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Studies Development Plan

FY 2014-2016



BOEM Environmental Studies Program

Fiscal Years 2014-2016 Studies Development Plan

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ABBREVIATIONS AND ACRONYMS

| | |
|---------|---|
| ArcSEES | Arctic Science, Engineering and Education for Sustainability |
| BOEM | Bureau of Ocean Energy Management |
| BOEMRE | Bureau of Ocean Energy Management, Regulation and Enforcement |
| BRS | behavioral response study |
| BSEE | Bureau of Safety and Environmental Enforcement |
| CMSP | Coastal and Marine Spatial Planning |
| DWH | Deepwater Horizon |
| DOI | Department of the Interior |
| DQM | Dredge Quality Management |
| EMF | electromagnetic fields |
| EPA | Environmental Protection Agency |
| ERDC | Engineer Research and Development Center |
| ESID | EcoSpatial Information Database |
| ESP | Environmental Studies Program |
| ESPIS | Environmental Studies Program Information System |
| ESP-PAT | Environmental Studies Program - Performance Assessment Tool |
| FY | Fiscal year |
| FWS | Fish and Wildlife Service |
| GBIF | Global Biodiversity Information Facility |
| GIS | Geographic Information System |
| GOM | Gulf of Mexico |
| HPPG | High Priority Performance Goal |
| HTML | Hyper Text Markup Language |
| IARPC | Interagency Research and Policy Committee |
| IOOS | Integrated Ocean Observing System |
| IPC | Interagency Policy Committee |
| IT | Information Technology |
| 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 Programme |

| | |
|-------------|---|
| LME | Large Marine Ecosystems |
| MMP | Minerals Management Program |
| MMS | Minerals Management Service |
| MOCHA | Multi-study Ocean acoustics Human effects Analysis |
| NAS | National Academy of Science |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NMFS | National Marine Fisheries Service |
| NMML | National Marine Mammal Laboratory |
| NMNH | National Museum of Natural History |
| NOAA | National Oceanic and Atmospheric Administration |
| NOC | National Ocean Council |
| NODC | National Oceanographic Data center |
| NOP | National Ocean Policy |
| NOPP | National Oceanographic Partnership Program |
| NOSB | National Ocean Sciences Bowl |
| NSF | National Science Foundation |
| NSL | National Studies List |
| OBIS-SEAMAP | Spatial Ecological Analysis of Megavertebrate Populations |
| OBIS-USA | Ocean Biogeographic Information System - USA |
| OCS | Outer Continental Shelf |
| OCSEAP | Outer Continental Shelf Environmental Assessment Program |
| OSCLA | Outer Continental Shelf Lands Act |
| OEP | Office of Environmental Programs |
| OMB | Office of Management and Budget |
| ONR | Office of Naval Research |
| OREP | Office of Renewable Energy Programs |
| OSRA | Oil Spill Risk Analysis |
| OSRP | Oil Spill Response Plans |
| OSTP | Office of Science and Technology |
| OYPS | Office of Youth, Partnerships, and Service |
| PDF | portable document format |
| RESTORE Act | Resources and Ecosystems Sustainability, Tourist Opportunity and Revived Economics of the Gulf States Act of 2011 |
| SDP | Studies Development Plan |
| STEM | Science Technology Engineering Math |
| UNOLS | University-National Oceanographic Laboratory System |
| USACE | U.S. Army Corps of Engineers |
| USARC | U.S. Arctic Research Commission |
| USCG | U.S. Coast Guard |
| USGS | U.S. Geological Survey |

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 way. In addition to the Headquarters Office, 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 production projections, and conducts economic evaluations that ensure the receipt of fair market value by U.S. taxpayers for OCS leases. BOEM 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) is responsible for implementing and managing the offshore renewable energy program. The 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 compliance documents for each major stage of energy development planning. These analyses inform the bureau'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 function. The SDP provides the majority of the information used to develop the National Studies List (NSL) for the upcoming Fiscal Year (FY). 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, and is also important to coastal ecosystem function. 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 several projects related to the effects of this storm will be proposed as needs arise. BOEM has close ties to and supports the environmental

science needs of the Bureau of Safety and Environmental Enforcement (BSEE), our sister bureau. BSEE promotes safety, protects the environment, and conserves resources offshore 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 also is supported by three Regional Offices (New Orleans, Louisiana, Camarillo, California and Anchorage, Alaska) which are responsible for reviewing Applications for Permit to Drill to ensure all of the recently implemented enhanced safety requirements are met and for conducting inspections of drilling rigs and production platforms 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 2012, the approximately 36 million acres on active OCS leases (BOEM, 2013e) generally accounted for about 8 percent of America's domestic natural gas production and about 24 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 that specifies the size, timing and location of areas to be assessed for Federal offshore oil and natural gas leasing. It is the role of DOI to ensure 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.

The OCS oil and gas lease sales currently are held on an area-wide basis with annual sales in the Central and Western Gulf of Mexico (GOM) with less frequent sales 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).

As established oil- and gas-producing areas mature, America's energy industry is pushing into new frontiers (both in the GOM and in Alaska waters) in its search for hydrocarbon resources. This advance is critical to meeting the Nation's energy needs through production of domestic resources; but it also poses new risks in terms of the high reservoir pressures and temperatures faced during deep drilling operations, the cross-currents that affect deepwater operations, and the logistical challenges of operating in the Arctic environment. The risks associated with deepwater, high pressure reservoirs became evident during the Deepwater Horizon (DWH) oil spill in April 2010, creating substantial new baseline and monitoring requirements.

Legal settlements against British Petroleum and Transocean stemming from the DWH oil spill awarded \$500 million to the National Academy of Sciences (NAS). The 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. It is anticipated that BOEM will be involved in coordinating with this 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's planning process links its activities to the DOI's Strategic Plan (U.S. DOI, 2011) in two major 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 strategies guide the development of budget documents and 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 our 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 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 policy 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 the information needed for assessment and management of environmental impacts on the human, marine, and coastal environments of the OCS and the potentially affected coastal areas;
- Predict impacts on the marine biota which may result from chronic, low level pollution or large spills associated with OCS production, 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 identification of significant changes in the quality and productivity of these environments, and to identify 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 now are 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

The ESP Headquarters component of the Studies Development Plan (SDP) provides the national "context" of the Program and the linkages between BOEM's diverse Regional needs. In contrast to the Plans prepared by our Regional Offices which focus on specific geographic areas or technologies, the Headquarters Office SDP emphasizes issues (and sometimes specific studies) which are more national in scope with program-wide application. ESP Headquarters provides leadership and general program support (quality assurance, peer review planning, information and data management and dissemination), and 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 the scientific merit of the 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 both 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 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, development of curriculum materials or games for students, videos and poster development.

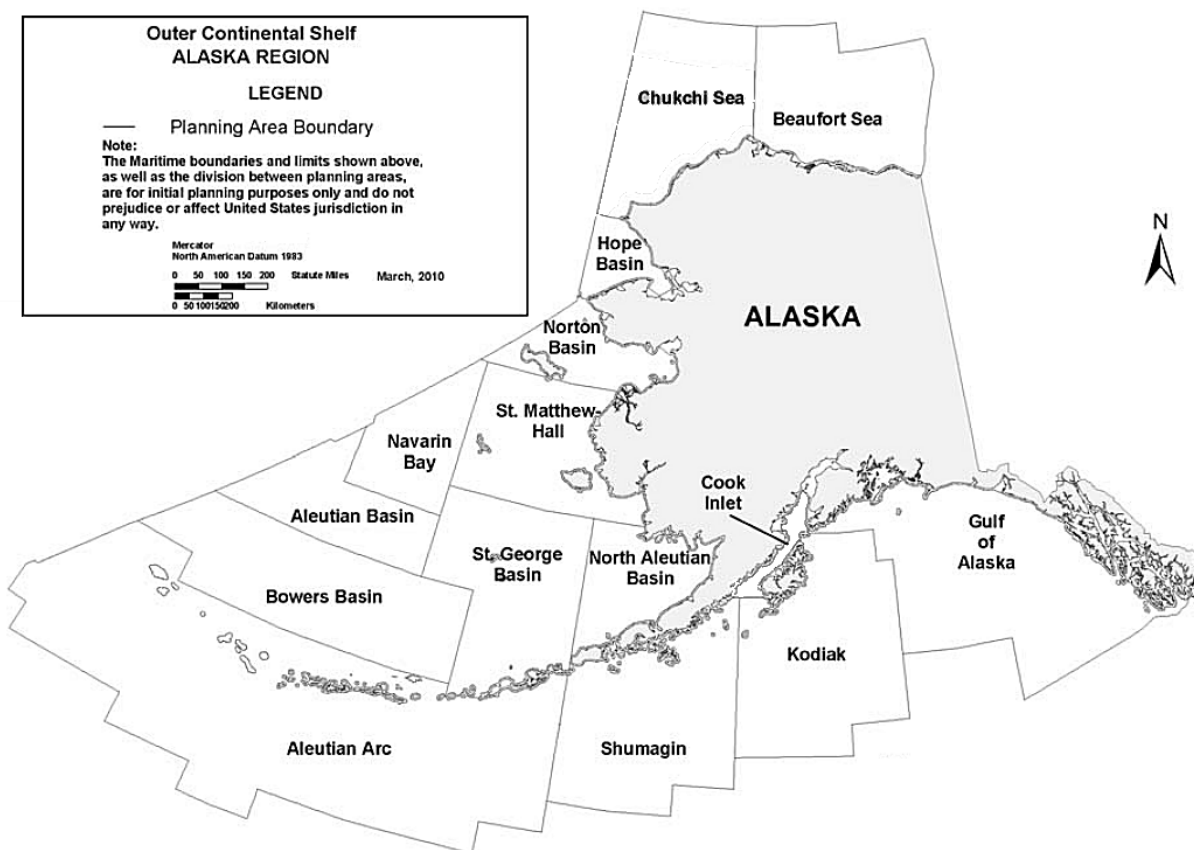
1.2 Map of the Planning Area

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 the Director of BOEM on the feasibility, appropriateness, and scientific value of the proposed studies.

In recognition of the benefits of peer-review and to enhance dissemination of environmental information as widely as possible, and to promote 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. Sometimes, BOEM-sponsored research is presented within the context of a wider scientific discipline. In other cases, BOEM supports meetings which have topics with strong relevance to mission related information needs. The conferences to which we provide funding usually also receive funding 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 made available to taxonomists around the world. Nearly 400 new species have been discovered in BOEM contributions.

1.3.2 Program Quality Assurance

National attention has been directed towards performance measures and accountability. In 2005, we designed and implemented the Environmental Studies Program Performance Assessment Tool (ESP-PAT), an internal, online system to monitor the effectiveness of ESP products in fulfilling the Bureau's information needs and the efficiency of the program in delivering products on time. While designing performance measures for research programs has always been viewed as problematic at best, 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.

In developing the FY 2012 budget and performance plan, the DOI's Office of Planning and Performance Management identified a limited number of high priority performance goals to be in focus. The ESP reports on two measures under the Renewable Energy High Priority Performance Goal (HPPG): "By September 30, 2013, increase approved capacity authorized for renewable (solar, wind, and geothermal) energy resources affecting DOI managed lands, while ensuring full environmental review, by at least 11,000 Megawatts." The program's stated milestone is to achieve approval of the upcoming fiscal year's National Studies List (NSL) by the end of September each year. Further, 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 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 part of the DOI Departmental Manual (Part 305: Chapter 3) (U.S. DOI, 2011). The DOI policy 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 use of science and scholarship to inform management and public policy decisions and establishes scientific and scholarly ethical standards, including codes of conduct, a process for the initial handling of alleged violations, and clear guidance on 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, or 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 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 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 information management activity. An important resource for easy access to completed ESP products through the 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 by the system. This 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 and presentation abstracts and papers are provided where applicable.

In some cases, BOEM supports the archiving of data collected as part of a study. 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 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.

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 physical 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 analysis is conducted on the 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, particularly BSEE, and private industries in such matters. These efforts leverage BOEM's resources, while providing additional needed information and external review.

BOEM is similarly committed to improving air quality models applied to assess air quality impacts. A study with is proposed to improve numerical air quality models used OCS-wide. This effort will investigate the algorithms currently in use and use the information to improve the models in use by BOEM now. This area of research is expanding with the recent addition of the responsibility to monitor air quality in Alaska, with additional cooperation with U.S. Environmental Protection Agency (EPA).

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 monitor environments for renewable energy activities just 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 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 from electromagnetic fields (EMF). In particular, the placement of the first wind turbine generator offshore offers an excellent opportunity to make real-time observations. Renewable energy information needs have been folded into the appropriate regional plans. 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 the global climate are of concern to BOEM. The changing 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 the potential impacts from offshore energy-related activities. Of particular concern are the changes in ice conditions in Alaska and the implications for oil spill projection and response. Ice also provides habitat and changing conditions will alter the distribution of some species. Along the Gulf and Atlantic Coasts, sea level rise and the implications of changing patterns of storm activity are concerns. BOEM is incorporating these effects and their implications in NEPA documents. Our many monitoring efforts to meet other requirements provide excellent time series data 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 include:

- For nearly 20 years, BOEM has collaborated with colleagues in the National Oceanic and Atmospheric Administration (NOAA) to conduct a program 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 monitor 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 in Alaska.

1.3.9 Partnerships

The ESP actively coordinates our efforts with programs such as the National Oceanographic Partnership Program (NOPP). NOPP is a collaboration of federal agencies to provide 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. Our NOPP investments have grown dramatically in recent years. We have funded research through NOPP focused on chemosynthetic communities, the archaeological and biological effects of shipwrecks, surface circulation radar mapping in Alaska, improving cetacean electronic data loggers and a variety of renewable energy projects. Upcoming, we have projects to study shipwrecks and marine Arctic ecosystems. Several recent studies have received the NOPP Excellence in Partnering Award and also the U.S. Department of the Interior Partners in Conservation Award.

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 observing 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 which is used to provide services for supporting the working group.

Similarly, BOEM 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 (IPC) 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 collaborating with partners to identify, develop, and employ valuation frameworks for ecosystem services.

1.3.10 Ecosystem-Based Management

We continue our efforts to support ecosystem-based management through the studies planning process. BOEM has a good track record in this arena. Looking back, early ESP planning in the Gulf of Mexico Region by and large was ecosystem-based. The coastal habitats were studied via U.S. Fish and Wildlife Service's (FWS) ecologically defined "coastal characterization" studies, and each included a standard suite of reports: habitat descriptions, species profiles, socioeconomics, mapping and GIS information, etc. 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 special habitats (Topographic Features, Deepwater). For each of these areas, a standard suite of studies was planned: baseline or benchmark studies (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 which continue today. In light of recent events and changing conditions, more efforts are 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.

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 Coastal and Marine Spatial Planning (CMSP). It also creates the National Ocean Council (NOC), a two-tiered institutional framework to implement the NOP.

CMSP 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. CMSP 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 US. The planning scale for the nine regions proposed in the NOP framework document is the Large Marine Ecosystems (LME's). This includes regions with 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 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.

1.3.12 Marine Minerals Program

Erosion of and storm damage to the Nation's beaches, dunes, barrier islands, and wetlands is a serious problem that affects 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 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 sand into coastal sediment budget which 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 is the principal contrasts with alternative sources that are closer to shore and are part of the active coastal system. For FY 2013, some funding for Superstorm Sandy recovery may be directed towards identifying sand borrow sites along New Jersey and New York. BOEM is currently coordinating the environmental review of projects that will occur over the next five years.

BOEM's Marine Minerals Program is the sole steward of OCS sand, gravel and shell resources, so it plays a unique role and has unique responsibilities in many beach nourishment and coastal restoration project. As of January 2013, the Bureau has conveyed rights to more than 73 million cubic yards of OCS sand for 38 coastal restoration projects in five states (BOEM, 2013d). These projects have resulted in the nourishment or restoration of more than 202 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 habitat.

BOEM has authorized use of OCS sand resources in an unprecedented number of projects over the past few years, nine projects in last year in Louisiana, Florida, North 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 Delaware, New Jersey and Mississippi. Major RESTORE Act restoration 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 morphologic features 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 has increased, sand management issues and potential environmental conflicts have also become more complex and deserving of rigorous environmental 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 support its responsibility to manage these 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 the physical, chemical, biological, cultural, and human environment and develop appropriate mitigation to minimize or prevent adverse impacts.

Recent Marine Minerals Program studies have addressed the potential for effects to essential fish habitat, measured noise levels in the marine environment due to the operation of dredge engines and pumps, synthesized biological impacts from dredging and identify topical areas requiring additional study, and identified and studied the areas most prone for prehistoric cultural resources and shipwrecks (in an effort to avoid dredging in those areas).

1.3.13 Acoustic Studies

One of the issues of concern is the impacts of noise generated during offshore activities. Some examples are seismic exploration, pile driving during construction, vibration and vessel traffic during operation, and explosive removals during decommissioning. The ESP has several recent studies in all of these areas and continues to expand our knowledge base on the effects of these sounds on aquatic life.

Another aspect of sound regards its use as a means of gathering information about the organisms. We have studies underway to use acoustic detection mechanisms to identify and quantify birds by their calls. These will expand our information about the distribution and abundance of birds during low light conditions and in poor weather, information that is particularly useful in the siting of offshore wind farms. Similarly, we

are funding work to acoustically detect, classify and locate marine mammals with our partners through the NOPP.

BOEM conducts and participates 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. A workshop planned for 2013 proposes to examine quieting technologies and other alternatives for reducing noise generated during offshore activities.

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. We must be able to attract well-qualified marine scientists and engineers to meet our 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 Priority Object 2, Inform Decisions and Improve Understanding, of the National Ocean Policy Implementation Plan. The ESP is a member of the Department of the Interior STEM (Science Technology Engineering Math) Education Working Group that prepared the newly released 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 who help 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 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 an ocean literate public and the next generation of marine scientists and engineers. We support 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. The 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), a high school competition on the ocean. The NOSB provides BOEM with the opportunity to develop links to the pre-college community and make students aware of career opportunities in the marine sciences and in the federal government. The NOSB reaches out to students and communities to increase participation by minorities, women, and disadvantaged students, which supports BOEM’s goal of a diverse workforce.

The ESP studies using cooperative agreements with universities often use undergraduate and graduate students as part of the research team. The 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, some of these students enter government service that may 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 our studies. We will continue to maintain and expand tools to make collated samples, data, reports, and literature more accessible to our internal scientists and the academic and general communities. One project proposes enhancements to and expansion of our existing EcoSpatial Information Database (ESID). Information contained in ESID is and will continue to be a primary source of environmental information to use in NEPA reviews. The ESP proposes to continue archiving invertebrate specimens collected through BOEM-sponsored projects. This archiving effort supports the credibility of the ESP, by ensuring the specimens are properly identified and preserved and by making them accessible to researchers. The

ESP plans to support the development of 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 2013 and Ongoing Studies Table

This section enumerates the new starts for FY 2013 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, 2013a). 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, 2013b).

Table 1. New Starts for FY 2013 and Ongoing Studies

| NSL # | Study Title | Planning Area(s) | Start FY | Partners |
|---|---|------------------|----------|--|
| New Starts | | | | |
| Habitat & Ecology | | | | |
| NT-13-01 | Expanded Nation-Wide Scope for Archiving of Outer Continental Shelf Invertebrates by the Smithsonian National Museum of Natural History | All | 2013 | NMNH |
| NT-13-05 | Marine Arctic Ecosystems Study: A Multi-Agency NOPP Partnership (also appears under Physical Oceanography) | AK | 2013 | ONR, NOAA, US ARC, NSF, USCG, USGS, US IOOS, Shell |
| Information Management | | | | |
| NT-13-02 | Support for the National Ocean Sciences Bowl (NOPP) | All | 2013 | |
| NT-13-03 | COSEE Support to the Environmental Studies Program's Education and Outreach Efforts | All | 2013 | |
| NT-13-04 | Second Meeting of Marine Mammals and Sound Stakeholder Working Group | All | 2014 | NAVY, NMFS, US MMC |
| NT-13-x10 | Support for the 4th National Forum on Socioeconomic Research in Coastal Systems | All | 2013 | |
| Physical Oceanography | | | | |
| NT-12-03c | Improving Oil-Spill Risk Analysis in the Gulf of Mexico: A Multi-Model Approach - Part C | GM | 2014 | |
| 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 |
| *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 and Effects | | | | |
| NT-10-10 | Improving Emission Estimates and Understanding of Pollutant Dispersal for Impact Analysis of Beach Nourishment and Coastal Restoration Projects | All | 2009 | |
| 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 | ACOE |
| 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 | |

| Information Management | | | | |
|--------------------------------------|--|------------|------|------|
| NT-01-05 | National Ocean Sciences Bowl | All | 2001 | NOPP |
| NT-10-04 | Workshop to Identify Information Needs and Data Gaps on the Effects to Fish, Fisheries and Invertebrates in the U.S. Atlantic and Arctic from Sound-Generating Activities by the Energy Industry | AT, AK | 2011 | |
| 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-11-11 | Review of Biological and Biophysical Impacts from Dredging and Use of Offshore Sand | All | 2011 | |
| 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-12-x15 | Support to the Gulf of Mexico Oil Spill & Ecosystem Science Conference | GM | 2012 | |
| 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-10-x33 | Underwater Hearing Sensitivity in the Leatherback Sea Turtle (<i>Dermochelys coriacea</i>): Assessing the Potential Effect of Anthropogenic Noise | AT, GM, PC | 2010 | |
| NT-11-08 | Development of Software and Hardware to Acoustically Detect, Classify, and Locate Marine Mammals | All | 2011 | ONR |

| 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 BOEMRE Oil Spill Risk Analysis (OSRA) Model: Applying Lagrangian Stochastic Model to Track Oil Spills | All | 2011 | |
| 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-11-09 | Synthesis, Legislative Review, and Case Law History Applicable to Cultural Heritage in the Marine Environment | All | 2011 | NOAA |
| NT-11-13 | Commercial Fishing Hang Data as a Proxy for Locating Shipwreck Sites off the Mid-Atlantic Coast | AT | 2011 | |
| Planning Area Codes | | | | |
| AT = Atlantic NT = National | | AK = Alaska PC = Pacific | | GM = Gulf of Mexico |
| Partner Codes | | | | |
| ACOE = 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 nine new studies for FY 2014.

