statistical analysis of existing data on the Atlantic OCS is needed to support this assumption in BOEM's environmental review and interpretation of avian survey data. BOEM envisions working directly with NOAA or USGS through an interagency agreement.

Objectives: The objective of this study is to provide an understanding of how commercial shipping traffic and fishing vessel activity influence the distribution and abundance of seabirds on the Atlantic OCS.

Methods: This study will incorporate existing data from three sources: 1) the USGS Compendium of Avian Occurrence; 2) Vessel Monitoring System (VMS) data; and 3) Automatic Information System (AIS). BOEM has acquired and processed five years of VMS data (2006-2010) and three years of AIS data (2009-2012) that spans the entire Atlantic OCS. Ten species are known to be influenced by fishery by-catch or boating traffic (black-legged kittiwake, herring gull, great black-backed gull, northern gannet, northern fulmar, common loons, common eiders, common tern, Cory's shearwater, and

greater shearwater) (Schwemmer et al., 2011; Bicknell et al., 2013; Veit and Perkins 2014), and the distributions of these species for the Atlantic OCS have been modeled in the avian compendium study. New statistical models will be developed and be used to predict the potential decrease in seabird abundance associated with reduced fishing vessel activity within the wind energy areas after commercial development. Another set of models will describe the association between shipping traffic and select bird species. These models will be used to predict shifts in seabird distribution due to future changes in shipping traffic described in BOEM's "Marine Vessel Traffic and Wind Energy Development Infrastructure on the OCS Risk Analysis."

Predicative accuracy of the models will be assessed with a variety of diagnostic and validation statistics. All model and maps and products will be peer-reviewed by the statistical and seabird experts. All maps will be versioned so that they can be updated, include detailed metadata, and made available for the Marine Cadastre and other public data portals.

Revised Date: March 21, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): North and Mid-Atlantic

Title: Changes in Fishery Bycatch and Protected Species Incidents Resulting From Wind Development in the Atlantic

BOEM Information Need(s) to be Addressed: In avoiding wind energy sites during construction and operations, fishing vessels may opt for alternative grounds with different bycatch portfolios. More fishing in areas with high bycatch for overfished species (e.g. yellowtail flounder) or protected resources (e.g. harbor porpoises, Atlantic salmon) may exacerbate bycatch-related choke points, resulting in constraints on fisheries not directly affected by wind development. Furthermore, increased takings of protected species may have ramifications under the Endangered Species Act and the Marine Mammal Protection Act.

Approximate Cost: (in thousands) $300 **Period of Performance:** FY 2016-2018

Description:
Background: A fragile balance between commercial fishers, protected resources, and overfished species exists in the Northern Atlantic. When certain thresholds for incidents or catch are crossed, entire fisheries are subject to a medley of constraints on fishing, creating significant inefficiencies in commercial fishing. For example, when tradable quota for yellowtail flounder becomes scarce, groundfishers targeting species such as cod or monkfish are unable to operate, leaving many vessels idle. Currently, efforts by BOEM are underway to understand the economic impact on the fishers from wind development. While the impact on profits is important for the socio-cultural portion of a NEPA analysis, changes that are external to the fisher are not included in changes in profit. What if development of a wind area drives fishermen into high-bycatch areas, resulting in constraints on the fishery? What if effort is reallocated to areas with high probabilities of taking an endangered or threatened species?

NEPA analyses benefit from the best available science and while the primary impact of wind development on protected species would be considered in the context of direct impact (e.g. habitat loss, noise impacts), changes in fishery interactions with protected species should be considered to a reasonable extent. This study would use existing information on overfished and protected resources' distributions and bycatch, as well as results from an ongoing BOEM analysis on fishery effort reallocation, to identify potentially problematic interactions.

Objectives: The objectives of this study are to improve wind energy area siting by accounting for potential changes in bycatch and protected species takings resulting from reallocations of commercial fishery effort and inform policymakers on the trade-offs between specific wind energy sites and second-order impacts on bycatch and protected species not accounted for in an economic impact study.

Methods: Using results from BOEM's ongoing study on economic impacts from potential fishery effort reallocation, combined with fishery-dependent and fishery-independent data on bycatch rates and species abundance, an estimate of expected bycatch and takings would be generated for a variety of policy scenarios. Modeling would build on location-choice models and other constrained optimization methods frequently used in assessing protected species reduction proposals. One or more existing wind energy areas would be identified for initial evaluation.

The final deliverable would consist of a written report as well as spatial data sufficient to identify proposed wind development areas that may have high potential for reallocating fishery effort to areas of concern for overfished species or protected species.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): Mid-Atlantic

Title: Socioeconomic Impacts of Offshore Wind Projects: A Geographic and Temporal Comparative Analysis Given Experience

BOEM Information Need(s) to be Addressed: BOEM is responsible for assessing the environmental effects of offshore wind development on local communities. Currently, this involves addressing perceptions, with only limited actual data from the European experience. With the probability that a wind facility will be built in the next 5 years, BOEM will have the opportunity to collect actual responses to wind facilities to incorporate in environmental analyses.

Approximate Cost: (in thousands) $800 **Period of Performance:** FY 2016-2019

Description:

Background: Given that no offshore wind farms have yet been deployed in United States (U.S.) coastal waters, all existing offshore wind socioeconomic data sheds light on expectations and anticipated impacts. The entirety of the body of literature pertaining to socioeconomic dimensions of U.S. offshore wind development has focused on perceptions prior to development among a public with no experience or familiarity in close proximity to this technology, leaving actual socioeconomic impacts entirely unknown. To address this substantive knowledge gap, this study will geographically focus on the Atlantic coastal adjacent regions of the 2014-downselect U.S. Department of Energy (USDOE) Offshore Wind Advanced Technology Demonstration projects and on the other two early development projects—Deepwater Block Island and Cape Wind, totaling a minimum of two projects (Deepwater Block Island and Cape Wind) and at maximum four projects, assuming funding for two USDOE projects or the continuation of projects without DOE funding. The analyses will identify previously unseen impacts and changes in expectations leading up to and as a result of project deployment. Comparisons between the different platform technologies could bear notable, subsequent differences, or lack thereof, in the study's outcomes between the projects as could comparisons between near-shore demonstration projects and a large commercial project.

For the projects, the surveys and data collection will build off any existing studies already conducted at the projects or in the nearby regions, for example, the ongoing study: *Atlantic Offshore Wind Energy Development: Public Attitudes, Values, and Implications for Recreation and Tourism*. With eleven expected offshore wind facilities in various stages of development across the U.S., BOEM has a responsibility to iteratively understand and document relative socioeconomic impacts, to manage expectations, and to integrate sound data into related marine spatial planning, siting, and permitting. These ongoing analyses in the Atlantic from pre- to post- operation will

offer cross-cutting insight that can be applied nationally to other projects likely to be deployed in Pacific and Gulf waters in the coming decade.

Objectives: The objective of this study is to gain a real world perspective on the socioeconomic effects of offshore wind development based on responses to actual projects. The focus will be on the change in perceptions after wind development occurs, specifically the perceptions about affecting the beach experience from visual impacts.

Methods:

- Explore the socioeconomic expectations, experiences, and impacts of the first U.S. (USDOE-funded) offshore wind farms among local stakeholders;

- Iteratively compile a socioeconomic database for Deepwater Block Island and Cape Wind as well as each USDOE project region pre- (proposed study start-2015, i.e. Phase I), during (2015-2017, i.e. Phase II), and post-construction/deployment (2017-2019, i.e. Phase III);

- Create and employ existing qualitative/quantitative metrics to measure changes in perceptions, expectations, opinions, or behavior across Phases II & III given a Phase I 'baseline';

- Utilize metric findings to ascertain changes in perceptions, expectations, opinions, or behavior between each study phases I, II, and III for each project;

- Determine underlying factors contributing to differences or similarities within (intertemporal i.e. across Phases I, II, and III) or across projects (intraregional) through statistical analyses; and

- Compile recommendations for future offshore wind development given findings.

Revised Date: March 27, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Atlantic

Planning Area(s): North, Mid-, and South Atlantic

Title: Standards for the Collection and Analytical Processing of Subsurface Core Samples

BOEM Information Need(s) to be Addressed: BOEM needs to develop standards for adequate and appropriate spacing, density, collection, and post-collection (i.e. laboratory analytical) treatment of vibracores, including final disposition, as methods for aiding in the identification of historic properties offshore the Atlantic. These standards need to be communicated by augmenting BOEM's *Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 585.*

Approximate Cost: (in thousands) $750 **Period of Performance:** FY 2016-2019

Description:

Background: Although vibracore collection (and similarly-executed boring) is one of multiple subsurface sediment sampling techniques, it is unique with respect to its utility as a direct-sampling method that may be used in the identification of submerged archaeological sites. As one of the few subsurface sediment sampling techniques that are minimally invasive to these resources, vibracoring results in the collection of an intact, generally 4-inch diameter by (up to) 40-foot cylindrical sample of sediments from the seabed, which may then be subjected to further onshore analysis.

But questions remain to be answered with respect to applying this technology to the identification of historic properties for the purposes of Section 106 of the National Historic Preservation Act and under the Renewable Energy regulations at 30 CFR 585. First, consideration must be given to what constitute appropriate and adequate sampling strategies. Second, given adequate direct sampling is conducted, appropriate and consistent treatment of the collected cores must include subjection to certain laboratory and other analyses which may point to non-artifact indicators of human habitation. Standards must be developed for differentiating terrestrial stratigraphic sequences that are not archaeologically sensitive from those that are. Standard operating procedures for the handling and archiving of cores and coring materials (e.g., subsamples) also should be established and observed. Finally, standards for reporting of these results must be shared with developers to ensure the highest quality data are submitted with plans and thus utilized in BOEM's decision-making process.

A five-year study conducted in the Gulf of Mexico region (scheduled for completion in January 2013, but still ongoing) has at least two tangential objectives: (1) to determine if the core analysis data identified in previous studies (Stright, 1986) represent a universal set of characteristics indicative of prehistoric archaeological deposits, or is either geographically restricted to the Sabine River Valley or temporally restricted to the Paleo-Indian period, and (2) to identify additional core analyses that suggest, or are

indicator factors for archaeological deposits in the Gulf of Mexico region. These results may be applicable to the Atlantic, but they also may not. Participants at BOEM's 2012 Wind Energy Workshop – Archaeology tract discussed these questions and issues, but many of Europe's submerged prehistoric archaeologists speaking with the benefit of wind energy experience concluded that no consistency exists on the European side of the Atlantic with respect to analyses utilized. They also commented that, where lacking, standard operating procedures are desirable and would be beneficial. The lack of consistent application of standards in the European Atlantic and the question of applicability of the Gulf of Mexico study to the Atlantic region justifies the continued consideration of this topic within the geographic confines of the Atlantic OCS. Consideration also should be given to what variability may exist therein, identifying where different study regimes on the Atlantic OCS are warranted. Nevertheless, this study will build upon the GOMR study, and should not commence until the GOMR study is complete.

It is anticipated that the methods established by this study will become consistent treatment for Atlantic region core collection in support of plans and that analytical results and photographs of cores will be part of the Outer Continental Shelf Interactive Registry of Archaeological Surveys (OCSIRAS), which is also under development by BOEM at this time. Inclusion of core analyses and photographs in OCSIRAS will ensure that archaeologists working in BOEM's various regions will be able to see and interact with these data.

Objectives: The objective of the study is to develop and test standards for adequate and appropriate spacing, density, collection, and post-collection (i.e. laboratory analytical) treatment of vibracores, including final disposition, as methods for aiding in the identification of historic properties offshore the Atlantic.