2.2 FY 2014 Table

Table 2. Headquarters Studies Proposed for the Fiscal Year 2014 NSL

| SDP Page Number | Discipline | Regional Ranking | Study Title |
|-----------------------------|------------|---|---|
| 27 | IM | 1 | Topical and Functional Expansion of the EcoSpatial Information Database |
| 29 | IM | 2 | Continued Archiving of Outer Continental Shelf Invertebrates by the Smithsonian Institution National Museum of Natural History |
| 31 | SE | 3 | Human Dimensions National Portal Rebuild Using the Department of Interior ScienceBase Platform |
| 33 | MM | 4 | Developing BOEM's Access to Protected Species Occurrence Data for Impact Analyses and Rule-making |
| 34 | FE | 5 | Environmentally Benign Oil Simulants to Mimic the Behavior of Oil Droplets in the Ocean |
| 35 | HE | 6 | Variability in Ecosystem Service, Resiliency, and Post-Dredging Recovery of Ridge-Swale Habitat and Biological Communities in the Mid- and South-Atlantic Bight |
| 39 | PO | 7 | Propagation Characteristics of High-Frequency Sounds Emitted During High-Resolution Geophysical Surveys |
| 41 | FE | 8 | Environmental Effects and Cost Comparison of Single Beam, Swath, and Multi-beam Bathymetric Surveys Before and After Dredging Operations |
| 43 | FE | 9 | Monitoring Dredging Intensity Using Variable Grid Analysis of Dredge Quality Management Data |
| 45 | MM | 10 | Support for the Development of an Improved Biostatistical Method to Analyze and Interpret Observations from Marine Mammal Behavioral Response Studies |
| Discipline Codes | | | |
| AQ = Air Quality | | FE = Fates & Effects | |
| IM = Information Management | | HE = Habitat & Ecology | |
| PO = Physical Oceanography | | MM = Marine Mammals & Protected Species | |
| | | SE = Social & Economic Sciences | |

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: National

Planning Area(s): All

Title: Topical and Functional Expansion of the EcoSpatial Information Database

BOEM Information Need(s) to be Addressed: BOEM is responsible for environmental assessments of offshore energy development activities in compliance with the National Environmental Protection Act (NEPA). An important part of NEPA compliance is to identify relevant scientific information from the peer reviewed, white, and grey literature. For BOEM this includes but is not limited to reports and data from BOEM-funded environmental studies from the outer continental shelf planning areas. Eco-Spatial Information Database (ESID) provides tools to manage these information resources, and provides a transparent and consistent presentation of this information for NEPA analysis. Further, it will support gap analysis to identify information needs for continued research funded by the Environmental Studies Program.

Approx. Cost: (in thousands) \$2000 **Period of Performance:** FY 2014-2016

Description:

Background: The NEPA literature review is currently independently coordinated within each office at BOEM and sometimes for each Environmental Assessment. This represents a significant effort, because the number of relevant sources has grown substantially since this provision was initially mandated by NEPA. It also represents a growing source of liability to the organization at large, since NEPA holds BOEM to very high standards of scholarship, and failure to duly consider and reference appropriate sources could undermine large coordinated efforts to evaluate energy and minerals development options.

ESID (pronounced “ee-sid”) provides a transparent mechanism for sharing environmental information relevant to NEPA literature reviews. ESID was developed as an Environmental Studies Program pilot study to demonstrate the capacity and infrastructure to serve BOEM’s data and information needs. As it currently stands, it has a focus on the Atlantic region and is populated with information resources relevant to renewable energy development. When queried, ESID will dynamically generate a geographic bibliography, which is a list of references with associated geospatial information. Data and reprints associated with the references are linked to or available for public access directly from the ESID search results. Though ESID currently has limited utility, it has successfully demonstrated a proof of concept that can serve a much broader information need. There is currently no other platform available or planned for deployment at BOEM that could serve as a centralized and complete repository for NEPA supporting science. ESID provides ready access to this information with an ease of exchange within the organization, with BOEM partners, and with the public.

Objectives: ESID was designed to be built upon and extended indefinitely, and a renewal is proposed here that strategically expands the ESID to cover a broader set of BOEM's information needs. This expansion is geographic, as it will cover all planning regions. It is a topical expansion, as it will support different types of energy and minerals development from the different regions. Finally, it is a technological expansion, as it will allow machine to machine connections with related data assets within BOEM and others located externally and managed by partnering agencies.

This expansion of ESID will provide incremental improvements to the database, but this basic infrastructure could eventually fully integrate all public facing BOEM repositories. A dedicated database development team will provide critical support to help coordinate BOEM data systems with ongoing BOEM operations. It will enable BOEM personnel to quickly address emerging information needs and better operate in an adaptive management mode necessitated by the pace of environmental and societal change.

Methods: In order to meet these varied project objectives and to sustain BOEM mission goals, methods will focus on two distinct areas 1) base support for existing ESID functionality, and 2) funding to expand ESID's functionality in key areas.

- 1 Continued support for cloud based ESID database
 - Free text query across all public and proprietary documents
 - Geographically enabled searches
 - Access management for internal and public documents and data
- 2 Populate information resources
 - Expands ESID's scope geographically to cover all of BOEM's OCS regions
 - Rapid response to emergent needs in support of adaptive management
 - Visualization of information gaps for science needs analysis
- 3 Machine to machine connections delivering documents, maps, and data products
 - Seamless integration with web portals (i.e. Marine Cadastre) using WMS/WCS
 - Public copy of BOEM documents delivered in response to geoESPIS queries
 - Analytical products based on ESID data can be the basis for decision support
 - Secure distribution of limited access documents - including copyright protected information with project partners outside BOEM

The base funding is sought for ESID to support BOEM NEPA writing and conventional exchanges of scientific information. This would cover outreach to BOEM NEPA analysts, development of ESID information resources for analysts' use, and maintenance of ESID's online presence. The optional funding would be exercised incrementally on more focused efforts, such as addressing emergent information needs and adding new functionality to the ESID system. New technology would enable greater connectivity between BOEM employees and the broader scientific community, and would develop and support innovative dissemination mechanisms for BOEM generated information.

Revised Date: April 17, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2015

Region: National

Planning Area(s): All

Title: Continued Archiving of Outer Continental Shelf Invertebrates by the Smithsonian Institution National Museum of Natural History

BOEM Information Need(s) to be Addressed: Continued archiving and long-term reliable curating of the vast collections of invertebrate specimens acquired through BOEM-sponsored projects are essential elements of biological quality assurance. This effort provides BOEM with the scientific credibility important to stakeholders' acceptance of decision-making in the Offshore Energy and Minerals Program and addresses the intent of Congress through U.S. Code Section 59 calling for all collections by parties for the Government of the United States, when no longer needed for investigations in progress, shall be deposited in the National Museum. This BOEM-funded sample archiving program was also prominently highlighted during Congressional testimony as an invaluable baseline information resource related to the Deepwater Horizon spill event in the Gulf of Mexico.

Approx. Cost: (in thousands) \$1,600 **Period of Performance:** FY 2014-2019

Description:

Background: The Bureau of Ocean Energy Management (BOEM) conducts biological projects in all Regions including the Gulf of Mexico, Pacific, Atlantic and Alaska, in support of decision-making related to the development of offshore energy and mineral resources. These projects frequently result in large collections of invertebrate biological specimens. Taxonomy is a critical component to the ecological interpretation of biological data. Archiving of the collections provides for taxonomic verification and for the future use of the collections. The Smithsonian Institution's National Museum of Natural History (NMNH) is the Nation's most reliable and respected repository for biological collections. Early in the history of the BOEM Environmental Studies Program (ESP), it was recognized that extensive biological samples collected during BOEM environmental studies were invaluable to the relevant studies, but also to science in general. Since 1979, invertebrate specimens collected through the ESP have been carefully maintained through the NMNH's archiving standards and made available to taxonomists around the world. This long-term archiving project has been described by senior NMNH staff as "a part of the fabric of invertebrate zoology." These ESP collections represent one of the most extensive collections of marine organisms from U.S. continental shelves and slopes in the facility, in terms of geographic coverage and number of groups represented. Over the last 30 years, more than 220,000 specimen lots have been curated by the Smithsonian from a total of more than 350,000 lots received. Specimens from BOEM studies represent more than 20% of the total Smithsonian database, and in some species groups, BOEM samples represent the majority of the museum's collections. To date, over 400 species new to science have been identified in the BOEM collections. Recent and upcoming studies in the Pacific,

Atlantic and Alaska will be greatly increasing the input of specimens for archival in the near future.

Objectives: The objectives of the study are to:

- Provide quality assurance for biological data generated through the BOEM Environmental Studies Program and the credibility of offshore energy and mineral resources decision-making.
- Preservation of Federally-funded biological samples (including tissue genetics) and providing for their availability for scientific study into the future.

Methods: To accomplish the objectives of this project, it is required that contractors communicate with the NMNH to establish the specifications for the handling, storage, and shipping of invertebrate specimens collected through BOEM environmental studies within applicable contracts. These specifications were developed in coordination with the Smithsonian Institution to provide contractors with information required to ensure that the collected specimens are delivered to the NMNH in the best possible condition. The Smithsonian accepts the specimens, checks the condition of the samples and taxonomic identification, and makes them part of the national collections. Archiving of samples includes acquisition, administration, cataloging and curation, sorting and confirmation of identification. The collections are then maintained according to the strict guidelines of the NMNH and are made available to other researchers. Continuing recent initiatives, legacy samples from the Gulf of Mexico dating back to the mid to late 1800s will continue to be cataloged as appropriate. Also, utilization of the new NMNH tissue archival center will continue to be utilized where appropriate for all new biological collections. Continuing focus on backlog of previously received samples will be a priority as well as continued efforts to incorporate collections from past studies, some located at academic institutions and others such as the early Outer Continental Shelf Environmental Assessment Program (OCSEAP) collections at the California Academy of Sciences.

The dedicated NMNH independent website for collections from BOEM-funded projects will be continued. This resource includes extensive information about individual project locations, dates, station data, and links to BOEM final reports. It also includes direct links to the online catalog database where individual records and images of specimens can be retrieved. Quarterly and annual reports from the NMNH to BOEM provide updates on the numbers of specimens accessioned into the NMNH collections, those remaining to be accessioned, and those on loan to taxonomists around the world.

Revised Date: April 1, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: National

Planning Area(s): All

Title: Human Dimensions National Portal Rebuild Using the Department of Interior ScienceBase Platform

BOEM Information Need(s) to be Addressed: BOEM’s Environmental Studies Program (ESP) is implementing data policy that conforms with the best scientific practices from each of the contributing scientific disciplines. Socioeconomics is one of the main contributing scientific subject areas to BOEM’s environmental studies, yet as an applied science there is a highly specific context within which the research results should be presented for public dissemination. BOEM needs a mechanism to share the primary scientific data that have contributed to its socioeconomic analyses, while maintaining control over the manner and context in which it is displayed. This will help BOEM increase the transparency in how the science has been considered in BOEM’s resource management decisions, and it will address several Executive Office science and information policies, including Open Government (OMB, 2006), Public Access (OSTP, 2013), and the National Ocean Policy.

Approx. Cost: (in thousands) \$50

Period of Performance: FY 2014-2015

Description:

Background: Human dimensions is a concept from environmental resource management which includes topic areas such as geographic boundaries, economic resources, environmental governance/management, environmental impacts, habitat conservation/fragmentation, human settlements, infrastructure, natural hazards, population indexes, public health, social behavior, socioeconomics, and sustainability research (Olsen & et al., 2013). An interagency group of human dimensions professionals from natural resource management agencies, including representatives from the DOI and the Department of Commerce, identified a need to establish an authoritative source for human dimensions information on the World Wide Web. After much interagency deliberation and community engagement, in 2007 the group launched the Human Dimensions website (Gold-Krueck et al., 2007).

HumanDimension.Gov was a public website targeted to scientific and laymen audiences replete with information on methods, tools, data, publications, case studies, laws and policies, and issues and topics from the human dimensions scientific community. This information often ranked highly in response to web searching, like when using Google search. However, recent Executive Branch digital government initiatives have altered the rules for how the federal community can develop this web content. Specifically, there is a call to migrate government websites to enterprise systems, in anticipation of the deluge of government generated information, and better utilizing the latest technology.

In response to Executive Branch policies, the steering committee for Human-Dimensions.Gov has planned to migrate the website content to a DOI enterprise system called ScienceBase (USGS, 2013). This migration would preserve the original functionality of HumanDimension.Gov and satisfy the latest internet policy provided by the Executive Branch. Further, ScienceBase provides a suite of additional data management tools that would greatly facilitate the implementation of additional data management objectives and allow for the upload of BOEM socioeconomic data that could then be accessed by the public through HumanDimensions.Gov. In addition, by supporting the effort to move HumanDimensions.Gov to the science base platform, BOEM could leverage significant funds that were already invested into ScienceBase and the HumanDimensions.Gov by the federal government. BOEM would receive managed archival and dissemination services for the relatively small amount of requested funds.

Objectives: BOEM will have designated means of preserving and disseminating its socioeconomic data, thereby increasing the government's return on research funds by making the data readily available and preserved for use by the public and researchers in the present and in the future.

Methods: HumanDimensions.Gov used a structured hypertext markup language (HTML) format for consistent representation of scientific information. This is the most common medium for web page content on the internet, and this web content is harvested by web aggregators such as Google.com and USA.Gov. The HumanDimensions.Gov website will be migrated to the ScienceBase content management system. This will translate the structured HTML content into tagged database fields that can be more systematically searched and updated, and will integrate with Department of the Interior Information Technology systems.

ScienceBase would upgrade HumanDimensions.Gov content without changing the appearance, or functionality of the original website. Further, ScienceBase has a number of additional functionalities that would expand capabilities available through HumanDimensions.Gov. BOEM ESP studies staff will lead the Human Dimensions.Gov steering committee to determine the function and content of the site, and as a part of the steering committee BOEM will have joint decision power to ensure that BOEM's data needs and larger mission are considered as the site is updated and revised over time.

BOEM will maintain a distinct webpage under the HumanDimensions.Gov website for BOEM data. BOEM ESP personnel including the scientific data manager and the socio-economic Subject Matter Experts will be able to deposit BOEM socioeconomic data, and maintain control over the disposition and display of said data. For example BOEM is currently testing ScienceBase as a platform for its socioeconomic data using results from the recently completed Space Use Conflict Study (Industrial Economics, Inc., 2012). The data from this study are now available over the internet for the public to access (<https://www.sciencebase.gov/catalog/item/50f97251e4b0727905956048>). Another tool that addresses Public Access (OSTP, 2013) is a method of tracking and publicly disseminating project level data management plans. BOEM will be able to use any new capabilities developed in support of the HumanDimensions.Gov migration, and will also maintain control over the contents of the BOEM repository, including additional implementations and functional capabilities provided by the ScienceBase platform.

Revised Date: April 16, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: National

Planning Area(s): All

Title: Developing BOEM’s Access to Protected Species Occurrence Data for Impact Analyses and Rule-making

BOEM Information Needs(s) to be Addressed: BOEM needs ready access to information on marine protected species distribution for marine spatial planning, environmental impact assessments, rulemaking, adaptive management decisions, and day-to-day oversight of offshore operations to avoid or mitigate adverse impacts to protected species and other marine animals. A registry of protected species datasets is needed, to provide BOEM analysts and decision makers basic support in the discovery and use of information resources, even when the data in said resources are part of an ongoing monitoring program or research project.

Approx. Cost: (in thousands) \$175

Period of Performance: FY 2014 - 2016

Description:

Background: Observations of protected species come from many and various monitoring programs and scientific research projects. Biogeographic databases are integrative tools for combining the scientific knowledge on species distribution. These databases focus on common elements of species observational effort, such as the record of a species occurrence. The Ocean Biogeographic Information System of the United States of America (OBIS-USA) is the U. S. federal node for the international OBIS system, and it resides within the U. S. Geological Survey. OBIS-USA is evolving to fulfill the data needs of partnering organizations, and has served BOEM’s needs by developing an Archive for protected species observations. However, processing of these observations into an archival format depends on program or project-level timelines for delivering the observation data, which may cause months or longer delays between collection of such observations and when the information is available to the public using this method of data development. By the time data are made available in the typical way, there may be limited interest or applicability of the data to topical resource management issues, such as the navigation or siting of a drilling operation. These data have many applications beyond the initial program or project, and in many cases, there are many routine aspects of these observational efforts that could be automated for more timely delivery of the information.

Federal agencies in collaboration under the Subcommittee on Ocean Science and Technology have been building a federal architecture to capture, store, make available and archive federal marine biological data. This data system provides the basic infrastructure for synthesizing disparate data from multiple research projects using many different methods of observations and platforms from which to make the observations. OBIS is a distributed data system that has been pivotal in performing this

service for federal biogeographic data needs. OBIS-USA plays an important coordination role, interfacing with other federal entities, such as the U. S. Integrated Ocean Observing System (IOOS) and the National Oceanic Atmospheric Administration's National Oceanographic Data Center (NODC), and international entities such as the International OBIS and the Global Biodiversity Information Facility (GBIF). Of particular relevance, OBIS-USA leverages its relationship with OBIS-SEAMAP to provide for federal needs for protected species data. Ongoing efforts include CetMap/NOAA marine mammal modeling project (Hatch and Harrison, 2012), passive acoustical monitoring data development (Binkley, 2011), development of an online portal for Navy data and models (Halpin et al, 2011), and the near-real-time delivery of sea turtle tracks (tracking@seaturtle.org, 2009).

The study outlined herein will be complementary to another FY 2014 project described in the Alaska Regional profile titled "Data Interface Tools to Support Environmental Analyses: Interpretation of Existing Marine Mammal Data". That project is focused exclusively on the Alaska Region's informational needs. However, if both projects are successful, they may be adapted to the other BOEM regions.

Objectives:

- Improve timeliness and quality of data availability to BOEM personnel
- Use existing federal resources for data management, including NODC and IOOS
- Engage in data sharing arrangements with interagency partners such as NOAA and the US Navy while maintaining a secure venue to conduct operations
- Implement automation of routine tasks such as enrollment, dissemination, modeling, and mapping for recently collected protected species data

Methods: This study will be conducted by the OBIS-USA/OBIS-SEAMAP partnership, which is uniquely qualified to produce the desired products. OBIS will evaluate experimental tools from the biogeographic community, such as the GBIF Integrated Publishing Toolkit, to develop techniques to better interface with data producers. Additionally, OBIS will evaluate the benefits and dangers of early data sharing, and trade-offs that this may present in terms data quality and publication. Subjects of interest are 1) methods to develop the adequate context to understand recent marine mammal location observations for siting decisions, 2) modeling to detect patterns and trends in marine mammal distribution, 3) tools to identify outlier observations to target adaptive sampling capabilities, and 4) visualizations of protected species data that help identify information needs for future BOEM funding.

Revised Date: April 4, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: National

Planning Area(s): All Gulf of Mexico

Title: Environmentally Benign Oil Simulants to Mimic the Behavior of Oil Droplets in the Ocean

BOEM Information Need(s) to be Addressed: The results of the study will be used to improve the general knowledge of the behavior and fate of oil droplets in the water column and for improving particle transport models of spilled oil. These simulated particle experiments could be utilized in both laboratory and field projects, to improve and validate trajectories used in the OSRA calculations.

Approximate Cost: (in thousands) \$400 **Period of Performance:** 2013-2016

Description:

Background: Scientists and responders are hindered by U.S. permitting regulations to intentionally release petroleum oil in the environment for research purposes. Such releases are possible, but EPA has not issued a permit since 1974. Engineered particles have been used in a variety of air-related studies to model and visualize particle transport. The transfer of this technology to oceanic environments would provide a new tool for oil spill researchers to track the behavior of oil droplets without the need for petroleum releases in the environment. The understanding of how oil droplets are transported and dispersed in the environment would be advanced by oil droplet simulating particles that can be used as a surrogate to mimic the behavior of dispersed oil.

This powerful capability would improve particle transport models of spilled oils and our overall knowledge of the behavior and transport of oil droplets as they move in the water column under the influence of advection from currents and diffusion. The key is producing a simulant that is readily detected in both concentrated and dilute conditions, is easily degraded, and is as close as possible to petroleum in terms of behavior and measurement without having to release oil into the environment. The particles would disperse into larger volumes, but the concentration of the dye within the particles would degrade slowly. Many dye studies have been performed in the ocean, with application to oil spill and to sewage outfall. This particle method, where the concentration is maintained in the particles, is a contrast to a dissolved dye experiment, where the concentration is rapidly decreased by diffusion.

Objectives: The objectives of this project are to (1) fabricate environmentally benign, optically active particles that simulate oil droplets in the water column using synthesis techniques that are readily scalable from bench to industrial production, and (2) verify how well the particles simulate oil droplets using existing response tools, such as fluorometers and particle size analyzers.

Methods: In this project, the properties of oil will be simulated by varying physical characteristics such as the particle size, density, and surface coating of biodegradable, engineered particles. Controlling the particle density and surface properties would enable investigators to monitor the behavior of non-petroleum droplets by mimicking actual oil droplets in the ocean environment. These synthesis processes will impart simulant properties ranging from floating on the seawater surface to sinking at varying rates. The new particles would also be optically active, allowing the use of commonly used instruments such as fluorometers to track them in the water column. Dyes with unique fluorescent signatures will be selected and encapsulated into particles of varying physical properties resulting in a means to create “tagged” particles. In addition, the fluorescent materials used in the simulant particles have the potential to vastly extend the detection limits of the simulant, compared to dilute aquatic concentrations of dispersed oil.

Behavior and tracking of the tagged particles will be examined in batch laboratory experiments using laboratory-based spectroscopic methods as well as existing response tools (submersible fluorometers and particle size analyzers) to determine sinking and floating rates. Results will be compared with existing knowledge of behavior and transport of real oil droplets in laboratory and field settings. Once proof of concept has been achieved in batch studies, pilot studies will be conducted to test the advective flow, buoyancy, and dispersive behavior of the particles compared to dispersed petroleum oil, and possibly compare these to the diffusion of dissolved dye.

Such capabilities would vastly improve the response community’s ability to monitor and understand the movement of dispersed oil droplets in both the vertical and horizontal direction. This is because the need to release petroleum into the environment would be obviated, thus allowing many more researchers to conduct in-situ experiments without needing an oil release permit. Such improved capabilities would significantly accelerate the advancement of knowledge for responding to a catastrophic release of oil such as a deep sea well blowout. The overall goal, related to scalability, would be the ability to release the oil simulants into natural seawater despite the fact that much of the proposed work would be conducted in lab and tank tests.

We expect to procure this via an Interagency Agreement with The U.S. Environmental Protection Agency, with the specific participating group being the National Risk Management Research Laboratory, Land Remediation and Pollution Control Division, Cincinnati, OH.

Revised Date: April 8, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: National

Planning Area(s): Atlantic OCS

Title: Variability in Ecosystem Service, Resiliency, and Post-Dredging Recovery of Ridge-Swale Habitat and Biological Communities in the Mid- and South-Atlantic Bight

BOEM Information Need(s) to be Addressed: The ecosystem services (bioenergetics, trophic transfer) of ridge-swale habitat and the relevance of that habitat to resident benthic communities, fishes, and trophic structure is poorly understood, despite the relative abundance of such habitat along the inner shelf of the Mid- and South-Atlantic Bight. These sand-rich features are often targeted for dredging and used in beach nourishment projects because of the quality and volume of sand. To identify appropriate conservation and mitigation measures, a comprehensive understanding of the quality and function of the habitat and how it may contribute to different ecosystem services over storm, post-disturbance, and seasonal and inter-annual time scales is needed. This information will improve effects analyses in NEPA documents and greatly focus and improve the outcomes of Essential Fish Habitat consultations.

Approx. Cost: (in thousands) \$1,000 **Period of Performance:** FY 2014-2016

Description:

Background: The responsibility for managing OCS sand resources is vested within BOEM. BOEM, through its Marine Minerals Program (MMP), conveys the rights to OCS sand, gravel, or shell resources for in shore protection, beach or wetlands restoration projects. BOEM must analyze and minimize to the extent practicable the effects of these activities under the requirements of the National Environmental Policy Act and other environmental laws, such as the Magnuson Stevens Fishery Conservation and Management Act.

Limited scientific study suggests that the morphologic features often targeted for dredging are important to benthic and fish communities because of its habitat value. Dredging of the seafloor alters the water depth and geomorphic characteristics in the borrow area and often directly and indirectly contributes to coupled ecological effects. These effects are generally limited in spatial scale and temporary in most cases. Most benthic and fish communities using the borrow area are expected to return after several years unless there is persistent habitat disturbance. Nonetheless, there remains the potential for changes in community composition, trophic structure, and bioenergetics, but the pathways and severity of impact are poorly understood. BOEM currently is funding a study that will identify the principal scientific questions and data gaps and propose leveraged research programs to answer those questions.

Scientific study is particularly challenging because of naturally-occurring spatial and temporal differences in habitat, variability in community composition and trophic dynamics, especially in ecosystems adapted to frequent disturbance by storms or major

seasonal environmental changes (Posey, 2000) (Wilber, 2009). Most pre- and post-dredging monitoring is not of sufficient duration or temporal resolution to fully understand these complex systems (Peterson & Bishop, 2005). In the absence of extended and temporally-resolved monitoring data, short-term perturbations cannot be effectively differentiated from natural disturbances or longer-term trends. Observations over a longer time frame would allow for BOEM to determine the true extent, nature, and process of recovery. Long-term observations would also allow for the examination of recovery from multiple dredge events.

Typically, monitoring is generally completed within a year of project completion. In the absence of pre-dredge monitoring and extended monitoring, this information cannot be utilized to examine recovery and/or resiliency. Observations of the borrow sites over longer time periods (7-10 years) following completion of the sediment removal would allow for BOEM to determine the extent and nature of recovery. Further, these observations would allow for the examination of repeated use recovery in the selected study sites.

Objectives: Characterize the range and variability of ecosystem services (bioenergetics, trophic transfer) that ridge-swale habitats provide in the Mid- and South Atlantic Bights and determine the relative importance to this habitat type to keystone benthic and fish species. Characterize functional differences in dredged and non-dredged areas by comparing species composition and diversity, population dynamics, and trophic structure. Relate observed biological differences to physical and biophysical characteristics or other ecosystem changes.

Methods: Two potential study sites offshore Virginia and New Jersey have existing background benthic habitat, biological community, and other environmental data that could be used as a starting point. Both of these sites are proposed for near-term dredging. This would allow for sampling prior to the disturbance and post-disturbance using the Before-After-Control-Impact method (BACI). The study proposes additional sampling prior to the disturbance and post-disturbance in both borrow areas and proximal control sites with similar physical and oceanographic characteristics. Data would be collected from at least four strata (leading edge slope, ridge crest, trailing edge slope, and adjacent swale bottom) and over multiple seasons. Suggested methods include replicate bathymetric and side scan sonar surveys, box cores/grab samples, benthic video/camera, demersal and pelagic trawls, fish tagging, diurnal nekton sampling, gut content analysis, reflectance analyses for plankton size distribution, etc.). Data would be subject to geospatial and statistical analyses comparing newly acquired and legacy data. Species diversity varies seasonally and temporally so these collection methods are intended to account for that. Further, collection methods would be developed in an effort to build a framework for subsequent phases in an ongoing longer term (7-10 year) project examining residual impacts and recovery.

Revised Date: April 1, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: National

Planning Area(s): All

Title: Propagation Characteristics of High-Frequency Sounds
Emitted During High-Resolution Geophysical Surveys

BOEM Information Need(s) to be Addressed: Improved understanding of the operational and propagation characteristics of high-frequency sound sources is crucial to predict or assess the potential behavioral response of marine species and determine appropriate mitigation, as required under the NEPA, MMPA and ESA. Currently, limited observations are available on the underwater propagation of the high frequency sound generated from sources other than air guns (e.g., boomers, sparkers, chirpers, side-scan sonar, and single, swath, and multi-beam bathymetry).

Approx. Cost: (in thousands) \$1,200 **Period of Performance:** FY 2014-2017

Description:

Background: Marine geophysical data is critical for industry and BOEM to make informed leasing decisions. High frequency marine acoustic sources are commonly used and required during infrastructure siting, geological or environmental characterization, and shallow hazard or archaeological cultural surveys. The acoustic sources currently in use include boomers, sparkers, chirp seismic, side-scan sonar, and single, swath, and multi-beam bathymetric fathometers. The marine source acoustic operation levels generally range from 210 to 240 dB re 1 μ Pa @1 m, and operate in the <300 Hz to several hundred KHz range (Lurton and DeRuiter 2011).

High resolution geophysical surveys use high frequency acoustic sources that emit a signal within the water column at an intensity, frequency, and duration which may affect marine life (e.g., marine mammals, sea turtles, and fish). The potential for physical injury is only a concern in very close range to the source due to high frequencies, beam directionality, and short pulse length (BOEM 2012; JASCO in preparation). The sources may produce noise at an intensity and frequency which may harass marine mammals and adversely affect their behavior, depending on the species' hearing bandwidth and integration time (JASCO in preparation).

Limited in-field or laboratory data exists regarding acoustic propagation characteristics (e.g., pulse signature, beam directionality, transmission loss, power and frequency spectra) from non-air gun marine acoustic sources despite their wide use by industry. The propagation characteristics are especially poorly understood in shallow to intermediate water depths (e.g., 10 to <70 m), where propagation and transmission loss may be affected by complex bathymetric interaction, variable sediment composition, shallow water processes (i.e., breaking waves), and mesoscale oceanographic properties. Numerical models currently used to predict propagation and transmission loss need to be validated to more accurately represent these important physical processes.

Improved understanding of the propagation characteristics from these geophysical sources is crucial to more accurately predict and assess potential impacts to marine species and determine appropriate mitigation, as required under NEPA, MMPA and ESA. The Sound and Marine Life Joint Industry Project (JIP) has recently recognized the importance and expressed interest to explore this issue. BOEM will monitor and coordinate with related efforts and consider possible opportunities for cost and research leveraging. Information garnered from this project would benefit many BOEM program areas (oil/gas, renewable, marine minerals) and in all BOEM Planning Areas.

Objectives: The objectives of this study are two-fold: (1) characterize the propagation characteristics of commonly used high-frequency, high-resolution non-air gun geophysical impulsive sources (e.g., boomers, sparkers, chirp seismic, side-scan sonar, single, swath, and multi-beam bathymetric sonars); and (2) enhance and validate an existing acoustic propagation model to improve the accuracy of transmission loss predictions for shallow/intermediate waters (e.g., 10 to <70 m) and estimation of the zone of ensonification from these sound sources.

Methods: Possible study methods include:

- Identify the appropriate study area(s), capitalizing on existing research efforts. Design and complete the necessary lab or field work to: (1) characterize the near-field sound source(s), bathymetry, geologic environment, and oceanographic properties and processes at the field site(s); and (2) document propagation characteristics of sources.
- Modify and refine an existing acoustic propagation model(s) for use in shallow/intermediate water depths (e.g., 10 - <70 m), where complex bathymetry, variable bottom types and underlying geology, shallow water processes, and mesoscale oceanographic properties may affect signal. Multiple or ensemble modeling may be appropriate where results differ significantly between models or ecoregion.
- Develop and implement sensitivity testing of the model using field data for the purposes of validation.
- Form a peer-review scientific group to review field work design, model selection and development, and data validation/analysis.

Revised Date: April 2, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: National

Planning Area(s): All

Title: Environmental Effects and Cost Comparison of Single Beam, Swath, and Multi-beam Bathymetric Surveys Before and After Dredging Operations

BOEM Information Need(s) to be Addressed: BOEM has historically required the use of single beam bathymetric data, but is considering changing that requirement because of the data density and quality improvement that comes with swath and multi-beam bathymetric data. In order to understand the impacts of potentially changing this monitoring requirement, BOEM needs to accurately characterize the differences in environmental effects associated with different sound sources, vessel support, deployment, and acquisition protocols, as well as repeat surveys. Similarly, BOEM needs to evaluate cost implications of differences in mobilization, acquisition and vertical control/motion/tide correction, post-processing, and data management for single beam, swath, and multi-beam bathymetric survey data. BOEM will use this information to make a more informed decision about changing this monitoring requirement.

Approx. Cost: (in thousands) \$150-250 **Period of Performance:** FY 2014-2015

Description:

Background: The responsibility for managing OCS sand resources is vested within BOEM. BOEM, through its Marine Minerals Program (MMP), conveys the rights to OCS sand, gravel, or shell resources for use in shore protection, beach or wetlands restoration projects. As a condition of authorization, BOEM requires project sponsors to provide pre- and post-construction bathymetric survey data of authorized borrow areas. BOEM, as a steward of the sand and environmental resources, monitors the location of dredging, volumetric change, cut depth, and morphologic response. At present, there are serious limitations in data quality and utility of single-beam data collected along regularly-spaced tracklines. Only coarse generalizations of volumetric change, cut depth, and gross morphologic changes in the borrow area are possible.

Some project proponents have begun voluntarily collecting swath and multi-beam data in recognition of its improved data quality and greater utility. In the North Sea, multi-beam surveys are typically required in the marine aggregate industry because of its application to improved resource and environmental management. BOEM does not have an in-depth appreciation for the possible differences in environmental effects and costs associated with changing the BOEM requirement from single beam to swath or multi-beam bathymetry.

Objectives: Identify the principal differences in environmental effects associated with the use of a different source and survey method/equipment. Ascertain the differences in cost.

Methods: Possible methods include literature and monitoring report syntheses, structured surveys, and quantitative modeling. Perform cost and/or cost effectiveness analyses.

Revised Date: April 1, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: National

Planning Area(s): All

Title: Monitoring Dredging Intensity Using Variable Grid
Analysis of Dredge Quality Management Data

BOEM Information Need(s) to be Addressed: BOEM’s Marine Minerals Program needs to more accurately document and track project-specific and cumulative dredging intensity (location and duration) in the vicinity of the authorized borrow areas and project-specific transit intensity between the borrow-area and pump-out location. 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 Outer Continental Shelf borrow areas and environmental resources.

Approx. Cost: (in thousands) \$150

Period of Performance: FY 2014-2015

Description:

Background: The National Dredge Quality Management (DQM) Program, housed within the United States Army Corps of Engineers (USACE) Mobile District, supports nationwide, automated monitoring of dredging operations for federally-funded or federally-regulated beach nourishment, coastal restoration, and navigation projects. Sensors monitor the location of the plant, plant dragheads or cutterhead, hopper volume, vessel speed, and dredge pump-out, production, and efficiency. DQM data are filtered based on material recovery and pump-out status, and data is 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 OCS dredging operations.

DQM is one tool used by BOEM to ensure dredge contractors are operating in authorized borrow area(s). 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 project proponents the flexibility to access sufficient sand volume in the event that production challenges are encountered during dredging. Typically BOEM maps the dredge location data to determine where the dredge has been operating. 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.

Many of OCS borrow areas are targeted by multiple users and at regular dredging intervals. Even areas being dredged by a single user could be dredged at regular intervals. BOEM does not currently have a 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, and/or time-recovery intervals between uses.

BOEM would like to be able to measure dredge intensity in two ways: physically and temporally. 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 over a project window or multiple projects 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: Quantify dredge intensity in terms of exposure time to improve project characterization, effects analyses, mitigation measures, and resource management. Develop the algorithm to translate point time/location data into a grid representing the total time spent dredging or transiting in a particular area.

Methods: Develop the algorithm to determine the “total time dredging or transiting in a defined location” (unit time/ m²). Develop the GIS framework needed to convert random point location data into an 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 software. Explore cost-sharing and leveraging opportunities with the USACE DQM Support Center.

Revised Date: April 1, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: National

Planning Area(s): All

Title: Support for the Development of an Improved Biostatistical Method to Analyze and Interpret Observations from Marine Mammal Behavioral Response Studies

BOEM Information Need(s) to be Addressed: The Bureau of Ocean Energy Management needs to assess the possible adverse impacts to marine mammals, some of which are protected species, from anthropogenic sounds in the ocean. Sound generated by seismic survey ships is a particular concern. Among the possible adverse impacts from seismic surveying are: temporary or permanent alteration of hearing ability; disruption of feeding activities, breeding, or migration; separation of cow-calf pairs; and masking, wherein prevailing anthropogenic sounds overwhelm essential communication among members of a population. BOEM also needs to put in place operational rules to prevent or at least mitigate for these adverse impacts. Alone or together with industry partners or other federal or state agencies, BOEM has funded research to determine the extent of some of these impacts and to test ramp-up as a mitigation tool. This study seeks to support the development of an improved biostatistical method at the University of Saint Andrews's to improve the estimation of possible adverse effects to marine mammals from acoustical disturbances.

Approx. Cost: (in thousands) \$500

Period of Performance: FY 2014-2015

Description:

Background: With industry partners, BOEM co-funded a multi-year behavioral response study (BRS) of humpback whales seasonally migrating along the east and west coasts of Australia. This was done through the E&P Sound and Marine Life (Joint Industry) Programme (JIP) for the purpose of determining the possible impacts on these animals from seismic surveying sound and to test the mitigation effectiveness of ramp-up (progressively increasing the intensity of sound to the level needed for surveys). The second year of field experiments off the east coast has been completed with great success, obtaining many trials for greater statistical significance. The research team is currently analyzing the voluminous first- and second-year data before proceeding to the west coast experiments, which may be modified in light of the results of the east coast trials.

The Australian BRS is just one of several such investigations. The U. S. Navy, concerned about the impacts on marine life from various sonar systems employed in naval operations, has funded several of them including at permanent sites specifically instrumented for such studies. The multinational Three-S experiment in Norway and a ramp-up study on north Atlantic humpback whales led by a group from Saint Andrews University are two other prominent studies. Whereas much can be learned from any one of them, pooling together all of the data from similar BRSs offers the possibility of greater insight and conclusions formulated with greater statistical significance.

The Multi-study Ocean acoustics Human effects Analysis (MOCHA) investigation at the University of St. Andrews is conducting such an effort. Employing sophisticated biostatistical methods applied to the data from many behavioral response studies, this MOCHA group hopes to enhance the inferences drawn from existing and future BRS data. Specifically, this effort seeks to:

1. improve methods for combining diverse behavioral measures into a single response metric;
2. improve estimates of dose-response functions from individual studies through the use of cutting edge (hierarchical Bayesian) statistical techniques;
3. make scientifically valid predictions about taxa or contexts not yet studied by combining information across studies in a meta-analysis framework, informed by biological knowledge; and
4. conduct sensitivity analyses to quantify where future experimental effort will most reduce uncertainty.

MOCHA is funded by the Office of Naval Research (ONR), which has additionally provided the observations from BRS studies conducted to date by or for the Navy. Adding the observations from the JIP project mentioned above to the pool of MOCHA data would be a significant enhancement of that data pool. The ESP study proposed herein will, with the cooperation of the Australian investigators, add their present and future observations and fund the required increase in personnel to ingest the Australian data into MOCHA and to conduct the additional analyses on that data. Lead MOCHA investigators have had several discussions with the principal investigators of the Australian study, and the Australians are amenable to such a sharing of data and participating in the additional analysis.

Adding BOEM observations to the MOCHA data assembly improves the ability of the MOCHA investigators to develop their more advanced statistical method and provides one more realization of the process to investigate individually.

Objectives:

- (1.) assist in the development of an improved biostatistical method to analyze and interpret observations from marine mammal BRS using acoustical disturbances
- (2.) analyze the east-coast observations from the BOEM-co-funded Australian humpback whale BRS using the improved statistical method (hierarchical Bayesian) statistical techniques)

Methods: This study will provide funding for the integration of the east-coast observations from the Australian humpback whale BRS into the MOCHA data pool (<http://www.creem.st-and.ac.uk/mocha/links>) and for the additional analyses of that data. To accomplish this, one additional full-time post doc will be hired by the MOCHA group. (Two ONR-funded post docs are already employed.) The post doc will spend one year at the University of Queensland's Gatton Campus, near Brisbane, Australia under the guidance of two of the Australian PI's to acquire and become familiar with

observations obtained from the east-coast Australian humpback whale experiments. (The west-coast observations will not be completed before the MOCHA project will terminate, although there may be a successor project to MOCHA that could incorporate the west-coast observations.) The post doc will spend the second year of this effort at the University of St. Andrews, where he/she will assist in the melding of the Australian data into the larger, composite MOCHA data set and assist in the various statistical analyses to be performed on that larger data set. This will be done with the close supervision of one of the MOCHA lead investigators, who will be familiar with the various Bayesian biostatistical models to be used and developed, in part, at the School of Mathematics and Statistics, University of St. Andrews.

The biostatistical approach to be used in analyzing the MOCHA composite data set has been developed by Dr. Len Thomas and several colleagues over several years. Selected papers describing various aspects of this method(s) are referenced here: <http://www.creem.st-and.ac.uk/len/>. Even a short summary of this is beyond the scope of a study profile as well as beyond the knowledge of the author of this profile.

Cost Justification: The approximate cost of this study was based in part on the realized costs of the two ONR-sponsored post docs presently performing essentially the same work on the U. S. Navy's SOCAL data. Travel to and from Australia for the first-year's work and some salary support for part-time efforts by two of the Australian PI's were included in the cost computation as was overhead charged by the University of Queensland. Living expenses in Australia and Scotland were factors in determining the post-doc stipend to be paid. Saint Andrews University waived its overhead charges for the post doc during his/her year in Australia. There will be staff time, fringe benefits, and overhead charges for one St. Andrews faculty member working with the post doc part-time during his/her second year work (performed in Scotland).

Revised Date: April 3, 2013

2.3 FY 2015 Table

Table 3. Headquarters Studies Proposed for the Fiscal Year 2015 NSL

| SDP Page Number | Discipline | Study Title |
|-----------------------------|---|--|
| 51 | FE | Managing Dredging Impacts by Optimizing the Use of Sand Resources |
| 55 | PO | Sediment Character Modification During Dredging, Pump-out, and Placement Operations for Beach Nourishment Projects |
| 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 2014-2016

Region: National

Planning Area(s): All

Title: Managing Dredging Impacts by Optimizing the Use of Sand Resources

BOEM Information Need(s) to be Addressed: BOEM needs to develop a planning process to manage individual project and cumulative effects resulting from repeated use of sand resource borrow areas. One way to manage effects is to optimize the use of sand resources by developing borrow area management plans. A suitable borrow area planning methodology needs to be developed and tested.

Approx. Cost: (in thousands) \$500 **Period of Performance:** FY 2015-FY2016

Description:

Background: The typical beach nourishment and/or coastal restoration program involves an initial larger-scale construction phase followed by smaller-scale, regularly scheduled maintenance cycles. The fill material 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 over a 50 year or even longer period. In coastal areas where sand is scarce and multiple use conflicts are common, a single borrow area could also be used for the construction of several adjacent beach fill or coastal restoration programs. In this context, different types of sand bodies are dredged to different cut depths over different footprints. In many instances, the approach to managing dredging intensity is not systematically planned; transport distance and dredge productivity are the primary determinants of where dredging occurs. Fill performance, funding availability, construction windows, and dredge plant availability typically drive when and where dredging occurs.

Each dredging event diminishes not only the availability of sand resources, but the profile of the sand body or sheet, which potentially affects local and residual hydrodynamics, substrate composition, or the morphologic response of the sand body, *etc.* These interrelated affects, which could be magnified 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 these risks 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 is collected during or across construction cycles and could be used to constrain and validate anticipated impacts, BOEM cannot accurately estimate dredging intensity using monitoring data.

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. Furthermore, 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 benthic and essential fish habitat, benthic communities, and federally managed fisheries. As is consistent with the tenets of coastal and marine spatial planning, the preparation of a borrow area management plan is suggested to frame BOEM's resource management responsibility, and could help focus NEPA analysis, Essential Fish Habitat consultation, and National Historic Preservation Act (NHPA) Section 106 coordination to drive better environmental and stewardship outcomes. This management strategy necessitates advanced planning using a systematic framework that incorporates long-term project design, engineering, and economic requirements while considering sand resource availability and impact-minimizing strategies. This untested planning process could constrain the spatial and temporal effects that potentially contribute to persistent impacts.

Use optimization employs a four-tiered approach, starting with a detailed assessment of the sand resource and regional sediment transport dynamics (e.g., accretion from sediment transport convergence), as well as project engineering requirements (e.g., sand quality, design volume, and fill frequency). The second tier integrates environmental considerations into this planning framework, such as areas of avoidance and operational windows. The third tier integrates best-practice dredging techniques and mitigation measures that are expected to further minimize overall dredging intensity and persistent effects, and to maximize recovery from ecosystem perturbations while still meeting project objectives (e.g., rotating dredge areas; dredging accretional, leading edges of shoals). The fourth tier monetizes costs and benefits of use, including construction, mitigation, and monitoring costs and potential changes in ecosystem services. A multi-criteria analytical approach can help initially balance the range of project factors (Huang et al. 2011). Analysis of monitoring data and lessons learned from iterative projects provides an opportunity to further refine the borrow area management plan (Michel et al. 2004).

Objectives:

Develop planning procedures for optimizing sand resources while diminishing potential impacts.

Demonstrate 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: Methods proposed for this study include data compilation, literature review and syntheses, GIS analyses, and coordination with stakeholders. Additional data collection could be warranted to fill important data gaps. Historical sand and environmental resources information, including mitigation measures, for OCS borrow

area(s) must be compiled and analyzed to prepare the draft borrow area management plan(s). Preparation of the draft borrow area management plan could require a cost effectiveness analysis, multi-criteria decisional analysis, or equivalent statistical/econometric analysis.

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Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: National

Planning Area(s): All

Title: Sediment Character Modification During Dredging, Pump-out, and Placement Operations for Beach Nourishment Projects

BOEM Information Need(s) to be Addressed: BOEM needs to determine the extent of sediment sorting during dredging, handling, and placement processes associated with coastal restoration activities. This is because project proponents must ensure that borrow area sediments comply with accepted criteria to match grain size and sorting of native beach sediments; therefore, if fine-grained sediments are in fact sorted out prior to completion of coastal restoration activities, large areas of the OCS could currently be unnecessarily excluded as viable borrow areas. This information could be very important because alternative OCS borrow areas could potentially be dredged where lesser environmental impacts would result, and could expand the available inventory of borrow areas with suitable nourishment material.