Methods: (1) From applicable previous investigations into the subject, this study will synthesize successful methodologies and derive a focused research design. (2) The research design will guide the development of draft standards for using subsurface seabed sediment samples as a method of identification of archaeological resources offshore the Atlantic, including a standard suite of primary-level laboratory analyses and a possible suite of secondary-level analyses dependent upon the results of the first. (3) These methods will then be applied both to previously collected core samples, as appropriate, and newly-collected core samples, both of which will be tested for applicability within a developer-conducted framework. (4) Results of the testing will be incorporated into final standards that, if appropriate, BOEM may then consider incorporating into its *Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 585*.

Revised Date: March 10, 2014

SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2017

BOEM's immediate information needs for the Atlantic OCS are related to renewable energy, focusing on information needed for upcoming leasing and reviews of construction and operation plans. Over the next few years, those needs will shift to gathering baseline information at a finer scale and for new areas, studying the potential impacts of commercial wind and ocean energy facilities, and incorporating lessons learned regarding mitigation measures and post-construction survey protocols.

Within the next 5-10 years, BOEM anticipates that there will be several "game changing" technological advances in offshore renewable energy development that will result in the expansion of the number of leasing areas and likewise information needs for siting these lease areas. First, assuming that the sub-sea backbone transmission system (the Atlantic Wind Connection project) is successful, there will likely be many requests for development *outside* of the Mid-Atlantic wind energy areas – this will happen because it will become economically feasible to develop beyond 30 miles of a land-based electrical substation. Second, floating turbine technology will have likely matured, making the expansion of offshore wind development into deeper waters technologically and economically feasible. Third, Ecosystem Based Management and Marine Planning will have matured providing new regional baseline information. As a consequence, there may be a reassessment of areas that were initially excluded during the delineation of the first WEAs. These technological advances (including unanticipated advances) point to the critical need to the collection, compilation, and update of region-wide baseline data, maps, and decision tools.

3.1 Wind Energy on the OCS

3.1.1 Baseline Data

By 2017, a significant amount of baseline data should be available for evaluation. Some questions may be answered, and hopefully a clearer picture will unfold. Some limited construction will be in existence and under study. Additional baseline data may be needed, but will need to be determined in the context of the current knowledge. The time may be ripe for a critical evaluation of the baseline information and more targeted studies at specific areas of interest.

3.1.2 Post Construction Monitoring

BOEM has developed standardized monitoring protocols, including protocols for monitoring fish, turtles, marine mammals, birds, and benthos for pre-construction monitoring activities. Of course, this monitoring must be informed by potential post-construction requirements. As the technology is being developed, deployed, and operated, additional opportunities will be available to monitor the interactions between the technology and the environment. Incorporation of lessons learned will allow BOEM to determine the best monitoring technologies to use in order to assess the interaction of technology with the environment. How is the impact of facilities on these resources best

measured? This type of information will assist BOEM in assessing what levels of impacts are significant and if impacts are significant, how they would best be mitigated.

3.1.3 Technology Issues

While wind technology is the most advanced, and significant research has been conducted in Europe, there are still many questions to be answered as development moves forward along the U.S. coasts. European offshore wind energy efforts are focused mainly in the North Sea, where wind speeds are high and water depths are relatively shallow. Wind turbine spacing within the array as well as spacing between wind facilities is a consideration in terms of the environmental footprint and cumulative effects. The public has commented that a condensed configuration of wind turbine generators may mitigate visual impacts. However, there are questions as to how a condensed configuration may impact commercial fishing as well as reef effects. In addition, environmental impacts from new generation foundation types, particularly floating foundations are a concern. As turbines become taller, there may be impacts to visual flight rule plane operations, particularly in the Northeast where fog is common, which may impact the economics of airports, pilots, and tourist destinations.

3.1.4 Impacts

Scour effects and stability of shoals where development occurs could impact several species, benthic habitats, and offshore cultural resources. Therefore, near-field and far-field environmental impacts of various physical structures need to be assessed. Should initial development be underway or near completion, then post-construction impacts will become the focus for further study.

The cumulative effects of multiple projects along the coast will continue to be a concern. What are the cumulative effects of multiple projects to ecosystems and migratory species? What are the effects of multiple facilities on vessel traffic patterns? What will be the acceptance of communities to multiple facilities including aesthetics and recreational impacts?

3.1.5 Transmission

Assuming some transmission lines will be in place, key questions will remain about the long term changes in the environment and effects from maintenance. Additional studies concerning the effects of EMF on marine species may be necessary, particularly if areas are under consideration that have new species that have not already been considered.

3.2 Marine Hydrokinetic Projects on the OCS

The extraction of energy from ocean currents requires a location that has strong, steady currents. The only known ocean current that has these characteristics on the OCS is the Florida Current, located off the eastern coast of North America. Ocean currents are relatively constant and flow in one direction only, in contrast to the tidal currents closer to shore where the varying gravitational pulls of the sun and moon result in diurnal high tides. Only a small number of prototypes and demonstration units have been tested to

date. One such technology involves submerged turbines. Energy can be extracted from the ocean currents by using submerged turbines that are similar in function to wind turbines, capturing energy through the processes of hydrodynamic, rather than aerodynamic, lift or drag.

Mechanisms such as posts, cables, or anchors are required to keep the turbines stationary relative to the currents with which they interact. Turbines may be suspended from a floating structure or fixed to the seabed. Turbines may be anchored to the ocean floor in a variety of ways. They may be tethered with cables, with the relatively constant current interacting with the turbine used to maintain location and stability. In large areas with powerful currents, it would be possible to install turbines in groups or clusters to create ocean current facilities. One or more turbines would require cable interconnections and a central transformer to synchronize the electricity for compatibility with the onshore grid.

For the immediate future, marine hydrokinetic (MHK) projects on the Atlantic OCS are projected to be limited to technology testing offshore Florida and Massachusetts. As a result of those activities, BOEM will have a better idea of study needs associated with MHK projects for the next plan. Many of the environmental concerns are similar as for any development offshore, including space-use conflicts and alteration of habitat. The interactions of fish, turtles, and marine mammals with underwater turbines are a key concern.

3.3 Cross-Cutting Issues

One interesting cross-cutting issue is the manner in which offshore wind facilities are lit. Beyond 12 miles, the Federal Aviation Administration does not have jurisdiction, while the Coast Guard does. Lighting of wind facilities has also been extensively studied onshore for the effects of lights on wildlife. The visual effects are also of interest to the National Park Service because of the effects on the park experience. BOEM recently completed a study on lighting and will be determining the best lighting configuration of offshore wind facilities that addresses all aspects.

An important cross-cutting issue is global climate change and the benefits of OCS renewable energy development on the environment and human communities. Many questions arise when considering the effects of renewable energy on global climate change. What are the greenhouse gas emission impacts from construction, maintenance, and removal? Will development of renewable energy make a difference in global climate change by decreasing greenhouse gases? Skeptics suggest that it would take many years and significant developments to reverse the trends. However, others suggest that these steps towards renewable ocean energy are critical for the U.S. to take.

A worldwide analysis of manufacturing of OCS renewable energy technologies is needed to trace the most likely manufacturing aspects of commercial and non-commercial OCS renewable energy proposals. Manufacturing of wind turbines and current technologies are limited within the world. Indeed, the U.S. could become a leader in manufacturing for offshore renewable energy, but first it is important to understand the current state of manufacturing before determining the possibilities. An analysis of the manufacturing

OCS renewable energy technologies would allow BOEM to predict the economic and employment impacts of future development.

Eventually, decommissioning impacts will need to be considered including the methods of removal and potential effects of leaving structures in place.

BOEM
Bureau of Ocean Energy Management

CHAPTER 6

MARINE MINERALS PROGRAM

U.S. Department of the Interior
Bureau of Ocean Energy Management
Herndon, VA
2014

SECTION 1.0 PROGRAMMATIC OVERVIEW

Section 1.1 Introduction to the Marine Minerals Program

1.1.1 Responsibilities and Importance of the Program

The Bureau of Ocean Energy Management's Marine Minerals Program (MMP) is responsible for managing the use of non-energy mineral resources (i.e. mud, sand, gravel, and shell) on the OCS. These marine mineral resources must be wisely managed to ensure that resources are being conserved to the maximum extent possible, and that environmental damage to the marine and coastal environments, in association with the use of these resources, is avoided, minimized, and/or mitigated. To accomplish this objective, the MMP has relied on research conducted under the Environmental Studies Program in conjunction with marine mineral resource evaluations and in partnerships with other states and agencies. Environmental studies are important to inform decisions regarding the use of OCS mineral resources in the least environmentally damaging way, particularly the use of sand for the purpose of beach nourishment and coastal restoration activities.

To date, the MMP has authorized OCS sand for the purpose of public works beach nourishment and coastal restoration projects providing an important service to other federal agencies, states, and local communities in need of sediment resources. Coastal erosion and storm damage to the nation's beaches, dunes, barrier islands, and wetlands are critical issues that affect the sustainability and value of coastal ecosystems and economies. The extent and magnitude of erosion and storm damage are increasing along the U.S. coastline as a consequence of poor coastal management decisions coupled with changes in sea level and storm characteristics driven by climate variability (Figures 1 and 2). Erosion and storm damage can seriously impact habitat, tourism, energy development, public lands, defense, and other strategic infrastructure; therefore, storm damage reduction and coastal resiliency measures are of national importance.

Figure 1. Chandeleur Islands on the eastern flank of Louisiana from before and after Hurricane Katrina in August 2005 (Sallenger, et al. 2009)