Approx. Cost: (in thousands) \$400-500 **Period of Performance:** FY 2015-2016

Description:

Background: Many coastal states have stringent requirements for the quality of beach fill material that can be used in beach nourishment projects. This is 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. The characteristics that constitute beach-compatible sand varies from state to state, but in general, a typical beach grain-size distribution ranges from fine- to medium-grained sand. Some states require that the fill material must not contain more than 5 to 10% silt or clay and/or that the grain size distribution must be within a certain tolerance of the mean and sorting coefficient of the native beach sand. To satisfy these beach fill requirements, many beach nourishment project sponsors are moving towards potentially more environmentally sensitive areas (i.e., offshore sand ridges, shoals, capes) to find beach compatible sediment in sufficient quantity. If alternative borrow areas characterized by sand with relatively higher fractions of finer material could be deemed as containing potentially suitable sediments, different environmental tradeoffs could be considered, and/or different environmental outcomes could be realized. For example, although there is more offshore turbidity and sedimentation associated with hopper dredging and overflow of finer sediments compared to coarser sediments, those short-term impacts could be less disturbing or damaging than the alternative of dredging unique habitat, which may be important to benthic/pelagic food web dynamics and/or managed fish species.

Currently, sand sources that could have a slightly higher fine-fraction are often excluded from potential use in the initial phases of project planning, if the source and native materials do not comply with accepted criteria. However, this decision may be overly precautionary if all that fundamentally matters is the sediment characteristics at the beach at some interval after construction. It is expected that a substantial proportion of the already minor amount of fine-grained sediment in borrow area sediments is sorted out, so that a coarsening of the grain size distribution occurs. Anecdotal information and post-construction monitoring data indicate a repeated tendency towards coarsening; however, no systematic, controlled study has clearly demonstrated the degree of sorting relative to the operational phase. Between dredging, pump-out, and placement operations, sediment is entrained, dewatered, and re-slurried several times. The sediment handling process generally includes initial mechanical and jet disturbance and entrainment by a draghead and cutterhead; possible screening if screens are installed on the plant; subsequent dewatering in and overflow of turbid water from the dredge hopper; subsequent re-slurrying and overflow during pump-out and pipeline conveyance operations; and, finally, slurried discharge at the beach. During each phase, sorting and other character changes are anticipated to occur. At each phase, it is suspected that the finer-grained fraction is suspended in the water column (or re-suspended by breaking waves in the case of pipeline discharge) and advected by coastal ocean currents in turbidity plumes (Baird et al. 2004). It is also important to evaluate the potential for short-term sediment character changes during dredging and 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 so that the use of borrow areas previously determined to be unsuitable could be explored.

The dredging-related research conducted at the U.S. Army Corps of Engineers' (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 2010); cohesive sediment dynamics are not generally applicable to the dynamics expected with comparatively sandier sediments of the OCS. The 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 and Hitchcock, 1992); characterizing overflow sedimentation (Hitchcock et al., 1999;); or modeling hopper sedimentation, overflow, and sediment plume dynamics (van Rhee 2002; Baird & Associates et al. 2004; Spearman, J. et al. 2007; Braaksma et al. 2007). There is no known domestic study to date that has used a systematic and controlled method to document sediment character modification during the beach nourishment process (Smith, J., personal communication, June 2012; Smith, R., personal communication, June 2012). By expanding BOEM's knowledge of sediment characteristic changes that occur prior to the completion of coastal restoration activities, it is possible that the inventory of potential borrow areas could be increased, thereby introducing additional sources of finite sand resources available for use.

Objective:

- Assess 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 proclivity of sediment coarsening via removal of fine-grained sediments.

Methods: Field methods to determine potential sediment sorting and character changes in context of seasonal, inter-annual, and event-driven variability could include repeat geotechnical sampling, concurrent oceanographic and turbidity measurements, and sediment tracer studies. During operations, the borrow area, hopper, pipeline discharge, and beach must be sampled and a laboratory analysis conducted to ascertain sediment grain size, color, sorting, flocculation behavior, and settling velocity. Use of particle imaging videography/modeling methodology could be employed 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 explore partnerships with the USACE ERDC, dredging contractors, beach project engineering firms, and other vested stakeholders to manage funds and maximize collaboration.

Revised Date: March 29, 2013

SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2016

3.1 Shifting Baselines

As climate patterns shift, so do the ecosystems and their biological assemblages. These natural shifts along with major man-made events result in altered baselines. Future ESP work is likely to continue efforts to reestablish baselines and assess the changes from previous states. To cover large areas with the highest resolution, the ESP will engage new technologies. Efforts already underway to use high definition aerial surveys could be expanded along with undertaking new surveys using autonomous vehicles. An understanding of the new ecological and oceanographic baselines will be critical to making sensible decisions about what mitigations and stipulations to emplace. This reassessment is essential to providing accurate information to include in sections of NEPA documents that characterize the affected environments.

This direction is consistent with ecosystem-based management practices and with the NOP's revised Implementation Plan. Future initiatives will be designed flexibly to align with regional initiatives and directives and to take advantage of the results of meetings and workshops in specific disciplines or geographic areas.

3.2 Monitoring

In conjunction with the research on changing baselines, increased emphasis will be needed on monitoring environments in areas where development is 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 address changes in the biological, oceanographic and atmospheric regimes. Data collected during monitoring efforts will 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 mitigations and stipulations in place.

In the Gulf of Mexico Region particularly, increased monitoring efforts will focus on social and economic impacts and the movements of and contaminants in affected wildlife. Efforts there will be coordinated carefully with activities under the National Resource Damage Assessment to ensure there is no conflict.

3.3 Partnering in Arctic Research

Research needs in the Arctic Ocean increasingly have 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, the National Ocean Policy and several federal assessments have called generally for increased interagency collaborations in Arctic research. In particular, President Obama recently signed Executive Order 13580 (Executive Office of the President, 2011) to coordinate the efforts of Federal agencies responsible for overseeing the safe and responsible development of onshore and

offshore energy resources and associated infrastructure in Alaska and to help reduce our 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), the Environmental Protection Agency, the Fish and Wildlife Service, the USGS, and a consortium of French agencies to address sustainability issues in the Arctic. This integrated effort is aimed at providing a scientifically robust approach for decision making and is known as ArcSEES (Arctic Science, Engineering and Education for Sustainability). Additionally, BOEM is also partnering with NOAA and Russian institutions in the transboundary tracking of ice seals between the Chukchi and Okhotsk Seas.

From a more technical perspective, BOEM is leading an interagency (NSF, NOAA, ONR, USCG, U.S. Arctic Research Commission [USARC] and U.S. Navy) planning effort to use gliders and autonomous underwater vehicles in the Beaufort and Chukchi Seas to answer a number of questions across several disciplines (e.g. marine biology, physical oceanography, marine archaeology) and from different perspectives (e.g., ecosystem dynamics, climate change, oil spill risk analysis). 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 real projects. While much of the coordination effort with our partners is managed through the Headquarters office, Regional leadership and participation in working groups and in managing the actual studies is a critical component to bring the 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. Understanding of acoustic effects had long been an issue of concern for the ESP and it will continue to be explored. Work in marine minerals may focus on long-term monitoring of dredge sites and comparative studies.

3.6 Ocean Planning

Regional ocean plans in the long-run will inform the Bureau's regulatory and leasing functions. It is anticipated that these plans will reduce multi-use conflicts, facilitate environmental stewardship and enhance regulatory certainty. The Bureau's environmental science and assessment functions will assist the planning exercise in multiple ways. Many ongoing scientific studies will provide 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 will design studies to serve these needs. 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 will provide valuable input to the Regional planning process. Currently ESP is coordinating the ocean planning initiative within BOEM and across various DOI Bureaus.

3.7 New Geographic Areas for Science

Interest in renewable energy prospects remains on a rising curve. Along with continued and expanding interest in wind energy development along the Atlantic coast line, the possibility of wind energy in Hawaii is increasing. The particular application of offshore wind turbines in this area could be considerably different than that in the Atlantic due to different bottom topographies, wind regimes and other uses in the target areas. The potential for hydrokinetic energy applications offshore of the Pacific Northwest coast is also advancing. The state of information in these areas will need to be assessed, gaps identified and studies proposed to generate information needed to support potential bureau activities. While many of these efforts will be housed in the Pacific Region, the potential scope of these requirements may be significant at the national scale.

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BOEM Environmental Studies Program

Fiscal Years 2014-2016 Studies Development Plan

Alaska OCS Region

U.S. Department of the Interior
Bureau of Ocean Energy Management
Alaska OCS Region
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2013

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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.

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ACRONYMS and ABBREVIATIONS

| | |
|----------|--|
| ADCP | Acoustic Doppler Current Profiler |
| ADF&G | Alaska Department of Fish and Game |
| AEWC | Alaska Eskimo Whaling Commission |
| AKMAP | Alaska Monitoring and Assessment Program |
| ANIMIDA | Arctic Nearshore Impact Monitoring in Development Area |
| Approx. | Approximate |
| ASP | Alaska Annual Studies Plan |
| AOOS | Alaska Ocean Observing System |
| AUV | Autonomous Underwater Vehicle |
| BLM | Bureau of Land Management |
| BOEM | Bureau of Ocean Energy Management |
| BOEMRE | Bureau of Ocean Energy Management, Regulation and Enforcement |
| BOWFEST | Bowhead Whale Feeding Ecology Study |
| BPXA | British Petroleum Exploration Alaska |
| BRD | Biological Resources Division (USGS) |
| BSMP | Beaufort Sea Monitoring Program |
| BSEE | Bureau of Safety and Environmental Enforcement |
| BWASP | Bowhead Whale Aerial Survey Project |
| CAB | Chemistry and Benthos |
| cANIMIDA | Continuation of Arctic Nearshore Impact Monitoring in Development Area |
| CESU | Cooperative Ecosystem Studies Unit |
| CHAOZ | Chukchi Acoustics, Oceanography and Zooplankton study |
| CIAP | USDOJ Coastal Impact Assistance Program |
| CIRCAC | Cook Inlet Regional Citizens Advisory Council |
| CMI | Coastal Marine Institute |
| COMIDA | Chukchi Offshore Monitoring in Drilling Area |
| CTD | Conductivity, Temperature, Depth sensor |
| DFO | Department of Fisheries and Oceans Canada |
| DPP | Development and Production Plan |
| EA | Environmental Assessment |
| EFH | Essential Fish Habitat |
| EIS | Environmental Impact Statement |
| EP | Exploration Plan |
| EPA | Environmental Protection Agency |
| ERMA | Environmental Response Management Application |
| ESA | Endangered Species Act |
| ESP | Environmental Studies Program |
| EVOSTC | Exxon Valdez Oil Spill Trustee Council |
| FY | Fiscal Year |
| GIS | Geographic Information Systems |
| GOA | Gulf of Alaska |
| GOM | Gulf of Mexico |
| GPS | Global Positioning System |
| HF | High Frequency |
| IFO | Intermediate Fuel Oil |

| | |
|-------|---|
| ITM | Information Transfer Meeting |
| IUM | Information Update Meeting |
| JIP | Joint Industry Program |
| LCC | Landscape Conservation Cooperative |
| LCI | Lower Cook Inlet MMPA Marine Mammal Protection Act |
| MMS | Minerals Management Service |
| NASA | National Aeronautics and Space Administration |
| NEPA | National Environmental Policy Act |
| NMFS | National Marine Fisheries Service |
| NMML | National Marine Mammal Laboratory |
| NOAA | National Oceanic and Atmospheric Administration |
| NODC | National Oceanographic Data Center |
| NOPP | National Oceanographic Partnership Program |
| NOS | National Ocean Service |
| NPRB | North Pacific Research Board |
| NSB | North Slope Borough |
| NSSI | North Slope Science Initiative |
| NSF | National Science Foundation |
| NSL | National Studies List |
| OCS | Outer Continental Shelf |
| OCSLA | Outer Continental Shelf Lands Act |
| OSRA | Oil-Spill-Risk Analysis |
| OSU | Oregon State University |
| OWM | Oil Weathering Model |
| PMEL | Pacific Marine Environmental Laboratory |
| RCAC | Regional Citizens' Advisory Council |
| SDI | Satellite Drilling Island |
| SOAR | Synthesis of Arctic Research |
| TAR | Technology Assessment and Research |
| TK | Traditional Knowledge |
| UAA | University of Alaska Anchorage |
| UAF | University of Alaska Fairbanks |
| UAS | Unmanned Aircraft System |
| uERD | ultra-Extended Reach Drilling |
| URI | University of Rhode Island |
| USACE | U.S. Army Corps of Engineers |
| USDOI | U.S. Department of the Interior |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| UW | University of Washington |
| WHOI | Woods Hole Oceanographic Institution |

SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

1.1.1 Background

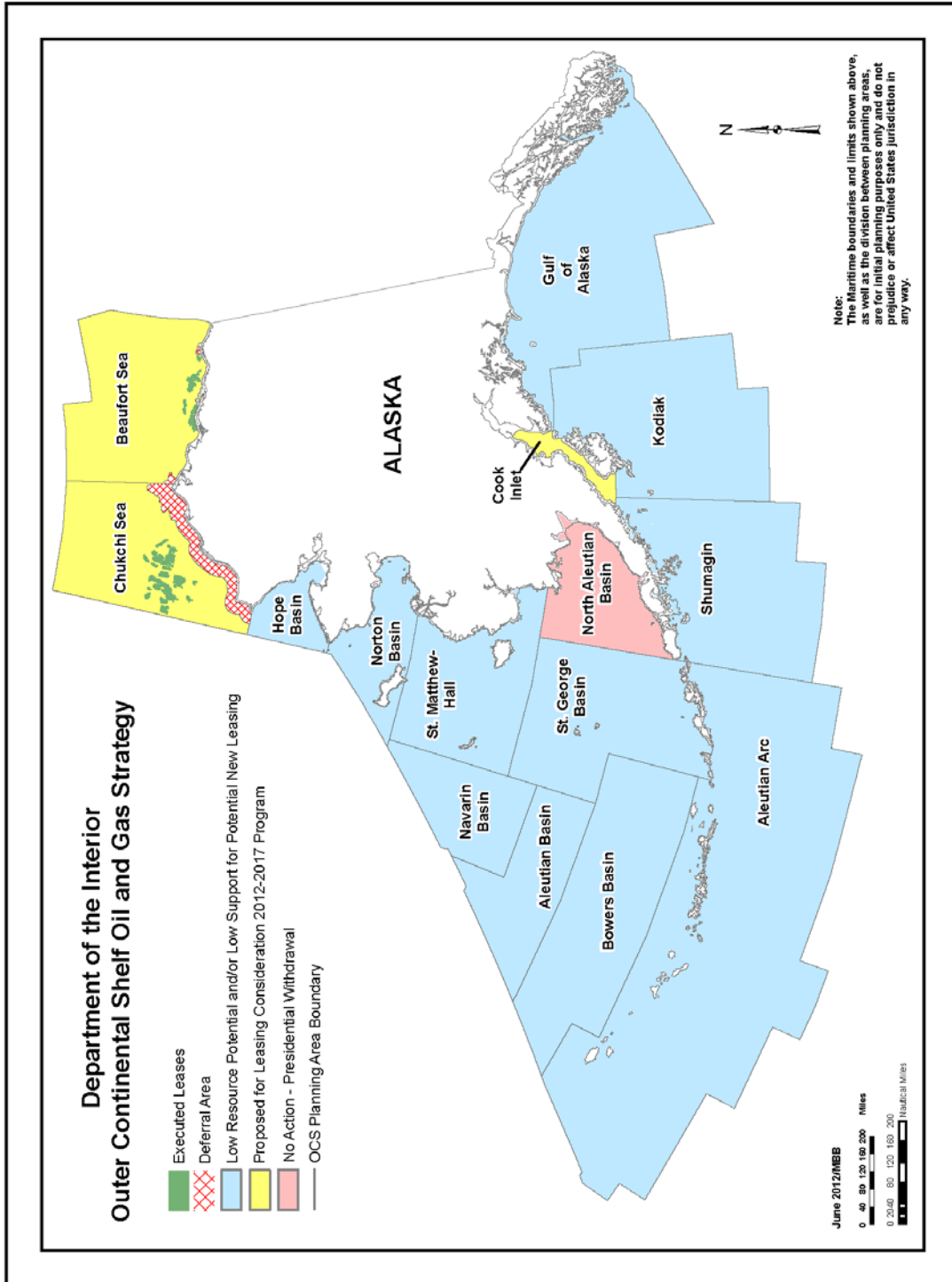
The Environmental Studies Program (ESP) of the Bureau of Ocean Energy Management was established and funded by the United States Congress to support the offshore oil and gas leasing program of the U.S. Department of the Interior (USDOI) in pursuit of national energy policies. The Environmental Studies 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 needed for assessment and management of potential impacts from oil and gas development on the Outer Continental Shelf (OCS) and coastal environments. 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 guidelines 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, including 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 Exploration Plans (EP's) and Development and Production Plans (DPP's). Of course, a wide range of arctic 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) 2012. More than \$400 million of that amount has funded studies in Alaska (see Figure 1) across 15 planning areas in

Figure 1. Alaska OCS Region Planning Areas



the Arctic, Bering Sea and Gulf of Alaska sub-regions 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 60) 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.

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 to BOEM decision needs. 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); U.S. Geological Survey (USGS)-Alaska Science Center; U.S. Fish and Wildlife Service (USFWS) and the Arctic Landscape Conservation Cooperative (LCC); USDOJ 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), Oregon State University (OSU), University of Washington (UW), Idaho State University, and University of Rhode Island (URI). The ESP also coordinates closely with active industry research and monitoring programs in Alaska conducted by British Petroleum, 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 \$17 million of agency funds into \$34 million worth of relevant marine-based research. During that time, the CMI program has also provided roughly 120 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 committed \$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 (CESU's). The CESU's are working partnerships among leading academic institutions, Federal, State, and non-governmental organizations. A national network of seventeen CESU's has been established, with each unit focusing 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 CESU's 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 September 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 relevant to interagency consultations under the Endangered Species Act and other processes. Ideas for new research also 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. We also 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 job 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 5-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 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 September, when the cycle starts all over again.

Once a research project achieves funding and gets underway, interim reports and project websites facilitate report dissemination and data sharing. When a project is complete, final study reports are posted at <http://www.boem.gov/BOEM-Newsroom/Library/Publications/Alaska-Scientific-and-Technical-Publications.aspx>, http://www.data.boem.gov/homepg/data_center/other/espis/espisfront.asp, 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 currently 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 Addition of a New Studies Planning Tool

While the well-established process of studies planning described above has served to meet agency and stakeholder information needs over the last four decades, we believe that a variety of new realities in the Arctic warrant development of additional science planning and assessment measures. Some of the more relevant pressures include: greater maritime traffic and global access to the region through loss of sea ice; greater social demand for access to energy resources from offshore leases; greater demand by stakeholders for more scientific precision in NEPA documents; greater public expectation for transparency in government planning and decision-making; and greater demand by senior government officials to demonstrate research coordination and data sharing among Federal agencies. In a spirit of adaptive management to meet these changing circumstances more effectively, the Alaska OCS Region has set a new course to supplement its environmental studies and assessment information collection process with an additional management tool. We call this new tool under construction the “data status matrix.”

In brief, once constructed the data status matrix is intended to facilitate more efficient identification of research priorities and better communication among Federal subject-matter experts, managers, decision-makers, and external stakeholders about the relative status of scientific information currently available for different categories of environmental resources. For each specific OCS planning area, each phase of development, and each specific data category of interest (such as the Beaufort Sea, lease sales, abundance estimates of bowhead whales), the data status matrix would evaluate the quality of knowledge available to assessment analysts on that topic by choosing a rank order from 0 to 4, with 0 representing the lowest level of knowledge (no data) and 4 representing the highest level (profuse data). Separate matrix sheets would be developed for different categories of resources, grouped according to relevance (such as species or family level taxa). Each matrix cell evaluation would maintain a corresponding brief bibliography of key sources to justify the assigned rank evaluation. As the matrix tool develops and matures over time, it is anticipated that its value will grow and become rather indispensable to promote more precise and productive scientific identification and collaboration over fluctuating information needs and research priorities.

1.1.5 Issues To Be Addressed

The *Alaska Studies Development Plan FY 2014-2016* 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 Seismic and Acoustic Impacts
- Understanding Social and Economic Impacts

- Maintaining Efficient and Effective Information Management
- Integrating Scientific Results with Local and Traditional Environmental 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 by mitigating 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 Sea and the Chukchi Sea include, but are not limited to:

- What refinements are there 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 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 in Cook Inlet?
- How do we improve our model predictions of the fate of potential oil spills in locations with extensive intertidal areas?

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 is an essential part of the pre-lease process that requires environmental information. This introduces an additional time-sensitivity to the information need. Although much information exists for certain Alaska OCS lease areas, data are sparse in other areas. In addition, changing conditions and environments often lead to the need to update past studies so that EIS information is current and accurate.

On June 28, 2012, BOEM released the *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017* (USDOJ, 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 planned 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 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 sale was held in order to provide information for decision making and EIS's. However, not all needed information can be obtained prior to a 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:

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

Figure 2. Chukchi Sea Oil and Gas Leases

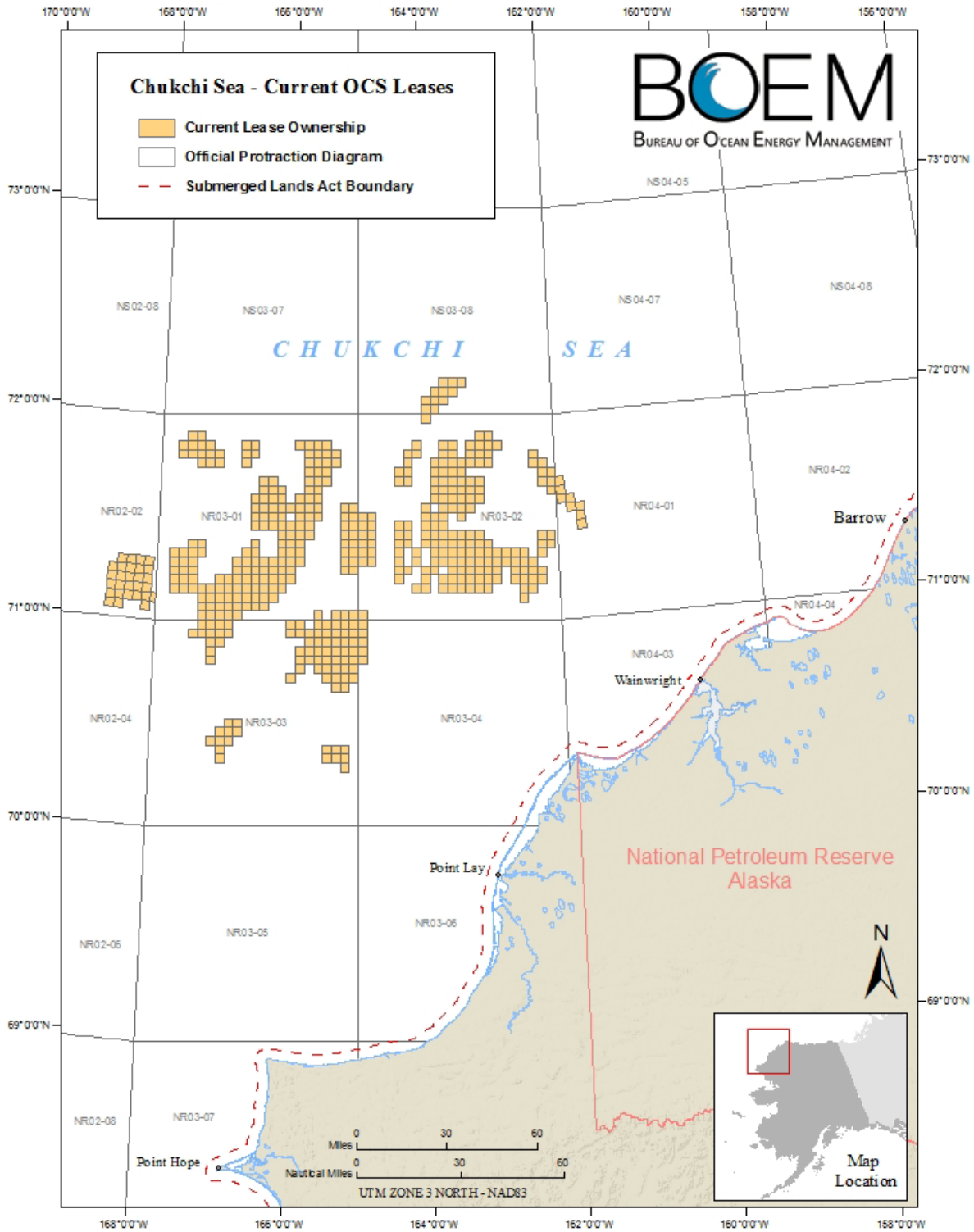


Figure 3. Beaufort Sea Oil and Gas Leases

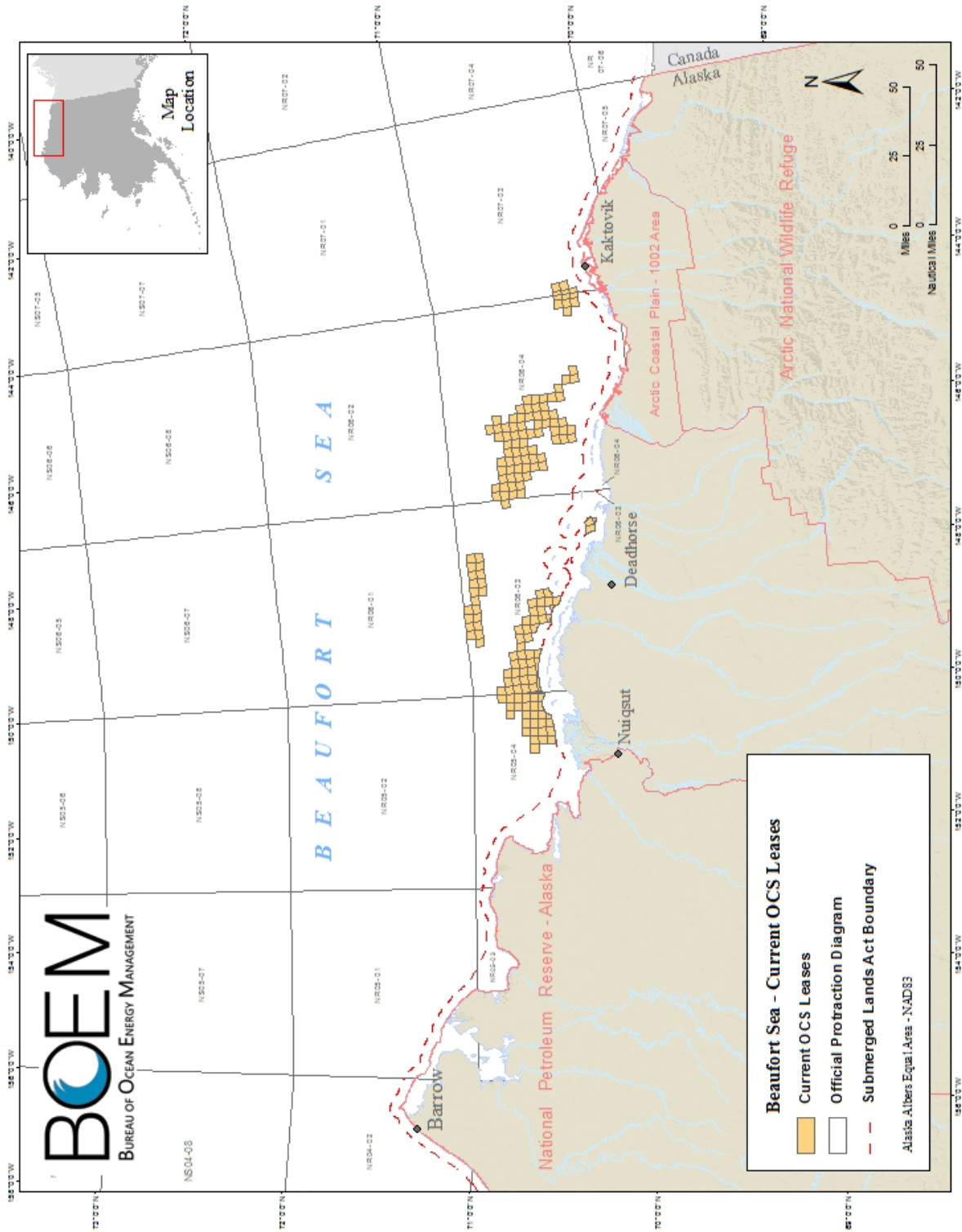
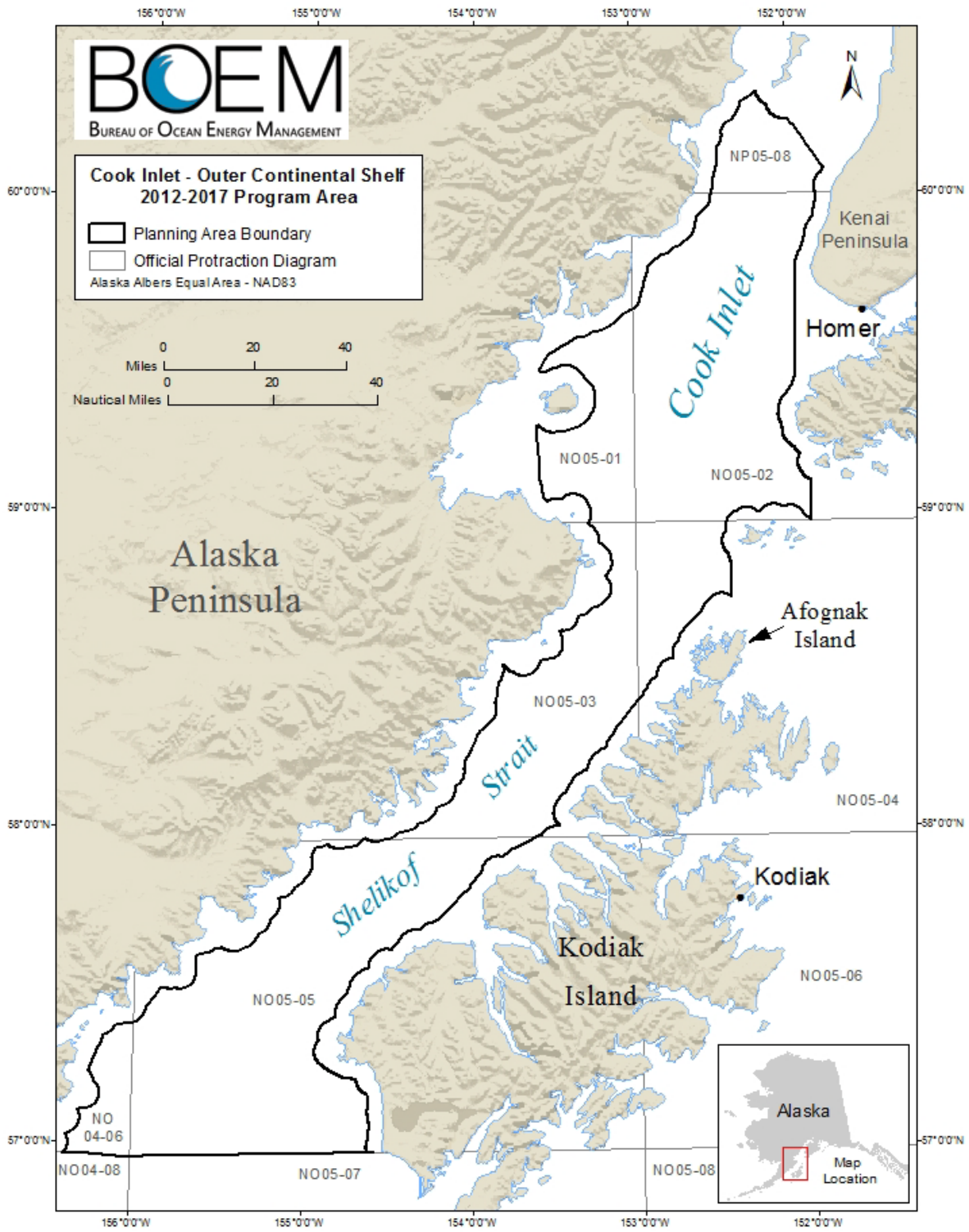


Figure 4. Cook Inlet Planning Area



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. As of April 2013, there are 183 active leases in the Beaufort Federal offshore area. Lease Sale 193 in February 2008, resulted in 487 leases being issued in the Chukchi Sea Planning Area. 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. British Petroleum 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 through July 2012 is nearly 156 million barrels; with the Federal portion comprising about 27.8 million barrels.

Development:

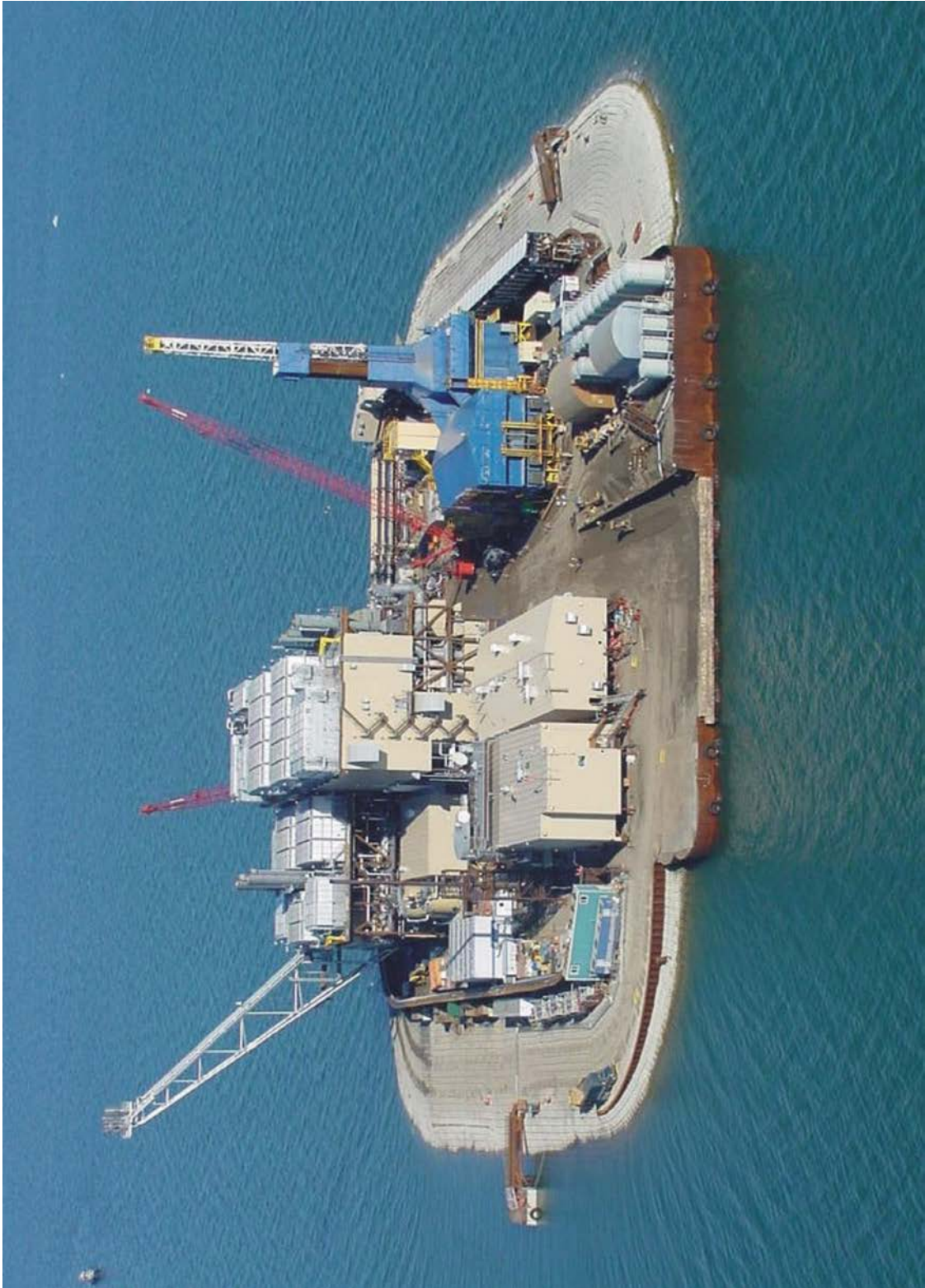
Liberty – The Liberty prospect is located in the central Beaufort Sea about 6 miles east of the existing Endicott Satellite Drilling Island (SDI). BPXA is considering development options, including potential construction of a gravel island. BPXA estimates that the reserves for the Liberty project total 105 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 Shell’s Beaufort Sea Exploration Plan 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 Native Alaskan villages have completed their subsistence hunts and Shell has received approval from BOEM to resume activity. During 2012, Shell completed the top hole section of one well at its Sivulliq Prospect in the Beaufort Sea. Because of problems encounter with towing its drill rig out of Alaska in December 2012, Shell will not be returning to complete its well until 2014.

Conditionally Approved Exploration Plan for the Chukchi Sea – Shell proposes drilling up to six exploration wells in Alaska’s 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. BOEM approved the Chukchi Sea EP subject to 15 conditions on December 16, 2011. 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

Figure 5. Northstar Island, August 2000



sufficient time for response and cleanup in the unlikely event of a late season oil spill. Consistent with the Department's cautious approach to offshore oil and gas exploration in the Arctic, Shell was directed not to drill into hydrocarbon zones after September 24 in the Chukchi Sea. 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 under the Exploration Plan 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. Because of problems encountered with towing its drill rig out of Alaska in December 2012, Shell will not be returning to complete its well until 2014.

Air Quality: The Consolidated Appropriations Act of 2012 effectively 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/or Beaufort Sea OCS no longer require an air quality permit from the EPA. Rather, their proposed facilities' emissions will be reviewed monitored by BOEM as a prerequisite to approval of the operator's proposed 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 1980s.

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

Native Village of Point Hope v. Salazar, No. 1:08-cv-00004-RRB (D. Alaska) (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.

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

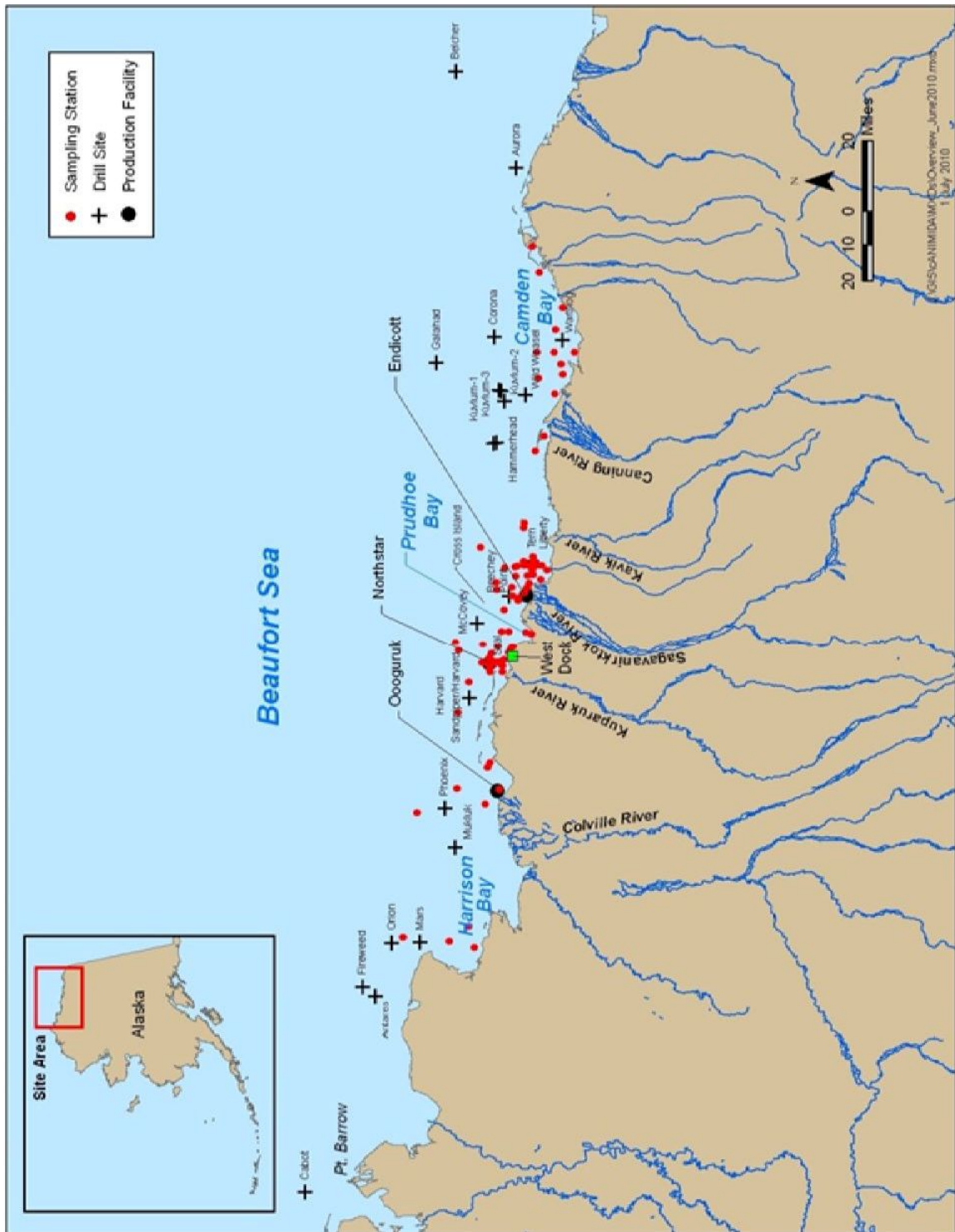
Both offshore and onshore oil and gas development and production activities are continuing across Alaska's North Slope. Residents of Nuiqsut, Kaktovik and Barrow are particularly concerned about long-term effects of offshore developments at Northstar and other possible developments, as well as long-term and cumulative effects of any exploration from OCS Beaufort Sea lease sales. Interagency reviews of related submitted plans and related NEPA analyses could lead to additional recommendations for monitoring impacts of Northstar and other possible developments. Key constituents have identified the need to monitor under-ice currents, sedimentation and potential effects on social systems/subsistence 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" 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 and Other Kelp Communities in the Development Area," begun in 2012, and "ANIMIDA III: Contaminants, Sources, and Bioaccumulation," that has been expanded to include Camden Bay and is slated to launch in FY 2013.

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.

The study "Data Interface Tools to Support Environmental Analyses: Interpretation of Existing Marine Mammal Data" is proposed for FY 2014. This project will integrate and analyze existing marine mammal data from various sources (e.g., passive acoustics,

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



aerial surveys, tagging studies) to facilitate visualization and interpretation by NEPA analysts and decision-makers. The “Synthesis of Oceanographic and Climate Data for Environmental Assessments and Model Validation,” proposed for FY 2015 will compile and synthesize oceanographic measurements collected in the Beaufort and Chukchi seas to produce climatologies of various parameters. In the future, the results of these studies, along with results from similar efforts in other disciplines, may be merged into a single data management framework that would provide ready access for cross-discipline analysis and interpretation.

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 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 of and seasonal changes in the distribution of polynyas, leads, and landfast ice.

Information about ice gouge characteristics and recurrence rates is needed to assess risks associated with burial of oil production pipelines to support BOEM’s fault tree modeling. The study “Integrated Seabed Surveys in the Arctic Ocean: Bathymetry, Archaeological Resources, and Ice Gouge Magnitude and Recurrence Rates” is proposed for FY 2014. Results from geophysical surveys of the seabed will be used to produce statistics on ice gouge characteristics in areas of potential industry interest in the Beaufort and Chukchi seas.

Air Quality: The transfer of authority to BOEM to regulate industrial emissions in Arctic OCS areas 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 study “Arctic Air Quality Impact Assessment Modeling,” planned to start in FY 2013, will compile a dataset of emission sources that will be used to drive EPA-approved air quality models.

Pollutants: North Slope villagers 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 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.