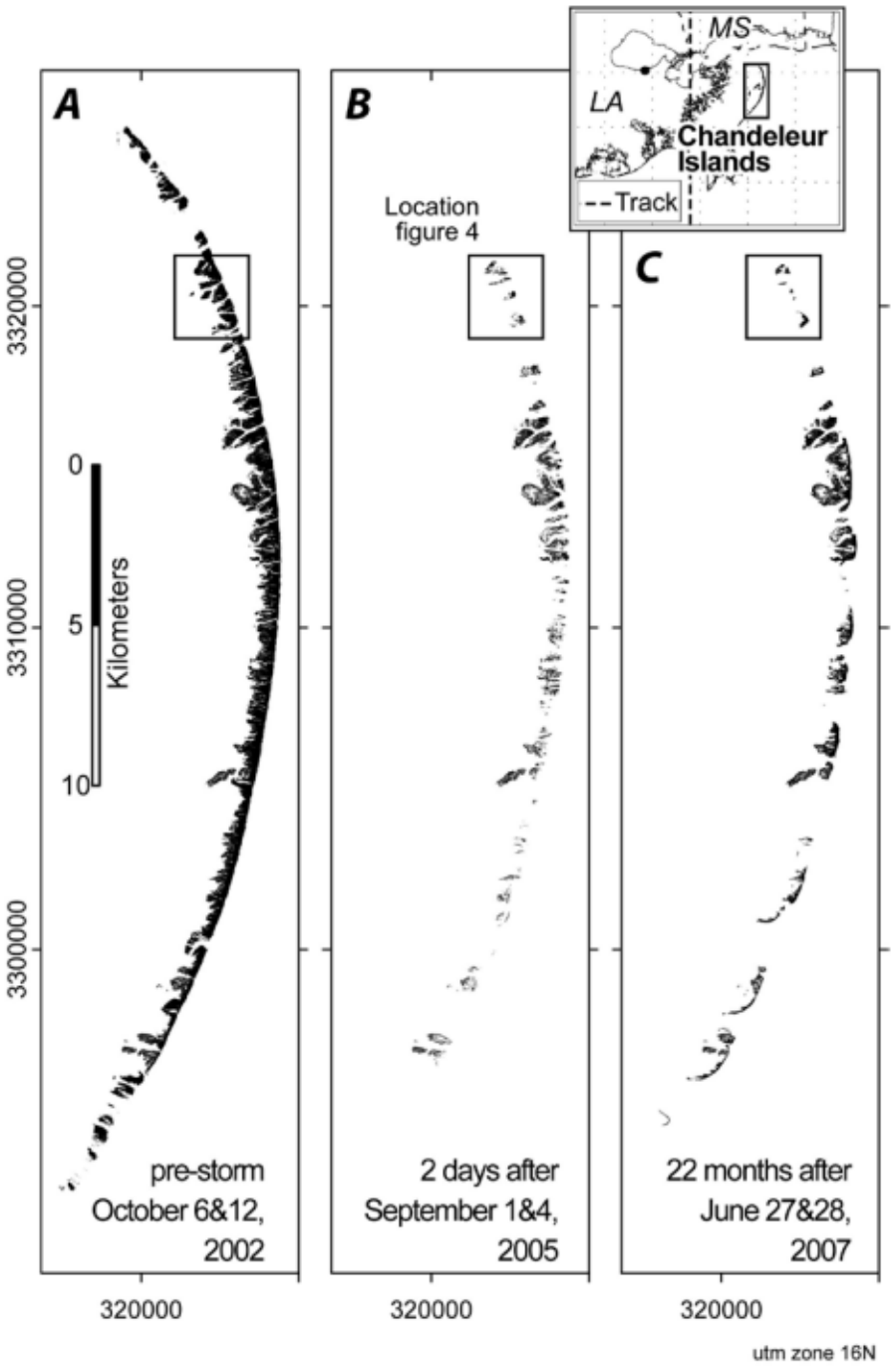


Figure 2. Before and After Hurricane Sandy Storm Damages (Seaside Heights, NJ).

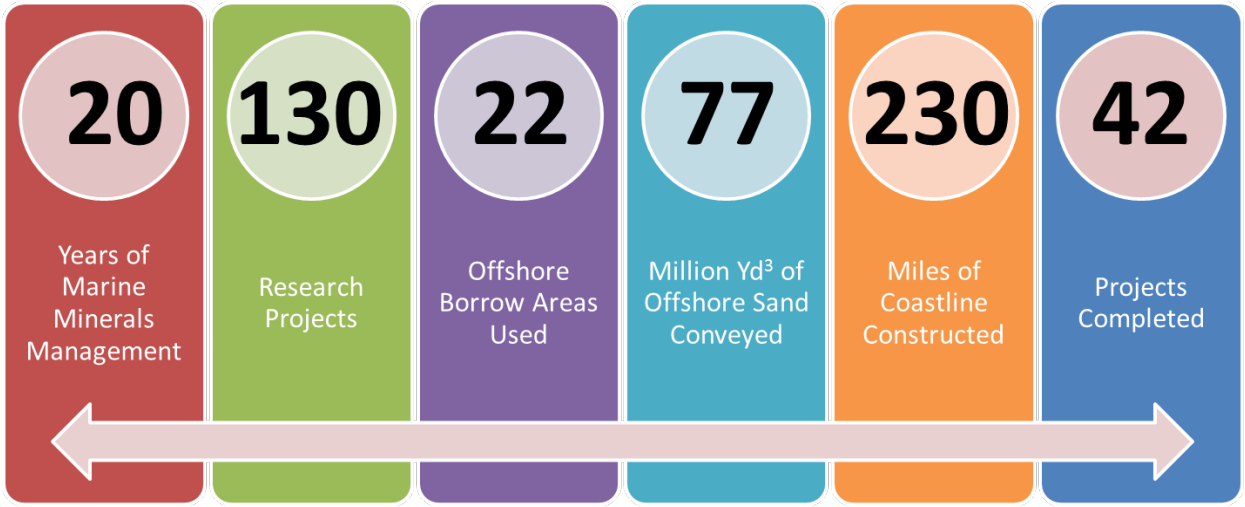
Beach nourishment and coastal restoration techniques that involve the addition of sediment to degraded systems continue to be the preferred options to address coastal erosion, storm damage, and related climate change effects. Nearshore sand resources historically used for constructing beach nourishment and coastal restoration projects are limited and in some regions depleted; thus, interest in identifying and accessing additional offshore OCS resources continues to increase. Therefore, OCS sand is increasingly considered as a resource alternative for the long-term success of many shore protection, beach nourishment, and wetlands restoration projects providing greater environmental benefits and more long term sustainable solutions than construction of hard structure defense measures such as seawalls, breakwaters, and groins.

One of the benefits of using offshore OCS resources is that new sediment is introduced into the coastal sediment budget, as opposed to using limited nearshore sources that are often part of the active coastal system, thereby improving project sustainability and geomorphic function. Additionally, dredging sand closer to shore may impact wave transformation and sediment transport and subsequently exacerbate shoreline erosion rates and contribute to more severe environmental effects. Therefore, the contribution of OCS resources to the sediment budget is very important to coastal resiliency and ecosystem condition. The MMP is the sole steward of these OCS mineral sediment resources (i.e. mud, sand, gravel, and shell) and plays a unique resource management role in response to an increasing number of project proponents proposing to use OCS sand for a myriad of beach nourishment and coastal restoration projects.

As of January 2014, the Bureau authorized access to more than 77 million cubic yards of OCS sand (13.5 Superdome equivalents!) (Figure 3) for 42 beach nourishment and coastal restoration projects in five states (BOEM, 2014). These projects have resulted in

the nourishment or restoration of more than 230 miles of the Nation's coastline (which is the approximate distance from New York City to Washington D.C.), protecting billions of dollars of federal, state, local, and private infrastructure, as well as restoring important ecological habitat. A fact sheet outlining the MMP's activities can be found at the following website: http://www.boem.gov/uploadedFiles/MMP-Fact-Sheet.pdf.

Figure 3. Marine Minerals Program Summary.



1.1.2 Authority

The Outer Continental Shelf Lands Act (OCSLA) (43 U.S.C. 1331, et. seq.) Section 8(k) provides the authority to manage minerals on the OCS. The Department of Interior's jurisdiction for leasing and regulating the recovery of minerals extends to the subsoil and seabed of all submerged lands seaward of State-owned waters to the limits of the OCS (except where this may be modified by international law or convention or affected by the Presidential Proclamation of March 10, 1983, regarding the Exclusive Economic Zone (EEZ)). The OCSLA does not authorize BOEM to issue prospecting permits or leases to private interests in the EEZ of a commonwealth or territory of the United States.

Regulations governing non-energy, competitive mineral prospecting, leasing, and production are in 30 CFR Part 580 (commercial prospecting), Part 581 (leasing), and Part 582 (commercial production).

Public Law 103-426 (43 U.S.C. 1337(k)(2)), passed in 1994, allows the Bureau to negotiate, on a noncompetitive basis, the rights to OCS sand, gravel, or shell resources for shore protection, beach or wetlands restoration projects, or for use in construction projects funded in whole or part by or authorized by the Federal Government. In addition , a 1999 amendment to OCSLA provides the following language with respect to a fee for the use of OCS sand, gravel, and shell resources;

"(2)(A) Notwithstanding paragraph (1), the Secretary may negotiate with any person an agreement for the use of Outer Continental Shelf sand, gravel and shell resources—
(i) for use in a program of, or project for, shore protection, beach restoration, or coastal wetlands restoration undertaken by a Federal, State, or local government agency; or
(ii) for use in a construction project, other than a project described in clause (i), that is funded in whole or in part by or authorized by the Federal Government.
(B) In carrying out a negotiation under this paragraph, the Secretary may assess a fee based on an assessment of the value of the resources and the public interest served by promoting development of the resources. No fee shall be assessed directly or indirectly under this subparagraph against a Federal, State, or local government agency."

For all other uses, such as private use for commercial construction material, the competitive bidding process is required for issuing leases. To date, the vast majority of the leases and agreements issued by the MMP have been negotiated noncompetitive agreements for sand. The MMP is also responsible for other non-energy minerals such as 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 have been no leases issued for these resources and there are no pending lease requests at this time.

1.1.3 Coastal Storm and Emergency Response Efforts

Storm damage associated with Hurricanes Katrina and Sandy devastated many Gulf and Atlantic coastal communities and elicited a renewed national focus and interest in coastal storm damage reduction, ecosystem restoration, and long term coastal resiliency initiatives.

The MMP is focusing on the immediate and foreseeable needs of coastal communities and states, as well as federal agencies and interests impacted by Hurricane Sandy. The MMP's first response was to develop a streamlined process to respond to requests to use OCS sand in beach nourishment and coastal restoration projects. To support longer term and sustainable coastal management, BOEM's MMP is investing in a comprehensive effort to identify and inventory available OCS sand resources.

Principal areas of focus for the MMP include the following:

Identifying environmental concerns in preparation for potential projects.

Communicating with stakeholders in areas of need to understand the level of restoration that could be required

Evaluating sediment characteristics of previously identified OCS sand resources and their suitability for coastal restoration projects.

Negotiating agreements with federal, state, and local government agencies for access to OCS sand resources.

Conducting geological and geophysical investigations within optimized portions of the OCS for potential sand resources.

Delineating offshore sand resources deemed suitable for future projects.

The MMP is also sponsoring environmental monitoring initiatives to better understand potential environmental impacts and more proactively manage dredging activities; this also furthers the goal of streamlining access to OCS sand resources. These initiatives include a partnership with the U.S. Navy, National Aeronautics and Space Administration (NASA), and the University of Florida (UF) to evaluate offshore sand shoal habitat use pre- and post- dredging (including benthic and fish communities). BOEM is also partnering with the USGS to study the sound characteristics of the high frequency geophysical sources most often used to map OCS sand resources.

The MMP continues to support coastal restoration efforts in the Gulf Coast states of Alabama, Mississippi, Louisiana, and Texas. The MMP is proactively identifying OCS sand resources and facilitating its use in restoring portions of the coastal areas that were damaged by Hurricanes Katrina and Rita in 2005. Sand resources needed to repair the damaged coastlines and barrier islands of the four states are estimated to be from 250 to more than 300 million cubic yards; in Louisiana alone, more than 200 square miles of coastal land was converted to open water habitat due to the hurricanes.

1.1.4 Habitat Restoration

In addition to addressing sand resource needs as a result of hurricanes, the MMP is actively leasing OCS sediment for Gulf of Mexico restoration projects proposed to repair natural resources damaged during the Deepwater Horizon oil spill. Projects currently under construction in the Gulf of Mexico include Caminada Headland Beach and Dune Restoration Project and Cameron Parish Shoreline Restoration Project. More than 10 million cubic yards of material has been authorized to be dredged from the OCS for these two projects. These projects are part of the overall Federal effort to work with Gulf Coast communities to help rebuild coastal marshes and barrier islands, restore damaged beaches, and conserve sensitive areas for wildlife while enhancing the natural protection the landforms provide from storms (Figures 4 and 5). In addition, major restoration efforts, including Resources and Ecosystems Sustainability, Tourism Opportunities and Revived Economy of the Gulf Coast (RESTORE) Act and Natural Resource Damage Assessment (NRDA), are requiring the use of OCS sand resources to restore coastal wetlands and barrier islands along the fragile Gulf Coast.

Figure 4. Gulf of Mexico Coastal Restoration Project.

Figure 5. Representative Equipment Types Used to Dredge and Convey Sediment from the OCS to the Coastal System.

1.1.5 Partnership

Stakeholder outreach, including coordination and collaboration with federal and state agencies, localities, and academia, is a critical element of effective project planning. Stakeholder engagement helps BOEM ensure that project priorities and schedules, engineering and dredging methods, legal requirements, and safety measures are being considered and effectively incorporated in Bureau decision-making. In addition, communication with our stakeholders helps define project and regional needs and challenges, and subsequently identify and implement solutions.

In order to leverage cost effective/mutual interest research opportunities, the MMP staff collaborates with coastal states, federal agencies, and academia on regional and project-specific environmental and resource evaluation research. Cooperative agreements have been developed with state agencies and universities to better understand environmental impacts and identify and manage sand resources in areas where sand is more replete. The MMP is currently working with the UF, the U.S. Navy and NASA (in cooperation with the USACE and Brevard County, FL) to evaluate the use and ecological recovery of

Canaveral Shoals II (an OCS sand shoal/borrow area) by various resident and transient fishes along with their prey. This study leverages funding and mutual interests of the UF and the U.S. Navy. The U.S. Navy and NASA have a large amount of existing data on fish movements offshore Cape Canaveral. Both agencies are integrating historical data with newly acquired data from tagging efforts on lemon sharks and scalloped hammerhead sharks. BOEM is adding 26 receivers to the 200+ existing receivers in the Florida Atlantic Telemetry Group (FACT) array (maintained by six universities, four state or federal governments, five non-profits, and one private group).

The MMP hosts regional Sand Management Working Groups (SMWG) throughout the Atlantic and Gulf states to encourage discussion about past, ongoing, and future projects, potential environmental concerns, study needs, and lessons learned. A new group was recently organized through funding provided by the BOEM ESP to improve our understanding of the habitat value and function of shoal/ridge/trough complexes to fish and fisheries. An initial meeting was held in association with the Southern Division of the American Fisheries Society in January 2014. This effort involved several academic institutions (i.e. University of Texas and University of North Carolina – Wilmington), other federal (i.e. USACE and NMFS) and State agencies (South Carolina Department of Natural Resources), as well as private industry involved with offshore dredging. The MMP intends to continue the momentum and collaboration from this working group (along with our collaborators) with additional work on regional essential fish habitat planning and consultations.

The MMP is also an active participant in regional planning groups such as the Northeast Regional Ocean Council (NROC), Mid-Atlantic Regional Council on the Ocean (MARCO), Gulf of Mexico Alliance, RESTORE Act Regional Regulatory Groups, and the RESTORE Act Science Team.

Section 1.2 Map of the Planning Area

The OCS is divided up into three planning areas for the Atlantic and three planning areas for the Gulf of Mexico (Figure 6). OCS borrow areas are concentrated on the inner shelf along the Mid-Atlantic and South Atlantic Bights, west coast of Florida, and Louisiana. Borrow areas are generally located 3 to 12 nautical miles offshore and within 30 m water depths.

Figure 6. Atlantic and Gulf of Mexico Planning Areas.

Section 1.3 Projected OCS Activities

BOEM has authorized use of OCS sand resources in an unprecedented number of projects over the past two years, including more than a dozen projects in Louisiana, Florida, North Carolina, South Carolina, and Virginia alone. BOEM has also begun to address the need for sand resources in other coastal states for the first time, such as New Jersey and Mississippi.

The demand for OCS sand has increased dramatically in recent years due to coastal erosion and storm damage along the Mid-Atlantic resulting from Hurricane Sandy and along the Gulf coast in response to a decade of increased storm activity from 1998-2008 (including Hurricane Katrina) and the Deepwater Horizon Oil Spill. BOEM has an integral role in the government's response to these national disasters. By the end of FY 2014, BOEM will have authorized the use of OCS sand in five different states to recover from erosion and storm damage resulting from Hurricane Sandy. Similarly, along the U.S. Gulf Coast, during FY14-FY15, BOEM will authorize use of OCS sand for four projects associated with DWH oil spill response.

As the availability of beach-compatible sand from proximal upland or environmentally suitable borrow areas in state waters continues to decline, an increasing number of project proponents, ranging from other federal agencies to local governments, rely on OCS sand to construct their beach nourishment and coastal restoration projects.

Regions that have not historically been interested in OCS sand resources, such as the New England states, have expressed a desire to explore them as alternatives to upland sources. In addition, there has been an increasing interest in the regional management of OCS sand resources to consider issues such as multiple uses of the OCS, including renewable energy in the Atlantic and oil and gas infrastructure in the Gulf of Mexico.

Section 1.4 Identification of Information Needs

BOEM carries out environmental studies in support of the MMP to address three main requirements:

- to comply with environmental laws and regulations;
- to support its responsibility to manage these public sand resources in an environmentally-sound, safe, and responsible manner; and
- to identify and consider long-term and cumulative impacts when making management decisions.

The sand bodies often targeted for dredging in the Atlantic and Gulf of Mexico OCS include shoals, sand ridges, cape associated features, and sand-rich buried channels (Figure 7). These seafloor features host many different biological species, from federally managed fish species to foraging sea turtles, and some may even harbor submerged archaeological resources. In some cases, these same sand resource areas may also be optimum sites for renewable energy facilities in the Atlantic and oil and gas

platforms and associated pipelines in the Gulf of Mexico. This can present complex competing use challenges (Figure 8).

Multiple adjacent beach nourishment and/or coastal restoration projects may rely on the same sand resource over the projects' lifecycles, resulting in new longer-term resource management challenges. Sand access and potential environmental resource conflicts are becoming more complex and deserving of rigorous environmental study, monitoring, and management. In order to better understand these complex resource management questions, additional controlled studies are needed to further understand the long-term recovery of benthic and fish communities from dredging and the function of the habitat important to those communities. The results of these studies will allow the MMP to consult and coordinate with other resource agencies such as the NMFS and U.S. Fish and Wildlife Service (USFWS) in a more informed and efficient manner.

Figure 7. Representative OCS Borrow Areas in the Atlantic Ocean and Gulf of Mexico.

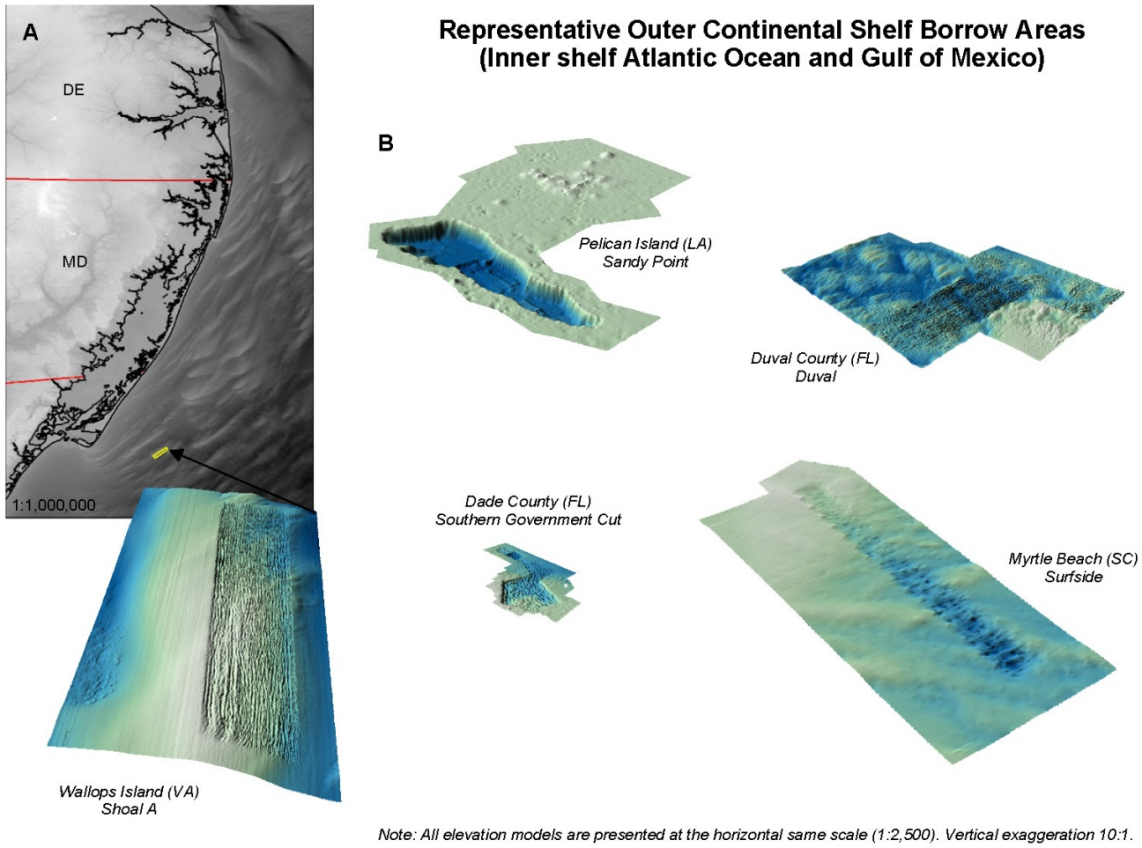
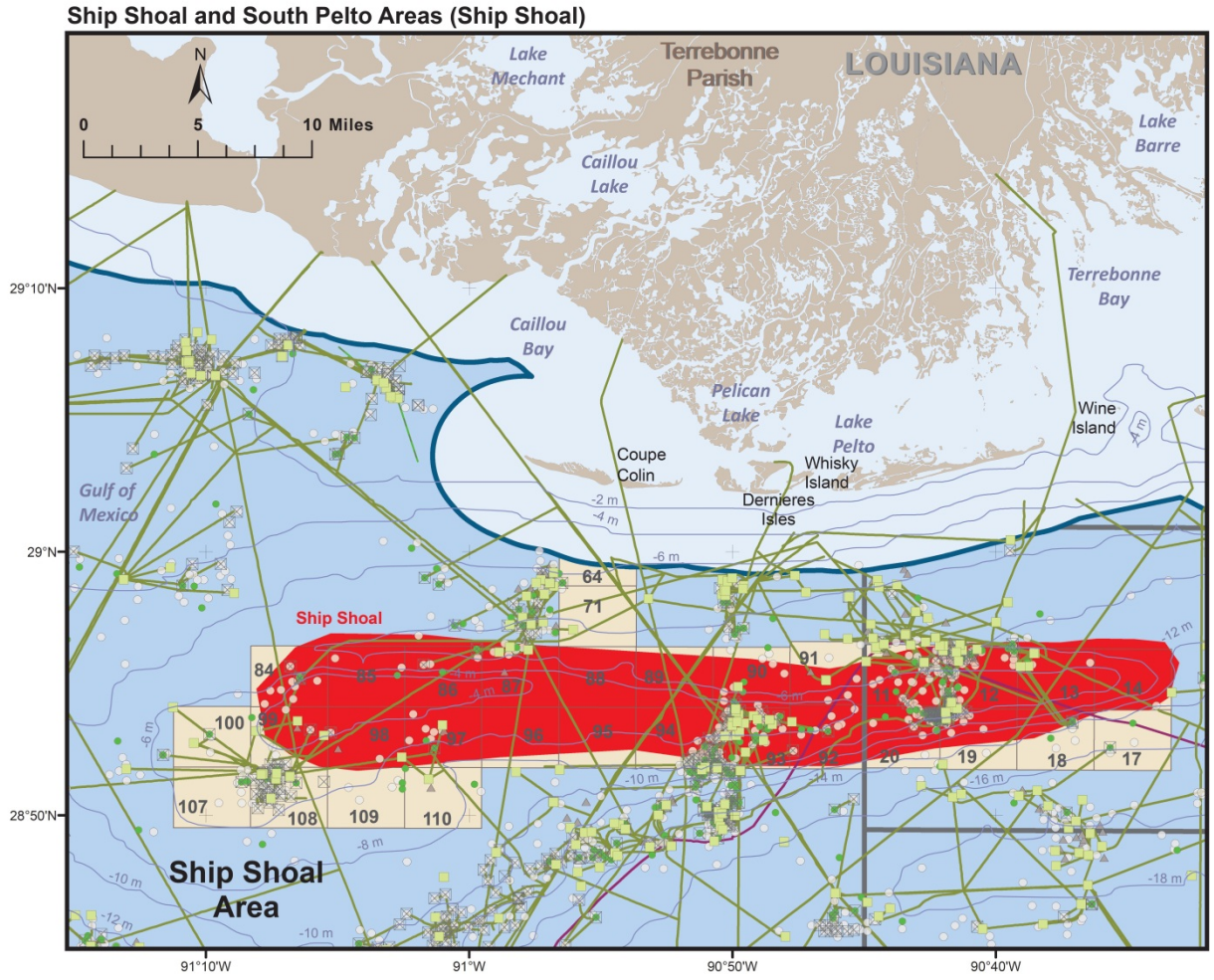


Figure 8. Complex Competing Use Challenges With Respect to Oil and Gas Platforms and Pipelines in the Gulf of Mexico.