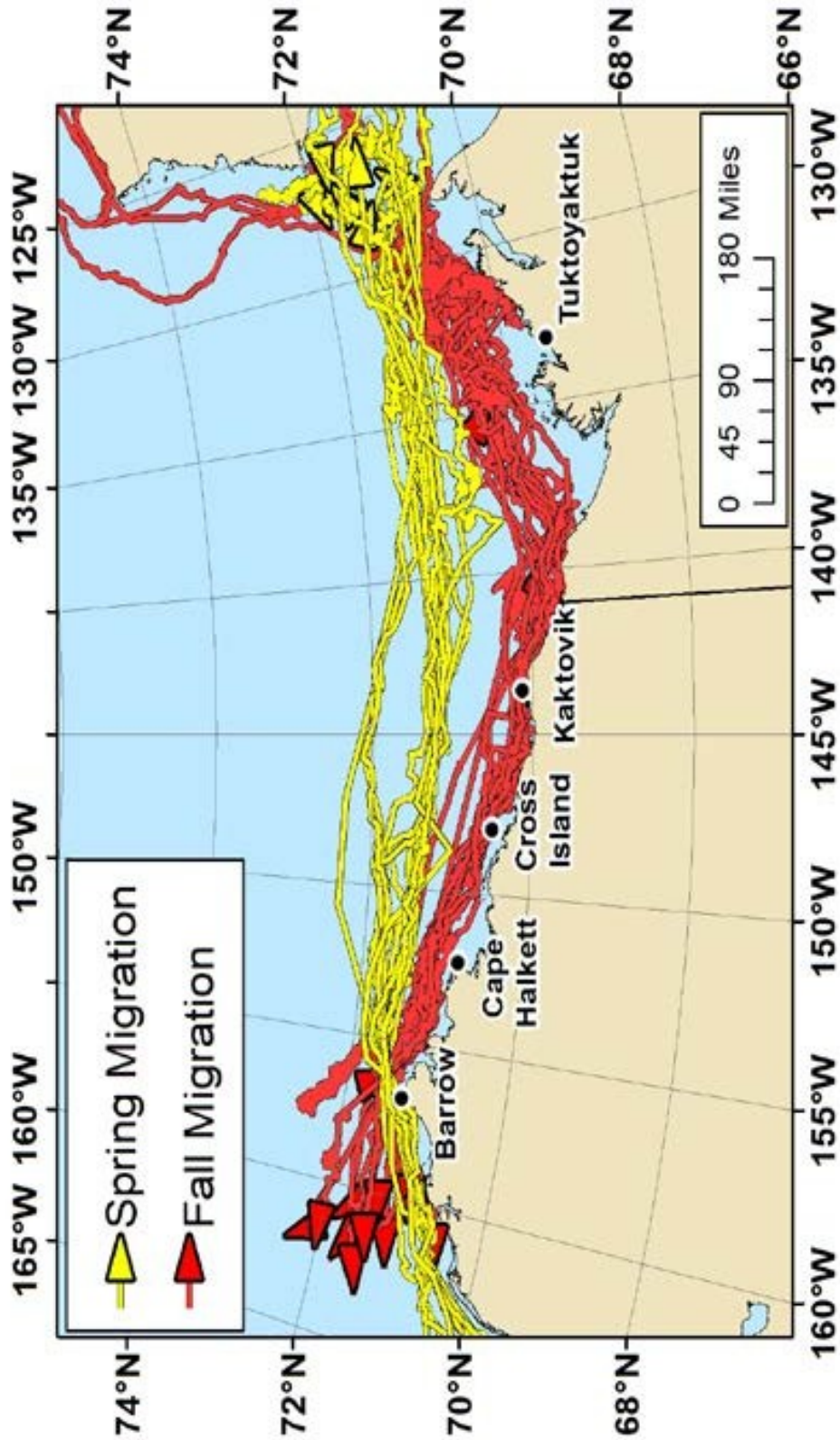
Information on Bowhead Whales and Other Wildlife: The Iñupiat rely heavily on bowhead whales for subsistence. The bowhead whale is central to village cultural and spiritual life. Whale hunters have reported that migrating bowhead whales deflect from their normal migratory route well upstream of active industry vessels and may divert a great distance from their migration route. A concern is that deflection around oil and gas-industry activity (including seismic surveys, drilling activity and associated icebreaker support) makes whales skittish and more difficult to hunt. Figure 7 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 are needed for 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 industry 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, fish assemblages and populations 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

Figure 7. Tracks from satellite-tagged bowhead whales during the spring and fall migrations (Quakenbush et al. 2012)



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 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 a number of species, including Arctic cod (adult and late juvenile), Pacific salmon (adult and late juvenile), and saffron cod (adult and late juvenile).

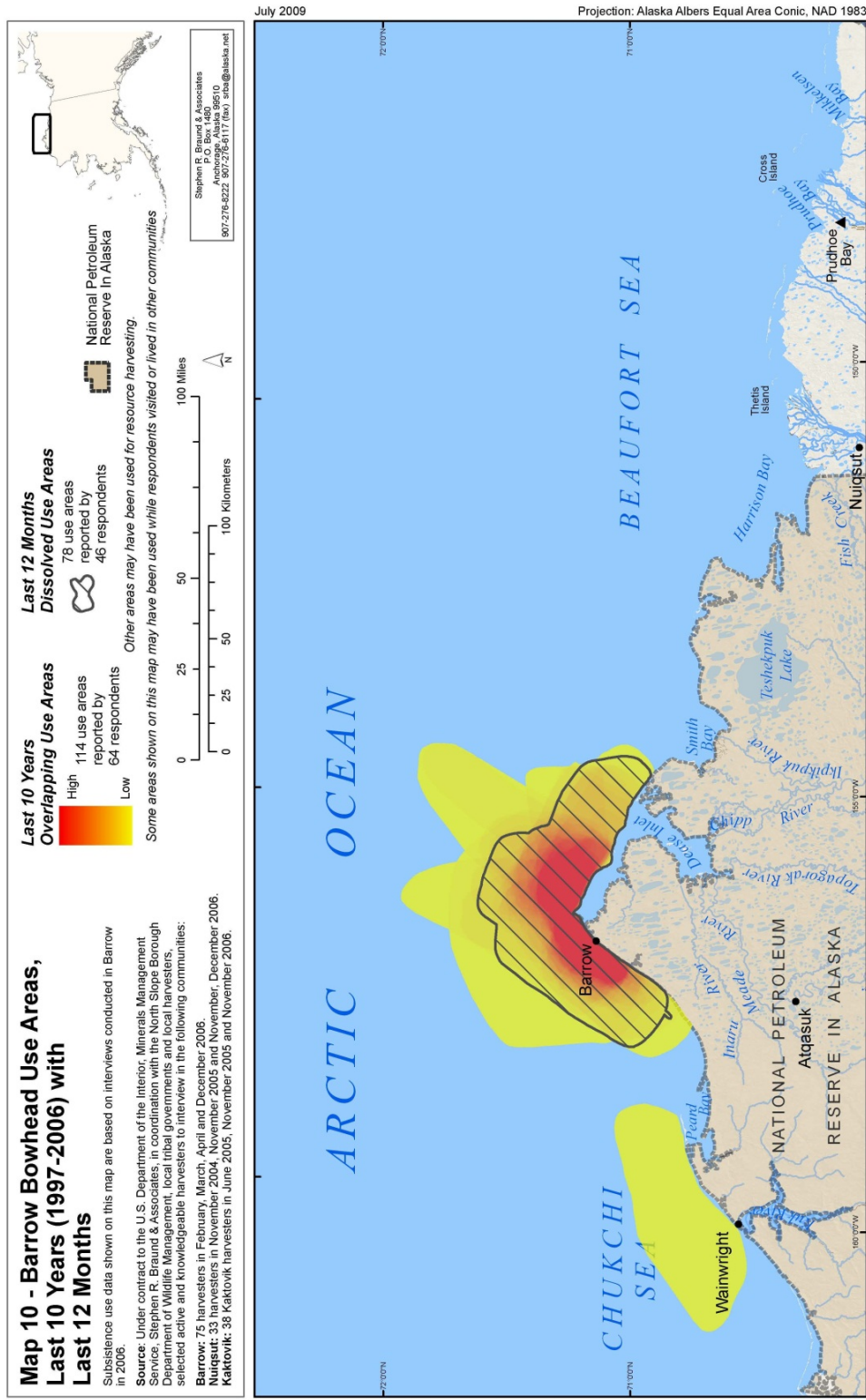
Native Culture: The Iñupiat report in public testimony that their culture is vulnerable to short-term, long-term and cumulative effects from OCS activities. They are concerned that OCS activities might lead to:

- 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 8 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 an issue of concern also. 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. To address this need, the study “Integrated Seabed Surveys in the Arctic Ocean: Bathymetry, Archaeological Resources, and Ice Gouge Magnitude and Recurrence Rates” is proposed for FY 2014.

Figure 8. A synthesis map depicting bowhead whale subsistence hunting use areas for the community of Barrow over time. (Stephen R. Braund & Associates, 2009)



1.3.2 Chukchi Sea General Information Needs

The fundamental issues in the Chukchi Sea are very similar to 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 USDOJ placed less emphasis on studying the Chukchi Sea than the Beaufort Sea beginning in the mid-1990s 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 more than \$50 million (through FY 2011) 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 for NEPA analysis to support 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 new 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 will continue the ecological monitoring of the recently completed Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA): Chemistry and Benthos (CAB) study and extend 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 will also 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 three-year study “Chukchi Acoustics, Oceanography and Zooplankton (CHAOZ): Hanna Shoal” planned to begin in FY 2013 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 will assess 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 will extend the research of the “Bowhead Whale Feeding Ecology Study” (also known as BOWFEST) research into the Chukchi Sea and expand the scope to include other cetacean species.

Air Quality and Meteorology:

Mesoscale Meteorology: Accurate specification of the surface wind and stress field is essential to predict ocean and ice circulation, and to improve oil spill models. In partnership with UAF, this study conducts a long-term hindcast simulation with an optimized data-modeling system to produce a high resolution meteorological dataset and to document climatological features of the Beaufort/Chukchi Seas. This study includes development of a database that synthesizes meteorological observations from nearly 200 locations across northern Alaska, covering the period 1979-2009 and encompassing several different observational networks (see Figure 9).

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 (HF) 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.

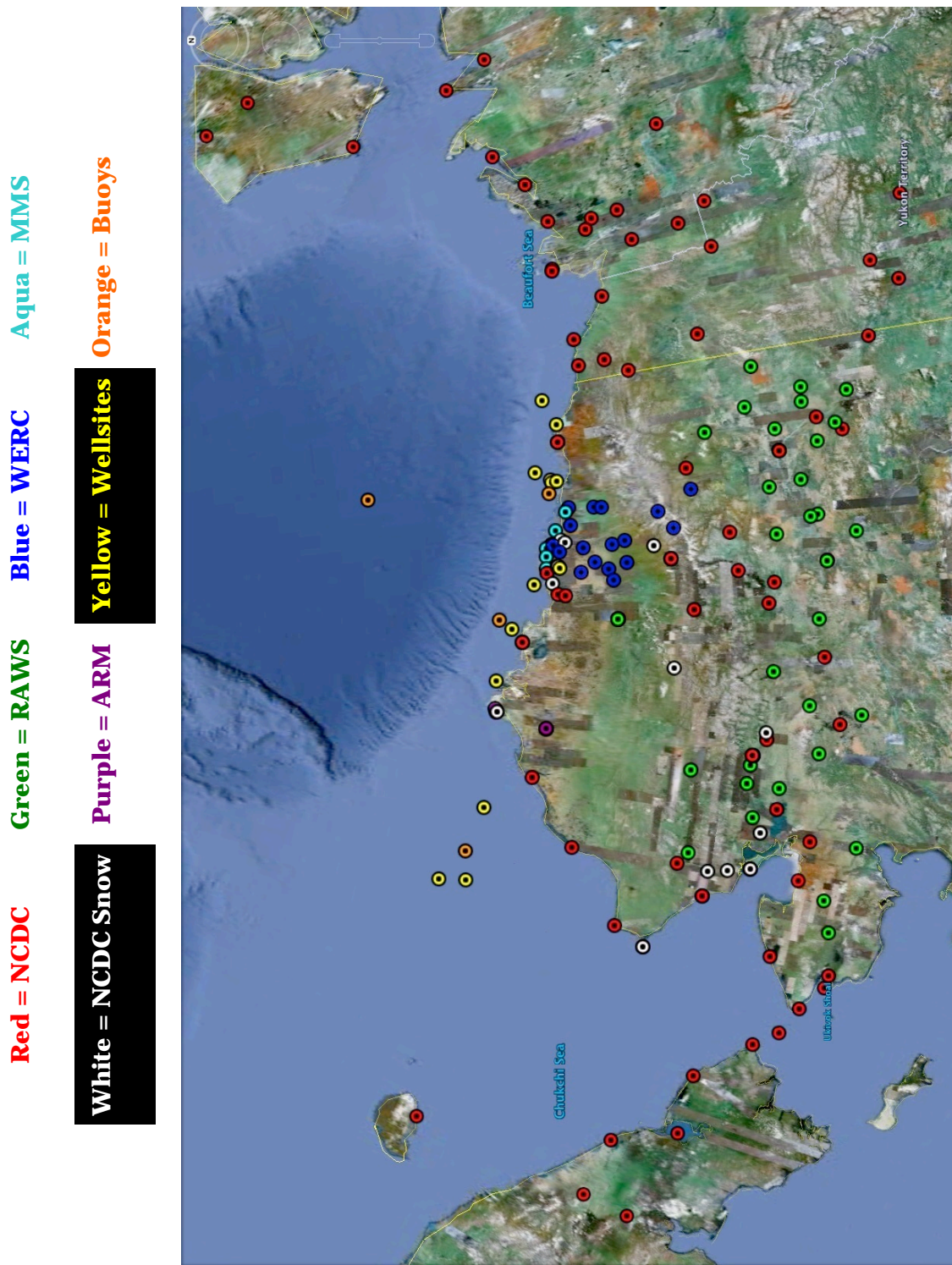
Arctic Circulation Modeling: This study, in collaboration with Rutgers University, will adapt a coupled ice-ocean circulation model to represent the physical processes, especially circulation, within the Chukchi and Beaufort seas. The study will conduct a multi-decadal hindcast simulation to provide surface circulation, ice and forcing fields for use in BOEM Oil-Spill-Risk Analyses (OSRA).

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 interannual variation

Figure 9. Locations of meteorological data synthesized as a part of the Mesoscale Meteorology Modeling Study Phase II (<http://mms-meso.gi.alaska.edu/>)



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 Giprobyflot, 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.

Beaufort Sea Marine Fish Monitoring in the Central Beaufort Sea: In partnership with UAF, this study designs a long-term fish monitoring plan for the central Beaufort Sea and implements a survey to establish baseline knowledge of fish species, distribution and relative abundance in the region.

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.

Social Systems:

Impact Monitoring for Offshore Subsistence Hunting: There is acute need for more information about offshore subsistence activities along the Chukchi coast, especially in the vicinity of Wainwright and Point Lay, where future offshore development might make landfall. This study gathers long-term monitoring data to allow BOEM to assess whether OCS activities in the Chukchi Sea will result in changes to offshore subsistence hunting practices.

Study of Sharing Networks to Assess the Vulnerabilities of Local Communities to Oil and Gas Development Impacts in Arctic Alaska: In collaboration with UAF, this study investigates contemporary subsistence food distribution and consumption patterns for residents living near areas of offshore oil and gas exploration. It identifies key nodes and thresholds in community food distribution networks to assess their relative vulnerabilities and resiliency to change. Study areas include Wainwright, Kaktovik and Venetie.

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 2013 and Ongoing Studies

Table 1 lists new studies planned to start in FY 2013 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 2013 and Ongoing Studies

| NSL # | Study Title | Planning Area(s) | Start FY | Partners |
|---|---|-------------------|----------|----------|
| * PLANNED NEW STARTS (FY 2013) | | | | |
| Air Quality | | | | |
| AK-13-01 | Arctic Air Quality Impact Assessment Modeling | Beaufort, Chukchi | 2013 | |
| Physical Oceanography | | | | |
| AK-12-03b | Applications for Mapping Spilled Oil in Arctic Waters | Chukchi | 2013 | |
| AK-13-04 | Enhanced Verification and Interpretation of Arctic Ice Formation, Distribution, and Density | Beaufort, Chukchi | 2013 | |
| Fates and Effects | | | | |
| AK-11-14b | ANIMIDA III: Contaminants, Sources, and Bioaccumulation | Beaufort | 2013 | |
| Marine Mammals and Protected Species | | | | |
| AK-13-02 | Chukchi Acoustic, Oceanography and Zooplankton Study: Hanna Shoal (Extension of CHAOZ) | Chukchi | 2013 | |

| | | | | |
|---|---|-------------------|------|------|
| AK-13-06 | Walrus Seasonal Distribution and Habitat Use in the Eastern Chukchi Sea | Chukchi | 2013 | |
| Information Management | | | | |
| AK-12-01-01 | Workshop—Interagency Protocols for Immediate On-Scene Arctic Oil Spill Impact Science | Beaufort, Chukchi | 2013 | |
| AK-12-01-02 | Cook Inlet Workshop: Information Status & Research Planning | Cook Inlet | 2013 | |
| <i>*Note: The procurement of any study is contingent upon availability of funding</i> | | | | |
| ONGOING STUDIES | | | | |
| Air Quality | | | | |
| AK-06-05 | Beaufort/Chukchi Seas Mesoscale Meteorology Modeling Study Phase II | Beaufort, Chukchi | 2006 | |
| 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-09-06 | Application of HF Radar to Potential Hydrocarbon Development Areas in the Northeast Chukchi Sea | Chukchi | 2009 | CMI |
| AK-12-03a | Characterization of the Circulation on the Continental Shelf Areas of the Northeast Chukchi and Western Beaufort Seas | Beaufort, Chukchi | 2012 | |
| NT-08-02 | Adaptation of Arctic Circulation Model | Beaufort, Chukchi | 2011 | |
| 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-11-02 | Oil Spill Occurrence Estimators for Onshore Alaska North Slope Crude and Refined Oil Spills | 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 | |
| Habitat and Ecology | | | | |
| AK-07-05 | Arctic Fish Ecology Catalogue | Beaufort, Chukchi | 2009 | BRD |
| 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-08-12-07 | Epifaunal Communities in the Central Beaufort Sea | Beaufort | 2011 | CMI |
| AK-08-12-09 | Population Assessment of Snow Crab, <i>Chionoecetes opilio</i> , 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 | FWS |
| 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-11-13a | Arctic Cod Pilot Genetics and Toxicity Study | Beaufort, Chukchi | 2011 | USGS |

| | | | | |
|---|--|-------------------|------|------------|
| AK-12-04 | U.S.-Canada Transboundary Fish and Lower Trophic Communities | Beaufort | 2012 | DFO |
| AK-12-06 | Distribution and Habitat Use of Fish in the Nearshore Ecosystem of the Beaufort and Chukchi Seas | Beaufort, Chukchi | 2012 | NOAA |
| Marine Mammals and Protected Species | | | | |
| AK-05-02 | Populations and Sources of Recruitment in Polar Bears | Beaufort, Chukchi | 2005 | DFO |
| AK-06-01; AK-10-01 | Bowhead Feeding Variability in the Western Alaska Beaufort Sea: Satellite Tracking of Bowhead Whales | Beaufort, Chukchi | 2005 | ADF&G |
| AK-06-01; AK-10-02 | Bowhead Feeding Variability in the Western Alaska Beaufort Sea: Oceanography and Feeding | Beaufort, Chukchi | 2006 | NMML |
| AK-07-04a | Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area (Loons) | Chukchi | 2007 | BRD |
| AK-07-08 | Pinniped Movements and Foraging: Bearded Seals | Chukchi | 2007 | NMML |
| 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 | BRD |
| AK-09-05 | Demography and Behavior of Polar Bears Summering on Shore in Alaska | Beaufort, Chukchi | 2009 | BRD, 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-12-07 | Use of the Chukchi Sea by Endangered Baleen and Other Whales (Westward Extension of BOWFEST) | Beaufort, Chukchi | 2012 | NMML |
| AK-12-x10b | Abundance Estimates of Ice Associated Seals: Bering Sea Populations that Inhabit the Chukchi Sea during Open-Water Period | Chukchi | 2012 | NMML |
| Social Systems | | | | |
| AK-05-04a | Study of Sharing Networks to Assess the Vulnerabilities of Local Communities to O&G Development Impacts in Arctic Alaska | Beaufort, Chukchi | 2007 | CESU-UAF, NSF |
| AK-08-01 | Continuation of Impact Assessment for Cross Island Whaling Activities | Beaufort | 2008 | NMML |
| AK-08-04 | COMIDA: Impact Monitoring for Offshore Subsistence Hunting | Chukchi | 2009 | |
| AK-08-06 | Subsistence Study for North Aleutian Basin | Bering | 2009 | |
| AK-08-09 | Aggregate Effects Research & Environmental Mitigation Monitoring of Oil Operations in the Vicinity of Nuiqsut | Beaufort | 2009 | NSSI |
| AK-08-12-04 | Subsistence Use and Knowledge of Beaufort Salmon Populations | Beaufort | 2009 | CMI |
| AK-11-09 | Social Indicators in Coastal Alaska: Arctic Communities | Beaufort, Chukchi | 2011 | |
| Information Management | | | | |
| AK-10-03 | Alaska Marine Science Symposium (co-sponsor) | Beaufort, Chukchi | 2010 | NPRB |
| AK-10-04 | Management, Logistics, and Warehouse Storage of Oceanographic Equipment | Beaufort, Chukchi | 2010 | |
| 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-05-04a | Study of Sharing Networks to Assess the Vulnerabilities of Local Communities to O&G Development Impacts in Arctic Alaska | Beaufort, Chukchi | 2007 | CESU-UAF, NSF |
| AK-06-01; AK-10-02 | Bowhead Feeding Variability in the Western Alaska Beaufort Sea: Oceanography and Feeding | Beaufort, Chukchi | 2006 | NMML |
| AK-08-04 | COMIDA: Impact Monitoring for Offshore Subsistence Hunting | Chukchi | 2009 | |
| AK-08-09 | Aggregate Effects Research & Environmental Mitigation Monitoring of Oil Operations in the Vicinity of Nuiqsut | Beaufort | 2009 | NSSI |
| 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-12-04 | U.S.-Canada Transboundary Fish and Lower Trophic Communities | Beaufort | 2012 | DFO |
| AK-12-07 | Use of the Chukchi Sea by Endangered Baleen and Other Whales (Westward Extension of BOWFEST) | Beaufort, Chukchi | 2012 | NMML |

RESEARCH PARTNERSHIPS

| | |
|--|--|
| BSEE Technology Assessment and Research Program (TAR) | Alaska Department of Fish and Game (ADF&G) |
| BOEM-University of Alaska-State of Alaska Coastal Marine Institute (CMI) | Cooperative Ecosystem Studies Unit (CESU)- University of Alaska Fairbanks (UAF); University of Texas-Austin (UT) |
| North Slope Science Initiative (NSSI) | North Pacific Research Board (NPRB) |
| USGS/Biological Resources Division (BRD) | Arctic Landscape Conservation Cooperative |
| Canadian Department of Fisheries/Oceans (DFO) | Arctic Council / Arctic Monitoring and Assessment Programme (AMAP) |
| National Science Foundation (NSF) | National Oceanographic Partnership Program (NOPP) |
| National Fish and Wildlife Foundation | Alaska Ocean Observing System (AOOS) |
| Federal Inter-agency Agreements: e.g. NOAA-National Marine Fisheries Service (NMFS) / National Marine Mammal Laboratory (NMML) / PMEL (Pacific Marine Environmental Laboratory) / U.S. Fish and Wildlife Service (USFWS) | Industry Studies |

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SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

The BOEM Alaska OCS Region proposes ten 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 2013 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:

1. An updated status of each study.
2. Report due dates.
3. Related publications.
4. Affiliated websites.

For completed Alaska OCS Region Studies, go to:

<http://www.boem.gov/BOEM-Newsroom/Library/Publications/Alaska-Scientific-and-Technical-Publications.aspx>.