Realizing the increasing demand for OCS resources and the competing use challenges for those resources, BOEM's MMP is working with the environmental resource agencies and other interested stakeholders to take a more strategic regional sand management approach to more effectively manage OCS resources and environmental impacts. Specifically, regional scale geological, geophysical, and biological data collection efforts are being pursued to support the MMP in improved resource management efforts. Coupled with these regional data collection efforts, the MMP will continue to pursue programmatic consultations efforts (i.e. Essential Fish Habitat, Endangered Species Act, etc.) to more holistically evaluate and manage resource impacts and promote efficiencies in the leasing process.

Section 1.5 New Starts for FY 2014 and Ongoing Studies Table

Table 1 contains all ongoing and new studies contained within the MMP. Additional information on current and previous Marine Minerals studies may be found here: http://www.boem.gov/Non-Energy-Minerals/Marine-Mineral-Studies.aspx

The two fates and effects studies at the bottom of the table are wholly funded outside of the ESP using appropriations from Hurricane Sandy supplemental funds. The MMP is also contributing supplemental funds to the new start NT-14-03 "Propagation Characteristics of High-Frequency Sounds Emitted During High-Resolution Geophysical Surveys" in order to better characterize the source character of different electromechanical geophysical sources, such as chirp sonar, frequently used in sand resource evaluation and borrow area clearance surveys.

Table 1. FY 2014 New Starts and Ongoing Studies Within the MMP.

NSL #	Study Title	Planning Area(s)	Start FY	Partners
New Starts				
Physical Oceanography				
NT-14-03	Propagation Characteristics of High-Frequency Sounds Emitted During High-Resolution Geophysical Surveys	NAT	2014	USGS
Ongoing Studies				
Fates and Effects				
NT-06-03	Environmental Investigation of the Long-Term Use of Trinity and Tiger Shoals as Sand Resources for Large Scale Beach and Coastal Restoration in Louisiana (formerly Biological Surveys and Physical Modeling for New Borrow Areas Identified Offshore Louisiana)	GOM	2006	LSU
NT-10-x31	Best Practices for Physical Process and Impact Assessment in Support of Beach Nourishment and Coastal Restoration Activities	NAT	2010	
NT-12-x12	Characterization of Underwater Sound Produced by a Trailing Suction Hopper Dredge During Dredging, Pump-Out, and Placement Operations	NAT	2012	USACE
Habitat & Ecology				
NT-12-06	Working Group and Research Planning to Identify the Habitat Value and Function of Shoal/Ridge/Trough Complexes on the Outer Continental Shelf	NAT	2012	
Social & Economic Sciences				
GM-09-01-10	Late Quaternary Stream and Estuarine Systems to Holocene Sea Level Rise on the OCS Louisiana and Mississippi: Preservation Potential of Pre-Historic Cultural Resources and Sand Resources	GOM	2012	LGS, LSU
GM-12-04	Analyzing the Potential Impacts to Cultural Resources at Significant Sand Extraction Areas	GOM	2012	

Ongoing Hurricane Sandy Appropriated Studies				
Fates and Effects				
NOT ESP	Ecological Function and Recovery of Biological Communities within Dredged Ridge-Swale Habitats and in the South-Atlantic Bight study	NAT	2013	UF
NOT ESP	Natural Habitat Associations and the Effects of Dredging on Fish at the Canaveral Shoals, East-central Florida	NAT	2013	NASA, Navy
Planning Area Codes				
ATL=Atlantic AK=Alaska NAT=National GOM=Gulf of Mexico				
Partner Codes				
UF=University of Florida USGS=U.S. Geological Survey NAVY=Department of the Navy NASA=National Aeronautics and Space Adminstration LSU=Lousiana State University USACE=U.S. Army Corps of Engineers LGS=Lousiana Geological Survey				

SECTION 2.0 PROPOSED STUDY PROFILES

Section 2.1 Introduction

The MMP has identified six study profiles for the FY 2015-2017 Study Development Plan. These profiles represent the most critical needs of the MMP at this time. They focus on improving our understanding of the physical and environmental characteristics of sand bodies and the effects from dredging and associated support activities so resource management can be enhanced and resources conserved.

The MMP recognizes that future increased storm frequency and intensity, as predicted by climate scientists, will translate into increased coastal erosion and the need for additional OCS sand resources to resist or recover from coastal erosion. A holistic understanding of physical and environmental processes across a regional scale is vital to successful resource management, particularly as a result of nearshore sand resource depletion, increasing requests for OCS sand, and intensifying multiple use conflicts in the Atlantic Ocean and Gulf of Mexico. The MMP is focused on conducting studies with a more comprehensive data collection and analysis context and using tools such as GIS to enhance resource management, inform decision making, and mitigate potential conflicts. With these objectives in mind, the MMP has included four study profiles for FY 2015 and two for FY 2016 in this plan.

Section 2.2 FY 2015

This section contains profiles of studies proposed as nominations to the FY 2015 National Studies List.

Table 2. BOEM MMP Studies Proposed for the Fiscal Year 2015 NSL.

SDP Page Number	Discipline	Program Ranking	Study Title
367	FE/HE	1	Ecological Function and Recovery of Biological Communities within Dredged Ridge-Swale Habitats in the South-Atlantic Bight
371	FE/HE	2	Development of a Decision Support Tool to Reduce Sea Turtle Dredging Entrainment Risk
373	IM	3	Managing Dredge Impacts by Optimizing the Use of Sand Resources
377	FE	4	Sediment Sorting During Coastal Restoration Projects: Implications for Resource Management, Environmental Impacts, and Multiple Use Conflicts
Discipline Codes			
FE = Fates & Effects	HE = Habitat & Ecology	IM = Information Management	

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Headquarters, Marine Minerals Program

Planning Area(s): Atlantic OCS

Title: Ecological Function and Recovery of Biological Communities within Dredged Ridge-Swale Habitats in the South-Atlantic Bight

BOEM Information Need(s) to be Addressed: This study proposes to continue an existing two year collaborative effort between BOEM, Navy, NASA, UF, and USACE to investigate the long-term recovery of benthic and fish communities following dredging of a borrow area offshore central Florida. BOEM needs to observe prolonged biological, physical and chemical recovery of borrow areas to understand the importance of dredged habitats to benthos, fish, and trophic structure/bioenergetics. Existing project-specific, post-construction monitoring is not of sufficient duration or temporal resolution to fully understand these cape-associated shoal complexes. In the absence of extended and temporally-resolved monitoring data, short-term perturbations cannot be differentiated from natural disturbances and seasonal changes, or longer-term trends, such as climatic oscillations. Observations over an extended time frame will allow for BOEM to more fully identify the potential impacts of sediment removal activities and determine the true extent, nature, and process of disturbance and recovery. Information on recovery is necessary for improved regional management of offshore habitat availability for prey and fish species. This knowledge will improve effects analyses in National Environmental Policy Act (NEPA) documents and greatly focus and improve the outcomes of EFH consultations.

Approximate Cost: (in thousands) $1,200 **Period of Performance:** FY 2015-2016

Description:

Background: The MMP is often involved with coastal restoration and construction projects that follow severe storms such as Hurricane Sandy. Environmental monitoring may be a requirement for project proponents to access and use sand resources. However, because of the relative expense, monitoring is generally limited in scope and concluded within a year of project completion. Using approximately $2 million of Disaster Relief Appropriations Act funds, the MMP initiated a comprehensive borrow area recovery study in Fall 2013 on Canaveral Shoals located off Cape Canaveral, Florida (currently funded until Fall 2015). Dredging began in November 2013 and will continue until late Spring 2014. Two years of information cannot be used to effectively determine the nature of the impact, let alone examine ecosystem recovery and/or resiliency especially in physically dominated systems. Previous studies have indicated that the recovery time may be greater than 3 years particularly in borrow areas that are repetitively used, such as Canaveral Shoals II (Byrnes, et al. 1999). In one of only two previous long term (5-10 years) studies, species composition in the borrow area still differed after 5 years (Turbeville and Marsh 1982). The benthic communities may

exhibit biomass recovery within 3 months to 2.5 years, however their taxonomic composition can remain different from pre-dredging to post-dredging for more than 3-5 years (Michel, et al. 2013). The impact of the change of this prey base to higher trophic levels has not been determined. Therefore, further observations of borrow and control sites over a longer time period (7-10 years) from completion of the sediment removal process will allow for BOEM to further understand the extent and nature of both disturbance and recovery.

Pre-disturbance and post-disturbance physical and biological sampling followed a Before-After-Control-Impact (BACI) methodology. The same sampling protocol is being used in two nearby control sites at the Chester Shoal complex. Present sampling regimes include multibeam sonar, Acoustic Doppler Current Profiler (ADCP) wave/current measurements, sediment cores and benthic grabs, benthic community analysis, demersal and pelagic trawls, acoustic telemetry, seasonal and diel observations, gut content analysis, stable isotope analysis, etc. Data is being collected from four different habitat settings at each site (offshore ridge slope, ridge crest, shoreward ridge slope, and swale bottom) over multiple seasons following a random stratified methodology. This data is critical baseline data for future long-term efforts examining the resiliency of these habitats. Observations will be analyzed via basic statistical procedures (e.g. determination of mean values, standard deviations, transformations of data, comparisons of means) along with more complex statistical analyses and comparisons of community structure. These observations will also be integrated into an Ecopath model to assess the perturbation to the system due to dredging.

Objectives: The objectives of this study are to examine the relationship of disturbance to ecosystem services in ridge-swale habitats. Further, to determine if there are functional differences in borrow sites pre- and post-dredging by examining species distribution, diversity, habitat use, and population dynamics.

Questions BOEM would like to address include:

Are there functional differences between the borrow sites and control sites?

If so, do these differences correlate with biophysical differences (grain size, flow characteristics)?

What is the rate of recovery of benthic habitats and habitat use in a previously dredged borrow site on the OCS (to be examined through subsequent phases over a 7-10 year period)?

Is this rate of recovery tied to any physical factors?