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2.2 Profiles of Studies Proposed for FY 2014 NSL

Table 2. BOEM Alaska OCS Region Studies Proposed for the FY 2014 NSL

| Page Number | Discipline | Ranking | Study Title |
|---|------------|---------|---|
| 41 | SE | 1 | Subsistence Mapping of Wainwright, Point Lay, and Point Hope |
| 43 | FE | 2 | Physical and Chemical Analyses of Crude and Refined Oils: Laboratory and Mesoscale Oil Weathering |
| 45 | MM | 3 | Data Interface Tools to Support Environmental Analyses: Interpretation of Existing Marine Mammal Data |
| 47 | HE | 4 | Genomics of Arctic Cod: A Sentinel Species in a Changing Environment |
| 49 | PO | 5 | Cook Inlet Circulation Model Calculations |
| 51 | PO/HE | 6 | Ecological Processes in Lower Cook Inlet and Kachemak Bay: A Partnership in Monitoring |
| 53 | HE | 7 | Benthic Invertebrate Habitats in Cook Inlet |
| 55 | MM | 8 | Polar Bear Habitat Use, Ecology, and Population Status in the Chukchi Sea |
| 57 | PO/SE | 9 | Integrated Seabed Surveys in the Arctic Ocean: Bathymetry, Archaeological Resources, and Ice Gouge Magnitude and Recurrence Rates |
| 61 | MM | 10 | Baleen Whale Distribution, Abundance, and Ecology in Cook Inlet and Shelikof Strait |
| AQ = Air Quality IM = Information Management PO = Physical Oceanography | | | FE = Fates & Effects MM = Marine Mammals & Protected Species SE = Social & Economic Sciences |
| | | | HE = Habitat & Ecology |

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Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Subsistence Mapping of Wainwright, Point Lay, and Point Hope

BOEM Information Need(s) to be Addressed: This study will provide baseline subsistence mapping data to monitor community impacts in the vicinity of the Chukchi Sea leased area. Systematic mapping of last decade and last twelve months subsistence harvest in Wainwright, Point Lay, and Point Hope will complement and add value to OCS Study 2009-003 (*Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow*). BOEM analysts and decision makers will use the information in NEPA analysis and documentation for lease sales, EP's and DPP's and in post-sale and post-exploration decision-making in the Chukchi Sea.

Approx. Cost: (in thousands) \$750

Period of Performance: FY 2014-2017

Description:

Background: The oil and gas industry has invested significant resources leasing tracts in the Chukchi Sea and is interested in exploring and potentially developing these leases. To assure methodological continuity over time for a potentially large exploration area, appropriate planning and implementation of post-lease monitoring baselines are needed. BOEM would benefit from an updated geospatial baseline in the communities of Wainwright, Point Lay, and Point Hope, and identify key harvest areas, trails, camps, and intensive use areas. This effort will enable more precise assessment of impacts and contribute to cumulative effects analyses.

Objectives: This study will parallel and match the objectives expressed in OCS Study MMS 2009-003, and will be a companion volume for providing baseline information on the Chukchi Sea. The study will gather and map long term (10 years) subsistence data and associated traditional and local knowledge to help assess whether OCS oil development activities in the Chukchi Sea will result in changes to onshore subsistence hunting practices. It will provide a time series or longitudinal record of subsistence activities over the last decade to document land use patterns and to develop a baseline from which to understand the potential impacts of any future development action. Specific objectives include:

- Consulting subsistence harvesters from Wainwright, Point Lay, and Point Hope about land use activities – where they hunted and what they harvested – delineating use over the past decade and then depicting use over the past year on map overlays.
- Recording discussion and topics of interest to provide supporting data.
- Addressing the methodological problem of respondent recall and accuracy, especially as related to “time.”

- Correlating hunter tract lines with environmental variables and socio-economic variables that explain land-use patterns.
- Drawing upon local knowledge and best available science as sources of information.
- Defining the intensity of use per species harvested over a 10-year period and in the last year (or last trip as duration).
- Developing geospatial layers to be used for modeling purposes.

Methods: This project will entail extensive community engagement. Early procedures will involve organizations such as the North Slope Borough Wildlife Management Department, the Alaska Eskimo Whaling Commission, the Iñupiat Community for the Arctic Slope, the Native Village Traditional Councils for Wainwright, Point Lay, and Point Hope and others as appropriate. The effort will include the compilation of information regarding subsistence geospatial patterns from BOEM and other studies conducted in Wainwright, Point Lay, and Point Hope. It will assess the quality of existing geospatial data and convert to Geographic Information System (GIS) format where possible. The study will gather primary source data regarding current subsistence effort, and use of resources from knowledgeable residents of Wainwright, Point Lay and Point Hope. The data collection effort will coordinate with other relevant BOEM studies.

Contractors will disseminate ongoing and final products of study to local residents through community workshops and integrate workshop feedback into the final analysis. All final spatial information on subsistence and industry activity will be put into a GIS or GIS compatible format for use by BOEM for NEPA analyses. The final product will include a descriptive report that is at least as explicit as OCS Study MMS 2009-003.

BOEM will seek to establish partnerships in this work with other organizations and agencies, including NSF and BLM.

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea, Cook Inlet

Title: Physical and Chemical Analyses of Crude and Refined Oils:
Laboratory and Mesoscale Oil Weathering

BOEM Information Need(s) to be Addressed: The Alaska OCS Region uses an oil weathering model (OWM) to provide NEPA analysts with a common, quantitative set of spill weathering parameters. Weathering of spilled oil and persistence of its most toxic components vary depending on the specific characteristics of the oil. Currently, NEPA analysts in the Alaska OCS Region must make assumptions about these processes because only a small subset of oil samples specific to the Alaska OCS and North Slope have been analyzed for use in the SINTEF OWM. In particular, the addition of new low-sulfur marine diesel fuels to the library would be especially useful information for analysts to use in upcoming NEPA assessments.

Approx. Cost: (in thousands) \$450

Period of Performance: FY 2014-2016

Description:

Background: The rate of oil dispersion into the water column calculated by the OWM is used to estimate whether State and Federal water quality standards and criteria would be exceeded by a spill, over what area and for how long. The model calculates the area covered by a spill, an important parameter for estimating effects, but the OSRA does not. The model also calculates the persistence of the lighter, but most toxic components of the oil slick. This calculation allows analysts to directly estimate persistence of toxicity, rather than assume for purposes of analysis that these toxic components persist over the first three days of a spill. Because the size of a spill affects its weathering, the model helps distinguish between effects of large ($\geq 1,000$ bbl) and small ($< 1,000$ bbl) spills. The *in situ* viscosity and degree of emulsification provided by the model are used in assessing the mitigation by and effectiveness of oil spill countermeasures such as mechanical recovery, dispersant, and in-situ burning.

This proposed research will be informed by results from the study “Validation of the Two Models Developed to Predict the Window of Opportunity for Dispersant Use in the Gulf of Mexico” conducted by the Bureau of Safety and Environmental Enforcement’s Technology Assessment and Research Program. That project aims to validate and improve two correlation models that were developed to predict the window of opportunity for successful chemical dispersant use in the Gulf of Mexico (GOM). That project will also evaluate the sensitivity of the models to various oil weathering parameters.

Objectives: This study will provide weathering characteristics of representative Alaskan OCS crude and marine fuel oils and expand the existing SINTEF oil weathering model library of oil compositions.

Methods:

- Research and compile existing updated oil weathering data for Alaska State and OCS crude oils within the last 5 years.
- Enter existing lab weathering data for Alaska State and OCS crude and marine fuel oils into the SINTEF oils library.
- Conduct lab and mesoscale oil weathering on 8-10 Alaskan crude or condensate oils (including: Oooguruk, Nikiakchuq, Badami, Endicott, Northstar, Point Thompson, Alpine, Alaska North Slope, Cook Inlet) and 2-4 refined oils (low-sulfur marine diesel, IFO and Bunker C).

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea, Cook Inlet

Title: Data Interface Tools to Support Environmental Analyses:
Interpretation of Existing Marine Mammal Data

BOEM Information Need(s) to be Addressed: Recent and planned offshore leasing, oil and gas exploration, and plans for development and production have increased managers' need for various types of environmental information. Some of this information is readily available, but other information requires analysis to facilitate interpretation by managers. This study will increase the speed at which certain data is analyzed to make it available to managers in BOEM, BSEE, National Ocean Service (NOS), NMFS, and other agencies.

Approx. Cost: (in thousands) \$400

Period of Performance: FY 2014-2016

Description:

Background: Natural resource managers are required to make decisions using the best available information. While multiple studies directed at Arctic marine mammals have been supported in recent years, managers have recently identified new needs for specific information about marine mammals. For instance, BOEM managers seek information on marine mammal presence in the Beaufort and Chukchi seas by month or by season, as well as information on "special" areas used by various marine mammals for feeding, resting, etc. In addition, NOAA's National Ocean Service is developing an Arctic Environmental Response Management Application (ERMA) with support from USDOJ/BSEE; this effort also requires detailed information on Arctic marine mammal seasonal abundance and locations of special use areas. Some of the products requested by managers require additional field work, but many of the products can be prepared using data already in hand. This study will provide the analytical resources needed to develop products on a timeline that meets the needs of agency managers.

Objectives:

- Support continuing analysis of existing data and provide statistics and graphics in reports to address information needs of BOEM analysts and managers
- Analyze existing acoustics data on calls of Arctic marine mammals to provide information on seasonal distribution in the Chukchi and Beaufort seas.
- Integrate aerial survey data with satellite tag data on ice seal movement patterns to infer the seasonal distribution and numbers of ribbon and spotted seals in the Chukchi Sea, and to infer the use of polynyas or lead systems for bearded, spotted, and ribbon seals.
- Delineate important areas for feeding, breeding, pupping, resting, etc. for Arctic marine mammals.

Methods: This study will focus on the analysis, write-up, and packaging of existing data on Arctic marine mammals to meet the needs of BOEM analysts and managers in the Alaska OCS Region. Available marine mammal information, including data collected through industry-sponsored research and BOEM-funded projects with the National Marine Mammal Laboratory, will be synthesized and analyzed. Specific methods for analysis will depend on the data being analyzed. Methodologies will include procedures to account for variable search effort in order to ensure valid and reliable data products. Managers will be consulted to obtain a clear understanding of their information needs and priorities. The primary deliverable will be a dataset suitable for use with GIS applications for integration with other relevant environmental data, such as prey information and oceanographic climatologies. This project will be coordinated with ongoing efforts such as NOAA's CetMap and ERMA, OBIS-SEAMAP, and the BOEM-NOAA Marine Cadastre partnership to ensure maximum utility of the results.

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Genomics of Arctic Cod: A Sentinel Species in a Changing Environment

BOEM Information Need(s) to be Addressed: To evaluate potential development effects in NEPA documents BOEM needs to understand whether Arctic cod on the OCS are part of a single pan-mictic population or part of more vulnerable sub-populations, and whether or not they exhibit genetic characteristics that will enable them to adapt to retreating sea ice and continue to feed their upper trophic predators. Thus, Arctic cod dynamics are important to multiple EFH- and ESA-related NEPA analyses.

Approx. Cost: (in thousands) \$300

Period of Performance: FY 2014-2017

Description:

Background: Arctic cod (*Boreogadus saida*) are estimated to funnel 93% of lower trophic energy to upper trophic predators including birds, seals, polar bears, beluga whales, and eventually to humans. Although Arctic cod are considered a sentinel species in the U.S. Arctic marine ecosystem, information about them is limited because of the difficulty of studying this ice-associated species. Despite the recognized importance of Arctic cod it is unknown whether there is a single pan-mictic population or whether there are sub-populations. This is an important distinction with respect to potential impact assessment. A sub-population limited to a smaller geographic location or a specialized habitat in the OCS would be more vulnerable to impact from an offshore development than a pan-mictic population spread across the circumpolar Arctic. BOEM needs a greater understanding of the ecological role this sentinel species plays as the primary pathway funneling lower trophic production to many marine mammals, birds and fish.

In 2012, a successful BOEM-funded pilot study conducted by USGS in collaboration with a Canadian genetics lab demonstrated that there is in fact a genetic break somewhere between the Chukchi/Western U.S. Beaufort and far eastern Canadian waters. This genetic break indicates that, rather than a single pan-mictic Arctic cod population, there may indeed be sub-populations. The pilot study relied on samples collected in 3 separate BOEM surveys in the northeast Chukchi and the western and central Beaufort seas. Now that a genetic break has been identified, it is important to fill in the large spatial area between the Central U.S. Beaufort and the far eastern Canadian Beaufort with additional genetic samples and analyses to delineate sub-populations.

Additionally, a greater understanding of the ability of Arctic cod to survive and adapt as the ice retreats is needed to separate potential effects of oil and gas development on Arctic cod and its predators from the cumulative effects of climate change. Recent climate-change modeling suggests that as the arctic ice retreats Arctic cod may be at risk of extirpation in the OCS by 2030. Genetics, transcriptomes and genomics can provide insight into whether any Arctic cod lifestages are truly ice-obligate or whether they are

simply ice-associated or ice-dependent and can potentially adapt to retreating ice conditions. Identifying whether there are genetically separated sub-populations, particularly near-shore and off-shore populations, could provide a clue that there may be differential adaptability due to differential gene expression rather than different genes. Transcriptomes can identify differential expression of the single 'antifreeze' gene that may confer adaptability to loss of ice habitat. Genomics can facilitate transcriptomics by identifying additional genes associated with possible ice-obligation.

The large spatial gap from the eastern U.S. Beaufort Sea across the Mackenzie River Canyon into the Western Canadian Beaufort coincides with the footprint of the current field study "US-Canada Transboundary Fish and Lower Communities." That field study will collect the genetic samples needed for the work described here. The USGS Alaska genetics lab, which recently published similar groundbreaking Polar Bear genetics research, will lead the Arctic cod lab research.

Objectives:

- Identify genetic differences that would change the BOEM approach to Arctic cod effects analyses from evaluating Arctic cod as a single pan-mictic population to evaluating several geographic sub-populations of Arctic cod.
- Test hypotheses that onshore/offshore differences in the extent of ice-obligation genes may be related to differences in either genes (genetics) or gene expression (transcriptomics).
- Test hypothesis that ability to survive loss of Arctic ice may be related to differences in gene expression (transcriptomes).
- Test the ice-obligate hypothesis by identifying both differential genetic ('deep' genomic) and differential gene expression (targeted transcriptomic) pathways.
- Archive genetic specimens for future use in new hypothesis tests or with new technologies and methods.

Methods: The USGS genetics lab will analyze the field samples (supplied by the US-Canada Transboundary survey) for both mitochondrial and microsatellite DNA to identify sub-populations. Genetics results will direct how the next year's samples should be spaced to test the hypothesized dichotomies of coastal vs. continental slope populations; eastern vs. western; warm freshwater inputs vs. cold saline marine waters populations. Laboratory analyses of samples collected during 2012 and 2013 fieldwork will be used to identify optimal sampling locations for the 2014 field season. Initial profiles of the 'antifreeze' gene transcriptome will be analyzed for variation in gene expression across and within hypothesized sub-populations. A complete genomic sequence of a single individual will be constructed to identify additional genes that may provide adaptive expression to climate change. The investigators will continue to coordinate and collaborate with a parallel Canadian collection and genetic analysis effort.

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Cook Inlet

Title: Cook Inlet Circulation Model Calculations

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. The results of this study will be used by BOEM to create the OSRA estimates of oil spill trajectories. The ocean models have been shown to have skill in estimating the near surface currents. This study will result in a time series of simulated current and wind fields that will be compared to field projects that have been conducted in the Cook Inlet and used in the OSRA calculations.

Approx. Cost: (in thousands) \$500

Period of Performance: FY 2014-2015

Description:

Background: Ocean currents in Cook Inlet are forced by winds and river runoff, as well as having very large tidal amplitude and extreme tidal currents. The Alaska Coastal Current that flows into Lower Cook Inlet and continues out through Shelikof Strait is an important element of the nearshore circulation of the northern Gulf of Alaska. Sea ice forms in Cook Inlet, but its effect on the overall circulation pattern has not been studied in detail.

The circulation of Cook Inlet has been studied through previous model simulations, with funding by NOAA, BOEM, USACE, and others. The models were subjected to many sensitivity calculations and skill was assessed by teams of oceanographers and the models were shown to have significant skill in simulating the ocean surface currents. Many field programs that may provide observational data for assimilation and validation have also been conducted in this area.

Objectives: The objective of this study is to obtain simulations of the surface circulation in Cook Inlet for use in OSRA. The simulations must have significant skill in reproducing the near-surface currents, compared to drifting buoy data, fixed current meters, ADCPs, and other data sets. The results of the model will provide environmental variability input into the OSRA calculations.

Methods: This study will adapt an existing community ocean model to produce a high-resolution hindcast of the current fields in Cook Inlet, using data assimilation methods whenever practical. The hindcast period will be determined by data availability, but shall be no less than 5 years. The tidal current must be accurately reproduced. The wind forcing will be derived from the products of an atmospheric model. Skill assessment comparisons against historical field observations, i.e. current meters and drifting buoy velocities, will be performed.

Revised Date: April 2013

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Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Cook Inlet

Title: Ecological Processes in Lower Cook Inlet and Kachemak Bay: A Partnership in Monitoring

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. An OCS Cook Inlet Lease Sale NEPA analysis hasn't been undertaken since 2003. Updated information is needed regarding the physical and biological environment, including variability in oceanographic conditions and plankton communities, and additional data related to sensitive species. The results will be used in NEPA analyses and documentation for lease sales, Explorations Plans (EP's), and Development and Production Plans (DPP's). Collected oceanographic data will support validation and sensitivity testing of ocean circulation models to BOEM's Oil-Spill Risk Analysis efforts.

Approx. Cost: (in thousands) \$350

Period of Performance: FY 2014-2017

Description:

Background: Cook Inlet circulation patterns are influenced by intrusions of the Alaska Coastal Current, large seasonal changes in freshwater input, geographically-influenced wind forcing and a large tidal range. The lower Cook Inlet and Kachemak Bay also support rich nearshore and pelagic biological communities. Improving understanding of this complex marine environment will help us understand biological variability and potential impacts from oil and gas exploration and development activities.

The *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) and state and federal agencies are currently supporting a five-year, \$12 million long-term monitoring program in the Gulf of Alaska region affected by the 1989 *Exxon Valdez* oil spill, including lower Cook Inlet. The multidisciplinary monitoring program, called GulfWatch Alaska, seeks to build upon the extended restoration research and monitoring by providing data to identify and help understand the impacts of multiple ecosystem factors on the recovery of injured resources. This program, headed by the Alaska Ocean Observing System (AOOS), Prince William Sound Science Center, and the NOAA Kasitsna Bay Laboratory, links changes in environmental conditions with population trends in nearshore benthic and pelagic species. In lower Cook Inlet and Kachemak Bay, the program includes seasonal oceanographic and plankton surveys, annual near-shore benthic surveys, and opportunistic seabird and marine mammal surveys.

Data management for the GulfWatch Alaska program is coordinated by AOOS and science synthesis is led by the NOAA Kasitsna Bay Laboratory. Oceanographic data from this study will also be used by NOAA for ongoing validation of the NOS circulation model to improve model use in environmental assessments and oil spill response planning. Collaboration with the GulfWatch Alaska program and partner organizations

(AOOS, NOAA, USGS, UAF, ADF&G, USFWS, etc.) presents a unique opportunity for BOEM to leverage funds and obtain needed information through support of expanded ecosystem monitoring efforts in lower Cook Inlet.

Objectives:

- Quantify seasonal and inter-annual variability in oceanographic conditions and plankton communities and provide information to assess long-term trends.
- Enhance monitoring of sensitive species (seabirds, sea otters) in conjunction with monitoring of environmental conditions.
- Improve understanding of water mass movement in lower Cook Inlet/Kachemak Bay for use in environmental analysis and circulation model validation.

Methods: This study will enhance existing oceanographic surveys, plankton surveys, near-shore benthic surveys, and upper trophic level surveys of seabirds and marine mammals to support NEPA analyses. Currently, oceanographic and plankton surveys are conducted quarterly along three transects in lower Cook Inlet and two transects in Kachemak Bay. Based upon consideration of results from analysis of data collected in 2012, surveys will be expanded in time and/or space to improve assessment of seasonal conditions. This study will also provide for addition of seabird and marine mammal observers to the surveys in Cook Inlet. Standard agency protocols are used for benthic, at-sea seabird and marine mammal monitoring.

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Cook Inlet

Title: Benthic Invertebrate Habitats in 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 Region in 2016. 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. Updated and readily accessible habitat information is needed to conduct environmental analyses for offshore continental shelf exploration and development in Cook Inlet, as well as for ongoing spill response planning. The intertidal is particularly susceptible to oil spills and updated information will be important to understanding and assessing potential impacts of an oil spill in Cook Inlet.

Approx. Cost: (in thousands) \$510

Period of Performance: FY 2014-2015

Description:

Background: Benthic invertebrates and their habitats are susceptible to effects from industry exploration and development activities. The intertidal 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. There are collaborative efforts underway and in planning stages to improve habitat mapping and the ability of a range of different users to more easily access habitat, imagery and related information.

In the past five years significant new information sources have become available for Cook Inlet. Examples of recently available habitat-related data, on-going surveys and planned studies that can help supply the information include BOEM's current collaboration in several multi-agency efforts such as the Rocky Intertidal surveys (including strong leadership and participation by the BOEM Pacific Region) and the multiagency ShoreZone program. Both the National Park Service and the NOAA's National Ocean Service are actively engaged in collecting aerial shoreline imagery while the Cook Inlet Regional Citizens Advisory Council (CIRCAC) has collected sediment and shellfish contaminant data. New data delivery tools are also available, such as the Cook Inlet Response Tool developed by CIRCAC and the Alaska Ocean Observing System (AOOS) that is directly aimed at improving delivery data and use of spatial information in spill response planning and response.