Do the reestablished sites fill the same trophic function as the original communities?

Methods: The proposed study sites include the Canaveral Shoals II borrow area and Chester Shoals control sites located off Cape Canaveral, Florida. This site is the location of the FACT array. A partnership with the Navy and NASA has provided leveraging for

this project. This allows for data sharing, use of the existing 200+ FACT array receivers and additional information on large-bodied predatory fish (NASA-funded work) within our study area. The methodological approach will match, as closely as possible, the sampling and analytical methods used in the present study for an additional two years. The present methodology includes sampling chemical (chlorophyll, N, etc.), biological (phytoplankton, zooplankton, meroplankton, benthic invertebrates, macroinvertebrates and fishes, stable isotope analyses, fish acoustic tagging), and physical parameters (ADCP and multibeam surveys), along with Ecopath modeling.

Revised Date: April 2, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Headquarters, Marine Minerals Program

Planning Area(s): All

Title: Development of a Decision Support Tool to Reduce Sea Turtle Dredging Entrainment Risk

BOEM Information Need(s) to be Addressed: BOEM, through its MMP, authorizes the use of OCS sand resources in shore protection and coastal restoration projects. One of the major environmental issues with these projects is the potential for dredging entrainment and mortality of federally protected sea turtles. In accordance with Section 7 of the ESA, BOEM is required to consult with the NMFS for these potential impacts. As a responsible steward of OCS resources, BOEM seeks to minimize adverse environmental effects related to project specific dredging operations through deliberate project planning efforts and implementation of relevant and effective mitigation measures. Historically, BOEM and federal partners have made a significant investment in improving protective measures and best management practices, principally focusing on dredging windows, the use of sea turtle deflecting dragheads, and relocation trawling. However, there has been little effort to analyze and subsequently tailor these mitigation strategies on a project specific level. BOEM and its federal partners need to develop a standardized decision support tool to assess project specific dredging entrainment risk and improve the effectiveness of mitigation planning decisions within state and federal marine mineral resource areas.

Approximate Cost: (in thousands) $500 **Period of Performance:** FY 2015-2016

Description:

Background: Trailing suction hopper dredges (TSHD) are often used to dredge and transport OCS marine mineral resources given the operational challenges of open-ocean conditions and the relative distance from borrow to fill areas. TSHDs are self-propelled vessels that remove surficial sediments from the seafloor by trailing dragheads off one or both sides of the vessel, agitating sediment with water to create a slurry, and entraining material through the draghead and into the vessel hopper using high powered pumps. Hopper dredges present a unique risk to three species of protected sea turtles (i.e., loggerhead, green, and Kemp's Ridley) in the Atlantic and Gulf of Mexico OCS. Sea turtles are particularly vulnerable to entrainment when they are oriented on the bottom (i.e. foraging) and within the path and suction field of the dragheads. Since 1996 there have been more than twenty sea turtle mortalities nationwide associated with dredging OCS sand resources.

Established mitigation measures to reduce entrainment risk have been in place for years (Dickerson, et al. 2004) and subsequently incorporated as non-discretionary Terms and Conditions (T&Cs) in NMFS Biological Opinions (BOs). However, residual risk of incidental take still exists and the efficacy of each mitigation measure in the context of a specific project is often not discerned. Though additional engineering modifications of dredging operations could be explored to further reduce this risk, modifications to

dredge plant equipment are very costly. Complementary protocols for managing residual risk include hopper dredging windows that are based on assumptions of sea turtle presence/absence relative to water temperature. This conservative broad based approach has reduced entrainment rates in some areas. However, broad implementation of the current dredging window has been questioned as an appropriate method for all project areas irrespective of site-specific considerations. Based on an analysis of historic sea turtle takes in offshore borrow areas, several factors have been linked to increased take risk beyond presence/absence assumptions including: (1) temporal and spatial relationship of sea turtle behavior (i.e. foraging, migrating, etc.) within the water column relative to draghead operating parameters and (2) borrow area design relative to turtle deflecting draghead efficacy. Considering the full array of all risk factors within the project specific context, targeted mitigation strategies may be more appropriate than conservative presence/absence based dredging windows.

Objectives: Evaluate and document entrainment risk parameters for dredging activities in the OCS. Develop a geographically and temporally based decision support tool to assess project specific dredging entrainment risk and guide mitigation planning decisions within state and federal marine mineral resource areas.

Methods: A decision support tool will be developed to evaluate sea turtle entrainment risk relative to OCS dredging activities associated with the MMP. Study methods may include data compilation, literature review and syntheses, GIS analyses, and coordination with stakeholders. A panel of sea turtle biologists, dredging industry representatives, USACE, NMFS, and BOEM scientists will be convened to identify critical data parameters to be considered in the development of a decision support tool. Initial parameters to be considered may include: (1) sand source geomorphology and physical dynamics, (2) sea turtle habitat type/use (i.e. foraging, migrating, reproductive, etc.), (3) dredging intensity and entrainment history, (4) borrow area bathymetry, design, and use plan, and (5) sea turtle distribution, abundance, and behavior (leveraging existing telemetry data). All identified critical data parameters that directly relate to sea turtle entrainment risk will be identified and weighted based on the significance of their risk contribution. Existing project specific data sets relative to each data parameter will be consolidated and built into the model and relevant external data sets will be identified and leveraged. Initial model outputs would include regional risk classifications of OCS sand sources that could be considered in project and mitigation planning. While the initial tool will be tailored to sea turtles, the framework of the decision support system could accommodate other OCS species of concern (i.e. Atlantic sturgeon).

Revised Date: April 2, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Headquarters, Marine Minerals Program

Planning Area(s): All

Title: Managing Dredge Impacts by Optimizing the Use of Sand Resources

BOEM Information Need(s) to be Addressed: BOEM needs to develop a planning process to optimize the use of sand resources to promote better resource management and conservation of our Nation's resources for coastal resiliency. Integrated borrow area management plans can help address this challenge. More robust planning is critically necessary to reduce the constraints from multiple use issues. Working in partnership with the USACE, BOEM could optimize borrow area use by integrating geological, engineering, economic, environmental, and dredge operation variables in a common analytical framework over relevant time horizons. This structured optimization process would provide for more strategic consideration and improved spatial/temporal management of environmental impacts.

Approximate Cost: (in thousands) $400 **Period of Performance:** FY 2015-2016

Description:

Background: OCS sand resources are finite and need to be carefully managed. The typical beach nourishment and/or coastal restoration program involves an initial large-scale construction phase followed by smaller-scale, regularly scheduled maintenance cycles. The sediment used for initial construction and subsequent maintenance is often dredged from the same sand resource area, which can equate to frequent dredging of the same or adjacent seafloor for a period of 50 years or longer. In coastal areas where sand is scarce and multiple use conflicts are common, a single borrow area could also be used by multiple stakeholders for the construction of several adjacent beach fill or coastal restoration projects. Large volumes of sand may also suddenly be needed to recover from severe storms such as Hurricane Sandy. Both instances can lead to rapid resource depletion and the need to identify, characterize, and delineate additional borrow areas.

Different types of sand bodies are dredged to different cut depths over different footprints. In many instances, the approach to managing dredging intensity (location, duration, and frequency) is not systematically planned and transport distance and dredge productivity are the primary determinants of where dredging occurs. Fill performance, funding availability, environmental construction windows, and dredge plant availability typically drive when and where dredging occurs. This current approach is not conducive to responsible and sustainable resource management.

Dredging can have direct and indirect effects on physical, biological, and archaeological resources. Each dredging event diminishes not only the availability of sand resources, but the profile of the sand body or sheet, which can potentially cause physical effects such as changes in local and residual hydrodynamics, substrate composition, and the

morphologic response of the sand body. These interrelated effects, which can magnify during multiple dredging events, could disturb the ecosystem function of sensitive biological habitat and resources in the vicinity of the borrow area. Such physical process changes could also cause unanticipated indirect impacts on archaeological resources that are otherwise protected by exclusion zones.

BOEM currently evaluates risk using the best available site-specific information; however, environmental reviews generally do not quantify with much precision the spatial and temporal scales over which effects and lasting impacts could occur. Although dredge monitoring data are collected during or across construction cycles and could be used to constrain and validate anticipated impacts, BOEM cannot accurately estimate cumulative dredging intensity until all data have been compiled and analyzed to consider dredge location, volume, extent/depth, extraction frequency and duration, and other factors.

The persistence of environmental effects from recurrent dredging of the same sand resource is a common concern of environmental resource managers. For example, the NMFS Habitat Conservation Division has repeatedly requested that BOEM and its federal partners develop site-specific and regional strategies to minimize cumulative dredging intensity and frequency, thereby reducing potential impacts on EFH, benthic communities, and federally managed fish species. As is consistent with the tenets of responsible resource management, the preparation of borrow area management plans would support BOEM's resource management responsibility, and could help focus NEPA analysis, EFH consultation, and National Historic Preservation Act (NHPA) Section 106 coordination to drive better environmental and stewardship outcomes. BOEM would work in partnership with the USACE to analyze and evaluate the potential benefits and costs of borrow area management plans.

The management of OCS sand resources is often a multifaceted challenge due to different engineering and design requirements, economic and environmental considerations, and stakeholder needs that must be balanced. This management strategy would likely benefit from advanced planning using a systematic framework incorporating long-term project design, engineering, and economic requirements while considering sand resource availability and environmental impact-minimizing strategies.

Objectives:

- Develop a planning process for optimizing sand resources while diminishing potential impacts using a four-tiered approach to evaluate physical, environmental, and economic concerns in context with appropriate mitigation and monitoring measures to minimize issues.
- Demonstrate the benefits and costs of this planning process by developing a draft borrow area management plan to optimize use of two or three OCS borrow areas characterized by frequent dredging and/or multiple users (i.e., Ship Shoal offshore Louisiana, Sandbridge Shoal offshore Virginia, or Canaveral Shoal offshore Florida).

Methods: A multi-criteria decision analysis (MCDA) approach is an established methodology to inform decision making, particularly for environmental decisions, where it is employed to balance the range of physical, environmental, and socioeconomic concerns for project/resource management considerations (Huang, Keisler, & Linkov, 2011). Data compilation, literature review and syntheses, GIS analyses, and coordination with stakeholders will be conducted to inform the MCDA. The following data would be collected and analyzed for this four-tiered approach:

1. **Physical Resource Characteristics and Borrow Area Requirements**, such as regional sediment transport dynamics, and engineering requirements like sand quality, design volume, and fill frequency
2. **Environmental Considerations**, including environmental, archaeological, and safety avoidance areas, and dredging operational windows
3. **Best Management Practices**, including dredging techniques (e.g., rotating dredge areas, selectively dredging accreting areas and/or leading edges of shoals, etc.), and mitigation measures to further minimize overall dredging intensity and persistent effects, and to maximize recovery from ecosystem perturbations while still meeting project objectives
4. **Costs and Benefits of Borrow Area Use**, such as construction costs, mitigation measures, monitoring, changes in ecosystem services and values

Sand and environmental resources information, including mitigation measures for OCS borrow area(s), would be compiled and analyzed to prepare a draft borrow area management plan for two or three OCS borrow areas. Relevant data would include the project design, geophysical and geological data used for sand resource identification, dredge operational data from the Dredge Quality Management (DQM) Program, bathymetric and other hydrographic data, data used for mapping of benthic or archaeological resources, environmental monitoring data, project performance data, and project cost data. Included in this four-tiered approach is the analysis of lessons learned from past projects to further refine the borrow area management for future projects (Research Planning, Inc (RPI), Tidewater Atlantic Research, Inc. and W.F. Baird & Associates Ltd. 2004).

Additional data collection could be warranted to fill important data gaps. Preparation of the draft borrow area management plan could require a cost effectiveness analysis or equivalent statistical/econometric analysis.

Revised Date: April 2, 2014

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Headquarters, Marine Minerals Program

Planning Area(s): All

Title: Sediment Sorting During Coastal Restoration Projects: Implications for Resource Management, Environmental Impacts, and Multiple Use Conflicts

BOEM Information Need(s) to be Addressed: BOEM needs to determine the extent of sediment sorting during dredging, handling, and placement processes. This can be accomplished by quantifying the losses and percent changes of fine-grained material through the full dredging life-cycle, by comparing measurements of in situ borrow area grain size characteristics (i.e., core samples) to measurements of placed material. BOEM needs to address this to determine if alternative borrow areas containing higher fractions of fine-grained material could be deemed as suitable sources for coastal restoration projects. By determining the percent of fine-grained losses during each phase of dredging, environmental trade-offs and impacts assessments can be better informed. This study will be conducted in partnership with USACE.

Approximate Cost: (in thousands) $400 **Period of Performance:** FY 2015-2016

Description:

Background: Coastal restoration project managers must ensure that borrow area sediments are compatible with native beach sediments with regard to sediment grain size and sorting. These requirements exist because sediment characteristics, in part, dictate beach fill performance, recreational experience, and the type and severity of environmental impacts along the beach during and after nourishment. For example, use of too fine-grained sediment could result in early and significant erosion due to the wave climate of a particular stretch of coastline. To satisfy these beach fill requirements and obtain compatible sediment in sufficient quantity, many beach nourishment project sponsors are moving towards potentially more environmentally sensitive areas (i.e., offshore sand ridges, cape associated shoals, etc.).

Beach fill compatibility is currently based on a comparison of in situ borrow area and native beach sediment samples; however, this approach only provides a partial comparison of sediment characteristics and does not reflect the changes that could occur during various dredging and placement operations. For example, during TSHD operations, seabed sediments are agitated into a slurry, excavated off the seafloor, and conveyed into the dredge's hopper. Once in the hopper, coarse sediments settle out for future pump-out while suspended fine sediments are subsequently discarded overboard (i.e., "overflow"). This overflow process results in a functional coarsening of sediment within the hopper. The current methods for assessing sediment compatibility do not adequately reflect the percent of fine-grained sediment retained in the hopper and then placed on the beach. It is also important to evaluate the potential for short-term sediment character changes during handling/placement operations and distinguish

those changes from others that have been observed to occur on the beach during the beach fill equilibration phase, or at the borrow area across multiple construction cycles.

If alternative borrow areas, characterized by sand with relatively higher fractions of finer material, could be used, different environmental tradeoffs could be considered, and/or different environmental outcomes could be realized. Absent this consideration, a complete tradeoff analysis of resource impacts is not conducted. For example, sand ridge crests instead of troughs may be pursued as borrow areas to minimize the percent of clays and silts placed on the beach. However, these areas also tend to be highly valued as EFH and are considered Habitat Areas of Particular Concern (HAPCs) for managed fish species. Although increased turbidity could result from dredging of alternative borrow areas with higher fines content, this source may be a preferred alternative when compared to dredging designated HAPCs. By quantifying the changes in sediment characteristics during dredging and placement, more informed decisions can be made to properly manage OCS resources and EFH. This could impact BOEM's long-term management of sand resources by expanding the available inventory of borrow areas with suitable nourishment material. In addition, this potential increase in the quantity of suitable borrow areas could assuage multiple use conflicts, particularly with renewable energy facility development or transmission line installation, where similar areas are sought for use.

Dredging-related research conducted at the USACE Engineer Research and Development Center (ERDC) has historically focused on hopper overflow and plume dynamics associated with dredging fine-grained sediment in navigation channels and estuarine settings (Smith S. , 2010); however, cohesive sediment dynamics associated with fine-grained particles are not generally applicable to sandier sediments of the OCS. International literature (principally, British and Dutch) has addressed this topic more explicitly, but only in terms of niche topics, such as linking seabed disturbance to the volume of overflow (Davies & Hitchcock, 1992); characterizing overflow sedimentation (Hitchcock, Newell and Seiderer 1999); or modeling hopper sedimentation, overflow, and sediment plume dynamics (Van Rhee 2002); (Baird & Associates, 2004); (Spearman, et al., 2007); (Braaksma, Klaassens, Babuska, & de Keizer, 2007).

By expanding BOEM's knowledge of sediment characteristic changes that occur prior to the completion of coastal restoration activities, it is possible that additional sources of finite sand resources would become available and the inventory of potential borrow areas could be increased. An increase of potential borrow areas could potentially alter BOEM's approach to sand resource management, reduce impacts on environmental resources, and ease multiple use conflicts.

Objectives: Quantify changes in sediment characteristics (i.e., grain size, sorting) and the degree, timing, and variability of sediment sorting during dredging, pump-out, and placement operations to determine the extent of sediment coarsening.

Methods: Field methods to determine potential sediment sorting and character changes in context of seasonal, inter-annual, and event-driven variability could include repeat sediment sampling, concurrent oceanographic and turbidity/suspended sediment measurements, and sediment tracer studies. During operations, sampling must be

conducted in four steps: (1) at the borrow area, (2) within the hopper, (3) from pipeline discharge, and (4) at the nourished beach. A laboratory analysis must be conducted to ascertain sediment grain size, color, sorting, flocculation behavior, and settling velocity. An ADCP backscatter/particle imaging videography could be used to document sediment transport and settling dynamics and quantify overflow losses. Robust sampling strategies and statistical analyses will be required to distinguish any changes in sediment properties during each of the operational phases. Existing research efforts, including required construction monitoring, will be identified and leveraged. BOEM will need to partner with the USACE ERDC and collaborate with, dredging contractors, beach project engineering firms, and other vested stakeholders.

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Section 2.3 FY 2016

This section contains profiles of studies proposed as nominations to the FY 2016 NSL.

Table 3. BOEM MMP Studies Proposed for the Fiscal Year 2016 NSL.

SDP Page Number	Discipline	Program Ranking	Study Title
383	IM	1	Using Dredge Plant Operational Data to Measure Cumulative Use and Cumulative Impacts
385	FE/HE/IM	2	Economic Cost & Geomorphic Comparison of OCS Sand vs. Nearshore Sand for Coastal Restoration Projects
Discipline Codes			
FE = Fates & Effects	HE = Habitat & Ecology	IM = Information Management	

Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Headquarters, Marine Minerals Program

Planning Area(s): All

Title: Using Dredge Plant Operational Data to Measure Cumulative Use and Cumulative Impacts

BOEM Information Need(s) to be Addressed: BOEM does not currently have an efficient and systematic method of tracking the "operational time" a dredge is operating in a particular location within a borrow area, the cumulative use of a borrow area, or time-recovery intervals between uses. BOEM's MMP needs to more accurately document and track dredging intensity (location, duration, and frequency) and vessel movement within and surrounding borrow areas. This intensity information will be used to document environmental performance, improve environmental analyses and consultations, develop and adapt mitigation strategies, and support good stewardship and management of OCS borrow areas and environmental resources.

Approximate Cost: (in thousands) $200 **Period of Performance:** FY 2016-2017

Description:

Background: Many OCS borrow areas are targeted by multiple users and at regular dredging intervals. Dredge operational data represents an untapped, but useful measure of cumulative use and bottom disturbance. The National DQM Program, housed within the USACE Mobile District, currently supports nationwide, automated monitoring of dredging operations for federally funded or federally regulated beach nourishment, coastal restoration, and navigation projects. Sensors monitor all operating parameters of the dredging operation (i.e. dredging location, vessel speed, material density, pump RPM, etc.). These operational data can be filtered based on material recovery and pump-out status and are logged every 10 seconds. The DQM Support Center provides and supports all information technology infrastructure, data analyses tools, and web-based data delivery systems. BOEM has worked cooperatively with the DQM Support Center and USACE districts to obtain DQM data for monitoring OCS dredging operations to (1) ensure dredge contractors are operating within the authorized footprint of the borrow area(s) and to (2) track the physical/spatial attributes of the dredging process. Leveraging the existing DQM program for the purpose of tracking dredge operational data to measure cumulative use and impacts is a new application of DQM data and will facilitate improved BOEM and USACE environmental analyses.

Frequently, the footprint leased by BOEM is notably larger than the area actually disturbed in a single construction cycle. The comparatively larger leased footprint provides flexibility to access sufficient sand volume in the event that production challenges are encountered during dredging. DQM currently provides the dredge location and operating status data which BOEM uses to determine where the dredge has been operating within a leased area. Additionally, BOEM also monitors the volumetric change, cut depth, and cumulative use of a borrow area through complementary pre-

and post-construction bathymetric surveys, collected separately using single-beam, swath, or multi-beam sonar.

To adequately gather necessary data, BOEM must be able to measure physical and temporal dredge intensity. BOEM needs a more efficient and standardized method to query the existing DQM database to produce cumulative dredging intensity data maps within repetitive OCS borrow areas. The dredge intensity data, measured as a function of time in location, would be complementary to existing volumetric change and depth cut determined from bathymetric isopachs. Exposure time, or the cumulative time the dredge operates in a defined area, would be determined from the dredge time stamp and operational code in the DQM data. Similarly, BOEM would also characterize the transit of dredge plants between the borrow area and the pump-out location in instances when a hopper dredge is used.

Objectives: Leverage the existing USACE National DQM program to:

- Quantify dredge intensity spatially and temporally in terms of exposure time to improve project characterization, effects analyses, mitigation measures, and resource management.
- Translate point time/location data into a grid representing the total time spent dredging or transiting in a particular area.
- Disseminate data and maps that depict areas of seabed dredged against time.

Methods: Identify cost-sharing and leveraging opportunities with the USACE DQM Program. Utilize existing operational dredge data from the DQM database to develop a dredging intensity algorithm and cumulative impact surface performance model. Develop an automated process to generate cumulative use spatial maps and time series line charts of area of seabed dredged and/or transited versus time in a defined location. Develop the geospatial framework to convert point location data into a defined exposure time grid using said algorithm. Perform geostatistical analyses to address any spatial and temporal autocorrelation issues to ensure the statistical validity and quality of time-exposure data. Test and validate different gridding approaches using structured and unstructured grid formats. Develop interpolation procedures necessary to address gaps in time series data. Develop suitable workflow model for use in GIS.

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Environmental Studies Program: Studies Development Plan FY 2015-2017

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Economic Cost & Geomorphic Comparison of OCS Sand vs. Nearshore Sand for Coastal Restoration Projects

BOEM Information Need(s) to be Addressed: BOEM requires a better understanding and quantification of relative contributions of using OCS sediment vs. nearshore sediment to long-term coastal restoration project effectiveness, cost, and contribution to the system as a whole. This will provide information about the overall value of OCS sand relative to alternative sources.

Approximate Cost: (in thousands) $400 **Period of Performance:** FY 2016-2017

Description:

Background: Coastal land loss in Louisiana is an ongoing threat to the people and industry of that region. The USGS determined about 1,883 (mi^2) of land became open water between 1932 and 2010 (25% of Louisiana's land area). Analyses conducted in support of Louisiana's 2012 Coastal Master Plan found that Louisiana could experience estimated annual damages from flooding coast-wide totaling $7.7 to $23.4 billion over the next 50 yrs, depending on future coastal conditions. Due to the sediment-starved character of the Mississippi River delta plain, sediment suitability and availability are limiting factors that have constrained larger scale projects in the past. However, the demand for addressing Louisiana's coastal land loss crisis means that the portfolio of rapid land building projects (dedicated dredging) will increase. There is a need for large quantities (> 90 million yd^3) of sediment for barrier shoreline and wetland restoration in Louisiana over the next 50 years (Khalil and Finkl 2009).

For dedicated dredging projects, coastal managers have to choose between nearshore sediment or sediment sourced from outside of the active coastal system, such as OCS sand or modern Mississippi River sediment load, for inputs. High quality sand (similar to native beach) is required for beach and dune barrier habitat restoration whereas sandy muds are required to rebuild marshes (Khalil and Finkl 2009). Availability of suitable sediment resources is a vital factor in restoration efforts; almost 80% of the restoration-budget is allocated to exploration, dredging, and emplacement of sediment (Khalil, Finkl and Roberts, et al. 2010), (Wang, Caffey and Perolia 2012). Sand resources in state waters are of poor quality, and dredging sand closer to shore can potentially alter wave climate, negatively affecting the landward shoreline. Moreover, excavation of nearshore sand often occurs within the active coastal system, compromising long term effectiveness of projects and failing to address the need to supplement a deficit in the coastal sand budget. Utilizing OCS sand resources minimizes alterations to wave climate and introduces new sand from outside of the active coastal system decreasing the coastal sand deficit, improving project sustainability and geomorphic function. To date, there has been no analysis comparing the contributions of OCS sediment versus nearshore sediment toward long term project effectiveness, lifespan, cost, and

contribution to system function as a whole. Better quantifying quality and value of OCS sand for coastal restoration projects relative to alternative sources is important for BOEM and federal, state, and local stakeholders to accurately estimate long term economic and ecosystem benefits of these projects.

Within the 2012 Coastal Master Plan over $22 billion (of the $50 billion) will be needed to fund those restoration projects requiring mechanical sediment inputs. The average cost of authorized projects under the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) is $289,686 and $100,795 per acre for barrier island restoration and marsh creation projects, respectively (Wang, Caffey and Perolia 2012). Borrow area distance to placement area is a limiting factor in terms of transportation costs, and using OCS sand further increases the project cost because unit costs associated with increased transport distance and types of specialized equipment needed to work in an offshore environment. But in Louisiana's Mississippi River delta, the nearshore sediment is a component of the sediment-starved system that is being restored, so use on projects does not address the long term need to supplement the deficit in the sediment budget.

The results of this study have implications for all coastal regions. For example, in New Jersey, Hurricane Sandy damaged 94 percent of beaches, with 14 percent suffering a major loss of dune vegetation and beach erosion of 100 feet or more; 43 percent were moderately affected, losing 50 to 100 feet of beach (American Littoral Society 2012). As a result, the USACE is spending billions on beach nourishment projects along the Atlantic coast. The results of this study will guide more comprehensive approaches to restoration planning and could support coastal resiliency initiatives within the Post Hurricane Sandy North Atlantic Comprehensive Study.

Objectives: This study will provide a better understanding and quantify the economic, ecologic, geomorphic long-term benefits of using OCS sediment vs. nearshore sediment for coastal restoration projects on the basis of: 1) sediment textural properties, 2) value of supplementing the coastal sediment budget, and 3) capital required to employ the various construction methods.

Methods:

Geomorphic Analysis:

- Analyze and compare the quality of nearshore vs. OCS sediment resources.
- Synthesize existing works on impacts of dredging closer to shore.
- Analyze benefits of supplementing the regional coastal sediment budget.
- Analyze and compare outcomes of completed restoration projects using both nearshore sand vs. OCS sediment resources.
- Create a matrix categorizing sediment type based on suitability for project type (e.g. barrier dune vs. back barrier marsh, etc.).

Economic Analysis: Building upon results of the geomorphic analysis, a comparative assessment of using nearshore sand and OCS sediment resources for coastal land-building will be developed to: 1) estimate generic models of costs and benefits by sediment sources/suitability; 2) conduct sensitivity analyses with varying degrees of risk; and, 3) perform case-studies to illustrate economic tradeoffs between and within sediment sources.

The $/acre and $/cy of borrow associated costs will be compared using nearshore sand sources vs. OCS sediment resources. The cost for delivery of physical quantities of sand ($/acre and $/cy) will be estimated using the full funded costs of a project, which should include variables including but not limited to project management, mobilization/demobilization costs, dredging plant type and delivery conveyance, distance, dredging quantity, containment, shaping, and vegetation.

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SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2017

For FY 2017, the MMP expects the following topical areas of interest:

1. Development of a comprehensive inventory of OCS sand resources and associated habitats.
2. Improved resource management capabilities through the collection and analysis of offshore biological and geological data sets in the Atlantic and Gulf of Mexico OCS.
3. Implementing a regional sediment management and borrow area monitoring program.
4. Continued long-term research on benthic and fish communities using borrow areas.

Section 3.1 Comprehensive Inventory of OCS Sand Resources and Associated Habitats

Much of the geologic and environmental research focus for FY 2017 will stem from Hurricane Sandy initiatives, including a $5 million geophysical and geological data acquisition effort along the Atlantic OCS from Maine to Miami, Florida. Up to 8,000 line-miles of survey data and 500 sediment samples will be collected. This research will provide: (1) a regional baseline for benthic habitat assessment and monitoring, (2) a basis to eliminate environmentally sensitive or resource poor areas from consideration, (3) information regarding previously unknown potential cultural resources requiring further study, and (4) regional bathymetry for physical oceanographic modeling and impact assessment. This new dataset will greatly improve our knowledge of the shallow Atlantic OCS (3-8 nautical miles offshore) shelf and shallow subsurface and undoubtedly frame future scientific investigations.

Focused mapping efforts are being pursued for the Gulf of Mexico. Much of the Gulf of Mexico OCS west of Mobile Bay is characterized by a dominantly muddy seafloor separated by discrete, large sand bodies; as such, there has been a focused effort over the past two decades by BOEM, USGS, and Gulf states to inventory these sand resources. BOEM anticipates that by FY 2017 these data will be assembled into a geodatabase that will provide a regionally consistent dataset as described above for the Atlantic.

Once this data has been processed and compiled, the MMP will use GIS to create a comprehensive map of newly delineated sand resources and borrow areas within the Gulf and Atlantic OCS. This geospatial database will help inform decision making based on resource availability, location, volume, and other characteristics important to coastal restoration managers. This tool would be used to plot other considerations such as EFH, hard-bottom areas, wind energy transmission lines, oil and gas pipelines, and sensitive cultural resources to help identify conflicts and contemplate impact trade-offs.

Once the MMP has integrated this comprehensive resource dataset on the Gulf and Atlantic OCS, work can begin to develop a strategic management plan for the entire area of the OCS where MMP activities occur or are anticipated. This effort enables national level stewardship of sediments with sand resource information will help scientists and policy makers with information necessary to address short and long term sand and gravel resource management issues.

Section 3.2 Improved Resource Management Capabilities through the Collection and Analysis of Offshore Biological and Geological Data

In addition to continuing the research funded from Hurricane Sandy supplemental appropriations, future research will flow from the results of previous studies funded through the ESP. For example, the study "Review of Biological and Biophysical Impacts from Dredging and Handling of Offshore Sand" (BOEM 2013-0119) identified 14 data gaps resulting from a systematic review of impacts to benthic resources, fishes and essential fish habitat, foraging seabirds, marine mammals, and sea turtles. Future MMP studies will be designed to address some of these data gaps depending on BOEM priorities. The new study NT-14-03 "Propagation Characteristics of High Frequency Sounds Emitted During High Resolution Geophysical Surveys" addresses one of these gaps.

In addition, the MMP has a strong interest in regional/programmatic planning. Our Agency is well positioned at the forefront of highly valued regional planning initiatives in the areas of EFH and endangered species in relation to the continued and increasing use of offshore sand. This overarching goal was apparent in NT-12-06 "Workshop and Research Planning to Improve Understanding of the Habitat Value and Function of Shoal/Ridge/Trough Complexes to Fish and Fisheries on the Atlantic and Gulf of Mexico Outer Continental Shelf." This working group, recently held in association with the Southern Division of the American Fisheries Society in January 2014, culminated in the identification of a number of important research questions. These questions necessitate the study of the biophysical/biological coupling characteristic of sand shoal ecosystems, broad scale use of shoal ecosystems by fish, turtles and other federally managed species, the scale of impact or lack of impact to various species following dredging and system recovery, and more comprehensive mapping of these habitats along the Atlantic and Gulf of Mexico for use in regional/programmatic consultations. Answers to these questions are critical to addressing EFH, the Marine Mammal Protection Act (MMPA) and ESA requirements.

Section 3.3 Implementing a Regional Sediment Management and Borrow Area Monitoring Program

While the scope of regional sediment management and borrow area monitoring extends beyond environmental impacts concerns, it is important that BOEM manage borrow areas on a regional scale in order to minimize potential impacts, cascading and cumulative. Moreover, monitoring of existing borrow areas subsequent to dredging activity is important to document and understand borrow area physical evolution and

track the timing and character of seafloor habitat recovery. While the latter is somewhat addressed under Section 3.4, physical evolution of dredge areas on the OCS is poorly understood, and could vary greatly in different locations due to local forcings such as physical oceanographic parameters, sediment supply, storminess, and borrow area design. While borrow area evolution is expected (e.g. expansion of depression beyond extent of dredging activity) and mitigation measures are applied to protect adjacent areas, the basis for assigning buffer distances is somewhat objective and effectiveness of mitigations has not been evaluated.

BOEM has devoted significant funding toward better understanding how dredge areas evolve and potential impact infrastructure and/or resources of concern located adjacent to the pit. However, site-specific data required to make accurate predictions and empirical measurements to test and validate predictive models are only available for a few of the OCS borrow sites because of a lack of a comprehensive borrow area monitoring program. This initiative would involve development of a comprehensive, systematic and repeatable framework for acquiring data (time series seafloor surveys, instrument deployment, etc.) at representative borrow areas on the OCS. This effort will build on BOEM's investment toward better understanding this problem by filling data gaps and refining predictive models developed during previous studies. It will also evaluate the effectiveness of mitigation measures applied to existing borrow areas (e.g. setback distances from pipelines or hard bottom benthic habitats) to determine if resources and infrastructure are being protected. Results will increase BOEM's decision making ability regarding safety and protecting environmental and cultural resources and provide for better management of valuable OCS sand resources. The influx of projects that MMP is presently experiencing on both the Gulf and Atlantic OCS will provide a unique opportunity to document baseline conditions and implement a monitoring program immediately after dredging has been completed.

Section 3.4 Continued Long-Term Research on Benthic and Fish Communities Using Borrow Areas

As previously discussed, Hurricane Sandy funding is also being used to support a two-year collaborative effort to: (1) to quantify the unique functional ecosystem services of ridge-swale habitats in the South Atlantic Bight; (2) to determine the functional, biological services that are potentially compromised by dredging of sand from ridge-swale habitats and determine the degree of impact; and (3) to investigate the mechanisms of recovery of invertebrate and fish communities associated with ridge-swale habitats post-dredging. While the funding for this work is limited by the appropriations to two years, continued monitoring of this recovery for a total of 7-10 years would be invaluable. Previous monitoring efforts are often limited to 1-3 years post impact. The extension of this monitoring program is being proposed in FY 2015 Study Profile "Ecological Function and Recovery of Biological Communities within Dredged Ridge-Swale Habitats in the South-Atlantic Bight."

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