Objectives:

- Quantify variability in habitat and invertebrate abundance of invertebrate communities

- Integrate results with existing shoreline geospatial data and BOEM Environmental Sensitivity Index and other NEPA analysis tools
- Provide robust spatial and temporal information that can be used in NEPA analyses
- Incorporate spatial data into GIS data tool (e.g. Cook Inlet Response Tool) that does not require GIS expertise to use and can be accessed online
- Develop new derived products to supplement data coverage in sparsely sampled areas
- Facilitate improve understanding of the potential influence of exploration and development activities on sensitive habitats
- Support National Park Service razor clam (*Siliqua patula*) and soft shelled clam (*Macoma sp.*) collections where available

Methods: This study will identify important historical temporal and geospatial habitat and benthic abundance data. It will merge methods and scientific survey protocols with existing BOEM and other agency monitoring programs and provide spatial and temporal information for lower trophic communities to incorporate into BOEM oil-spill risk analyses. Researchers will conduct targeted benthic surveys of epibenthic and infaunal populations and habitats on OCS and adjacent intertidal substrates and integrate results with existing data delivery systems to provide updated baselines and habitat map layers to BOEM NEPA analysts for oil-spill risk analyses and for assessing the potential impact on sensitive intertidal and subtidal habitats. Researchers will investigate potential multi-agency and industry collaborations.

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Polar Bear Habitat Use, Ecology, and Population Status in the Chukchi Sea

BOEM Information Need(s) to be Addressed: This study will provide additional baseline data by identifying important polar bear habitat and patterns of habitat use, targeting bears in the geographic region of the Chukchi Sea that includes the OCS; 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 for polar bear and polar bear critical habitat, as well as in NEPA analyses of Chukchi Sea lease sales, EP's, and DPP's. Data on patterns of polar bear habitat use provided by this study will be used in OSRA 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) \$3,000 **Period of Performance:** FY 2014-2019

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 USFWS in the Chukchi Sea 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. 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 collaborative BOEM-USFWS-USGS study builds upon the results of the previous 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 western and eastern peripheries of the subpopulation range. Study at the eastern periphery will 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 in the currently leased area by providing habitat use data in the area of overlap between the Chukchi Sea and Southern Beaufort Sea subpopulations.

Objectives:

- Evaluate distribution and population delineation in relation to industry exploration and 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 1980's and early 1990's.
- 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 (beyond those used in 2008–2011) north and east of Point Hope, Alaska and into areas of the Chukotkan coast to obtain a representative sample of the biological 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.

The Chukchi Sea subpopulation of polar bears moves freely between the U.S. and Russian coasts, and a large proportion of Chukchi Sea females are believed to den on Wrangel Island. This study will collect data in Russia, including 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 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Integrated Seabed Surveys in the Arctic Ocean:
Bathymetry, Archaeological Resources, and Ice Gouge
Magnitude and Recurrence Rates

BOEM Information Need(s) to be Addressed: Industrial oil and gas exploration has begun 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 and for development of mitigation and monitoring strategies to avoid irreparable impacts on nonrenewable resources and costly pipeline construction errors. Seabed and sub-seabed geophysical surveys will be combined with archaeological work to support regional archaeological assessments in support of the National Historic Preservation Act and analysis of prehistoric archaeology potential needed for NEPA analyses of proposed lease sales and review of planned exploration, development and production activities. Detailed information on ice gouge recurrence rates and gouge width and depth will help refine the Arctic effects portion of the fault tree model that is used to develop oil-spill occurrence probability distributions for the Beaufort and Chukchi seas. Collected bathymetry data will support Oil-Spill Risk Analysis (OSRA) through improvements to ocean circulation modeling and ongoing analysis of observational data.

Approx. Cost: (in thousands) \$6,000 **Period of Performance:** FY 2014-2018

Description:

Background: Remote sensing techniques, such as echo sounding, have been used to map the seabed since the early twentieth century, and modern multibeam and side scan sonar can survey to less than one-meter resolution. In addition to efficiently supplying high-resolution bathymetry data across relatively large areas, these technologies can be used to locate, identify and provide detailed images of features on the seabed. In combination with sub-bottom profiler data, these images can be used to discover specific characteristics of features on and under the seabed, such as ice gouges and archaeological resources.

Ice gouging. Available data is insufficient to determine the age, recurrence, extent, and depth of ice gouging on the U.S. Chukchi and Beaufort continental shelf areas of the Alaska OCS. Only single year surveys were done in siting exploration wells, therefore the age and recurrence rates of the gouges found within the Alaska OCS planning areas have not been ascertained. Recently, Upward Looking Sonar measurements within the Chukchi Sea have measured ice drafts of almost thirty meters and there have been recent unpublished surveys of grounded multi-year ice at water depths greater than thirty meters. Finally, large breakouts of landfast ice along the Chukchi coast, observed from MODIS satellite imagery have shown additional evidence that large ice masses may have been grounded offshore as recently as the past year.

Ice gouges of this magnitude have the potential to damage pipelines buried at insufficient depth. Data sets clarifying the magnitude and recurrence rates of ice gouging are needed to establish guidelines for burial of oil production pipelines that cross the shelf. The most common mitigative strategy for reducing ice gouge impacts on subsea pipelines, burial beneath the zone of sea floor disturbance, requires knowledge of ice gouge recurrence rates and depth of seabed disturbance which is poorly documented. Collecting new, contemporary data coincident with the old survey lines will extend the site survey data sets to the present. Collection and analysis of several years of contemporary ice gouge data will help document present ice gouge characteristics and recurrence rates for the active lease areas.

Archaeology. Current guidance calls for an Archaeological Baseline Study for each planning area to provide NEPA analysts with information for establishing the extent and potential for prehistoric resources in the area. The last Beaufort Sea Archaeological Baseline Study is decades old and one has never been undertaken in the Chukchi Sea. As a result, there is very limited information currently available regarding potential submerged cultural resources in areas of potential future industry activity, even though there is high possibility that archeological sites exist in these locations.

Alaska has unique importance in the study of prehistoric archaeology since it has long been believed that a major corridor for human migration to the New World was across a land bridge that formerly linked Asia with North America. New information on prehistoric archaeology has been discovered that needs to be integrated into a formal study to guide BOEM in protection of archaeological resources. For example, the results of 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), indicated that buried and drowned terrestrial sediments and associated landforms are less than 10,000 years old (between 1600 and 8600 years old). These Holocene features may have been occupied by humans and the potential exists for finding similar conditions in the Chukchi Sea. There is also the potential for shipwrecks associated with commercial whaling during the nineteenth century.

Objectives:

- Document ice gouge recurrence rate and physical characteristics, including: ice gouge incision depth, gouge orientation, and width
- Incorporate the collected data into the BOEM Geohazard Database and produce statistics on ice gouge recurrence rates in years, ice gouge incision depth, orientation, width for fault tree analysis
- Map Holocene and Pleistocene horizons as old as 35,000 years ago.
- Assess archaeological potential in areas of active and potential industry activity in the Beaufort and Chukchi seas based on geophysical and geologic information, including geomorphological features, shipwrecks, and sea-level indicators that can be used to hypothesize sea level curves.

- Synthesize existing geologic, paleoenvironmental, archaeological and historical data to more clearly define the relationship of prehistoric human populations to the prehistoric landscape into an Archaeological Baseline Study for the Chukchi and Beaufort seas.

Methods: This integrated multi-year study will conduct high-resolution surveys of the seabed in areas of potential industry interest the Beaufort and Chukchi seas of the Alaska OCS to obtain information on ice gouge characteristics and recurrence rates and prehistoric archaeology potential, as well as high resolution bathymetry data. Marine geophysical techniques, including side scan sonar, multibeam bathymetry, chirp sub-bottom profilers and precision GPS navigation will survey the sea bed and the shallow sub-seabed in areas of active and potential industry activity, including potential pipeline routes. Automated Underwater Vehicles (AUV) may also be employed to expand the survey effort during the short open water season. Historical and newly collected core data will be analyzed and integrated with the geophysical data across the survey area to better define the continuity of the Holocene and Pleistocene horizons. Ice gouge surveys will transect older site specific surveys where gouges had been identified in past years in order to compare contemporary and historical ice gouge occurrence. The combination of multibeam bathymetry and side scan sonar will provide ice gouge information that includes length, width, orientation, gouge incision depth, and water depth of the gouge. These geophysical methods will also be used for the archaeological survey portion of the project in additional areas of keen interest to industry to provide information on any prehistoric archaeological potential on or under the seabed, as well as shipwrecks. The sub-bottom profiler will provide detailed information on archaeological features, as well as characteristics of the shallow sub-seabed stratigraphy, in all surveyed areas. The combination of the coring and geophysical data will refine our understanding of the Holocene and Pleistocene boundaries and their stratigraphic presence across the active lease area. Ice gouges and archaeological features will be acquired in digital GIS format and incorporated into existing databases. Potential partnerships with relevant government research conducted by the Navy, USGS, NOAA-NOS and others will be pursued.

Revised Date: April 2013

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Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Cook Inlet

Title: Baleen Whale Distribution, Abundance, and Ecology in Cook Inlet and Shelikof Strait

BOEM Information Need(s) to be Addressed: Information gained from this study is needed to establish spatial and seasonal distribution and abundance of several species of baleen whales, including multiple endangered species, in areas that will be, and potentially can be, affected by oil and gas exploration, development, and production activities in the Cook Inlet Planning Area, including the proposed 2016 Lease Sale for Cook Inlet. Findings from this study will facilitate informed evaluations of the potential effects of such activities on whales, including listed species and designated critical habitat, that are required under NEPA, the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA). Such information can help inform future evaluation of potential limitations on offshore leasing, exploration and development, thereby reducing impacts. Information gained from the study can aid in the design of temporal and spatial mitigation for such activities, in the monitoring of effects of the activities, in the estimation of take (under the MMPA and ESA) from activities, and to long-term efforts to apply the best available science to adaptively manage impacts of oil and gas on such whales to reduce those impacts to the lowest practicable level. Results will support future Section 7 ESA consultations and the related preparation of future Biological Evaluations and Biological Opinions.

Approx. Cost: (in thousands) \$10,000 **Period of Performance:** FY 2014-2019

Description:

Background: There are numerous species of baleen whales that can occur within or near the Cook Inlet Planning Area. These species potentially include: humpback whales, fin whales, North Pacific right whales, blue whales, Sei whales, and gray whales. At least two species of endangered baleen whales (humpback and fin whales) have been commonly sighted in areas within or very near the Cook Inlet Planning Area. Fin whales can be present in Shelikof Strait year-round, but their use of the entrances to Cook Inlet and of southern Cook Inlet is not well-studied. Humpback whales are known to feed seasonally in the area near the Barren Islands, and to occur seasonally in southern Cook Inlet and Shelikof Strait. However, neither abundance in, nor seasonal-use patterns of, these areas are well documented. The pattern of use by individual whales and by populations is not well-defined. Sei whales have been, but are rarely, sighted in Shelikof Strait. However, current studies are inadequate to define their use of these areas. Individuals from the eastern stock of the North Pacific right whale, the most highly endangered large cetacean population in the world, have 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 endangered species. Previous studies are inadequate to determine if North Pacific right whales may occur in lower Cook Inlet or Shelikof Strait, and potential use of the areas near the Barren Islands by this species is

unclear. However, on the outer coast of Kodiak Island, this species has been sighted in areas in which humpback whales also feed. Large numbers of gray whales pass through the southern portion of the lease area during seasonal migrations. 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 resultant 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 species or some segments of some species of whales to avoid areas where seismic exploration is occurring. For example, it is known that female humpbacks with calves are sensitive, in some situations, to noise from seismic exploration. Other types of activity associated with oil and gas development also may disturb, and modify the behavior of whales or put them at risk from boat strikes.

Objectives:

- Document the spatial, temporal, and functional use patterns of the proposed Cook Inlet Planning Area, and of adjacent areas that may be affected by oil and gas activities within the Cook Inlet Planning Area (e.g., areas "downstream" of potential activity and areas within the Gulf of Alaska adjacent to Cook Inlet and Shelikof Strait) by individuals and populations of baleen whale species.
- Investigate ecological factors responsible for the distribution of large whales in the study area with emphasis on the relationships between baleen whale occurrence, distribution of potential prey and oceanographic conditions.
- Estimate minimum abundances of baleen whale species in the proposed multi-sale area.
- Assess potential overlap of important whale habitat and the planning area and associated ship traffic.

Methods: This study will deploy an array of continuous seafloor acoustic recorders in the deeper waters of lower Cook Inlet, Shelikof Strait, and nearby and downstream areas of the Gulf of Alaska and analyze data to address the aforementioned objectives. Sonobuoys will be used to assist aircraft and vessels for locating individual whales for detailed study and tagging. Satellite-linked transmitters will be deployed on individuals of each 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. 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.

Revised Date: April 2013

2.3 Profiles of Studies Proposed for FY 2015 NSL

Table 3. BOEM Alaska OCS Region Studies Proposed for the FY 2015 NSL

| Page Number | Discipline | Study Title |
|---|------------|--|
| 65 | PO | Assessment of Multiple Ocean Circulation Models to Support Ensemble OSRA Experiments |
| 67 | HE | Arctic Seafloor Ecology: Benthic Ecosystem Assessment |
| 69 | FE | Oil Seeps in the Chukchi and Beaufort OCS: Location, Magnitude, Persistence, and Composition |
| 71 | SE | Traditional Knowledge Implementation: Establishing Arctic Community Panels of Subject Matter Experts |
| 73 | PO | Synthesis of Oceanographic and Climate Data for Environmental Analysis and Model Validation |
| 75 | HE | Status and Trends of Seabirds and Forage Fish in Lower Cook Inlet |
| 77 | IM | Coastal Habitat Maps: Closing Spatial Gaps in ShoreZone Imagery and Data for the Cook Inlet Area |
| 79 | MM | Development and Assessment of Unmanned Aerial Systems for Estimation of Regional Abundance and Demographic Rates of Pacific Walruses |
| AQ = Air Quality FE = Fates & Effects HE = Habitat & Ecology IM = Information Management MM = Marine Mammals & Protected Species PO = Physical Oceanography SE = Social & Economic Sciences | | |

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Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: 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, EP's, and DPP's in the Alaska OCS Region.

Approx. Cost: (in thousands) \$500

Period of Performance: FY 2015-2017

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 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Arctic Seafloor Ecology: Benthic Ecosystem Assessment

BOEM Information Need(s) to be Addressed: Updated and accessible information on benthic habitats, from the nearshore to the offshore is needed along the continental shelf in the Beaufort and Chukchi seas to support NEPA analyses for lease sales, Exploration Plans, and Development and Production Plans, and to develop potential mitigation measures for the avoidance of sensitive and vulnerable habitats used by the Pacific Walrus and migratory birds, as well as Essential Fish Habitat.

Approx. Cost: (in thousands) \$350

Period of Performance: FY 2015-2016

Description:

Background: The Arctic hosts many complex benthic ecosystems that play key roles in habitat and food web support. Chukchi sea benthic communities are among the most abundant and diverse in Arctic regions due to the primary productivity created by phytoplankton populations.

In 2006 the BOEM-sponsored Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA) workshop described and discussed the importance of benthos in the Chukchi ecosystem. Knowledge of the benthic fauna along Alaskan arctic shelves at that time was largely based on a series of intensive surveys between the 1970s and early 1990s under the Outer Continental Shelf Environmental Assessment Program. The massive datasets collected under these programs were recently synthesized under the Arctic Shelf Basin Interactions (SBI) project sponsored by NSF. This synthesis revealed “hot spots” of high benthic biomass in several regions of the Chukchi Sea, particularly in the northeastern sector between Point Lay and Icy Cape at Hanna Shoal, which lies about 200 km west of Point Lay. Recent work in the area includes the BOEM-funded study “COMIDA: Chemistry and Benthos (CAB),” completed in 2012 that involved a two-year field effort to characterize the biota and chemistry in the offshore portions of the Chukchi Sea. A more discrete analysis of the benthos has been conducted by the oil industry on smaller geographical areas inside the Chukchi Sea lease areas. In addition, the Alaska Monitoring and Assessment Program (AKMAP) by the Alaska Department of Environmental Conservation has performed benthic sampling as part of a broader program in 2011 and 2012 in closer proximity to the coast in areas greater than 10 meters depth.

These benthic sampling efforts in the mid-shore to offshore areas of the northeastern Chukchi Sea reveal a highly productive and complex system characterized by significant spatial heterogeneity in both the benthic infauna and epifaunal populations. However, benthic information in the nearshore (<20m) areas is lacking in this area, particularly within lagoons. This project prioritizes sampling in lagoon areas, with a focus on

characterizing lagoon species and habitat quality, including contaminant concentrations in environmental media and biota.

Objectives: The overall goals of this study are to perform a retrospective analysis of information on the benthic environment in the Beaufort and Chukchi seas to better define the seafloor ecology and to locate vulnerable habitats or those utilized as feeding areas for upper trophic level organisms. Specific objectives include:

- Providing a benthic habitat classification manual and supplemental geospatial data, similar to work completed for the nearshore waters of the main Hawaiian Islands which will assist in a comprehensive database of sensitive habitats.
- Determining “hot spot” areas characterized by high benthic biomass that are critical feeding areas for upper trophic level organisms.
- Assessing key habitat characteristics (fauna, sediment type) that define sites that are highly sensitive to anthropogenic activities.
- Developing a strategy for conducting a survey of Arctic nearshore waters (<20m), including an assessment of baseline conditions for contaminants in environmental media and biota in lagoon systems of the Chukchi Sea.

Methods: The researchers will conduct a literature review and associated data mining and synthesize the information to produce a benthic habitat classification manual. Data mining will be coordinated with efforts from North Pacific Research Board’s Pacific Marine Arctic Regional Synthesis of the Northern Bering, Chukchi, and Beaufort seas (PacMARS) benthic data synthesis efforts. A rigorous statistical design will be developed to establish a baseline description of nearshore areas with focus on prospective development areas already identified in both the Beaufort and Chukchi seas. The sampling plan should include benthic surveys near Point Lay, Kasegaluk Lagoon, and Camden Bay with side scan or similar technology and collection of high-resolution bathymetry, backscatter imagery and underwater video/photography of these nearshore marine habitats to map the seafloor and facilitate description of nearshore benthic habitat complexity. The sampling plan should employ standard quantitative methods for infaunal, epifaunal and demersal nearshore benthic surveys, including abundance, community structure and biomass similar to previous collections.

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Oil Seeps in the Chukchi and Beaufort OCS: Location, Magnitude, Persistence, and Composition

BOEM Information Need(s) to be Addressed: BOEM needs information on the location, magnitude, persistence and composition of oil seeps in the Beaufort and Chukchi seas. Natural seeps represent a large portion of the petroleum input to the sea and are a natural background. However, total seep volume in the Arctic is uncertain. Refined information of area seeps provides insight into assessing the effects from seeps and to provide additional context when considering estimated oil spills in agency NEPA analyses for leasing, exploration, and development in the Alaska OCS.

Approx. Cost: (in thousands) \$1,700 **Period of Performance:** FY 2015-2018

Description:

Background: Natural oil seeps in the Chukchi and Beaufort seas are not mapped in the open or gray literature, and we have limited information of their spatial extent or volume of environmental release, or of the deposition of the oil in the environment and its residence time. Some information about the location and extent of natural oil seeps in the Chukchi and Beaufort OCS does exist, but this was obtained in cooperation with industry and is proprietary.

The physical properties of Alaska OCS seep oils can be estimated from equivalent oil types in onshore formations: how it is affected by weathering of the environment, how it compares to known crude types in other development areas, or the deposition of the oil within the environment. The presence of natural oil seeps is indicative of resident organisms adapted to metabolize the hydrocarbons. These organisms in turn indicate the capacity for microbial remediation of hydrocarbons in the environment, or natural bioremediation through the means of reducing pollutants. Oil-eating, cold-water bacteria in the Gulf of Mexico waters were a major factor in the removal of spilled oil from the Macondo spill in 2010.

Objectives: This study has three objectives:

- Identification of the location and extent of oils seeps in the Chukchi and Beaufort OCS
- Collection and chemical characterization of oil (water column and/or sediment) samples
- Collection and characterization of oil-associated heterotrophic microbes

Methods: Likely techniques will include remote sensing and ground truthing. Aerial and/or satellite remote sensing will be used to detect, locate, and estimate size of oil

slicks from seeps during the open water season. Multiple passes over two open water seasons will be made to estimate seep persistence. A subset of seeps will be chosen for vessel sampling of surface slick (or surface layer if no slick), water, and bottom sediments beneath the remote-sensed slick locations. Oil, surface layer, and sediment samples will undergo hydrocarbon fingerprinting analyses and remaining oil samples will undergo oil weathering characterization. Heterotrophic activity/potential and identification of primary heterotrophic microbe species will be ascertained from collected water, surface layer, and bottom sediments. Chosen oil (hydrocarbon) and microbial techniques would allow comparison with existing Alaska Arctic OCS data. Potential for industry and other government agency partners (e.g., NOAA's Office of Ocean Exploration and Research) to aid in pursuit of project goals will be investigated and pursued if appropriate.

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Traditional Knowledge Implementation: Establishing 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 be authorized and made 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) \$500

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 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 hunting of marine mammals; (4) subsistence harvest of seabirds and waterfowl; (5) subsistence sea-run fish; and (6) subsistence terrestrial species and nearshore use. Currently, formalized panels do not exist to serve in this capacity.

Objectives: The successful integration of TK into decision-making processes requires unprecedented collaboration between scientists and local communities. This will be achieved by the following:

- Enhance TK authority and integration of TK with western 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 into specific 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 Iñupiaq model of linking youth with elders.
- Achieve greater timeliness between project award and report. Currently, studies may be delayed as long as a year to 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. Three TK panels will be created in each North Slope coastal community: marine subsistence; terrestrial hunting; and birding and fishing. The inland communities of Atqasuk and Anaktuvak, would each have 2 TK panels (there being no need for a marine subsistence panel in either one). 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 in recognition of their service. Barrow will be the first community to develop a strawman charter that would serve as a template for other communities. The process will replicate social network methodology as described in *Variation in the Abundance of Arctic Cisco in the Colville River* (MMS study 2007-0042).

The study will develop protocols to facilitate engagement of the pre-authorized TK panels and promote dissemination of TK to external scientists with consistent methods. Western scientists would initiate dialogue through describing information about their project goals, methods, objectives and findings with the TK panel. The panels' engagement and comprehension may lead to suggestions, guidance, and other forms of support. A debriefing on the use of TK and panel involvement in decision-making will encourage a respectful dialogue between the local experts and BOEM. 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 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Synthesis of Oceanographic and Climate Data for Environmental Analysis and Model Validation

BOEM Information Need(s) to be Addressed: Information from physical measurements of the ocean, sea ice and the atmosphere will be brought together into an integrated set of data results and be incorporated into a newly created Climatic Atlas for the Beaufort and Chukchi seas. The data and summary statistics will support NEPA analyses for lease sales, EP's and DPP's, and support efforts to improve Marine Spatial Planning. These results may also be used to provide skill assessments for ocean circulation and oil-spill trajectory modeling.

Approx. Cost: (in thousands) \$1,500 **Period of Performance:** FY 2015-2018

Description:

Background: Oftentimes, BOEM analysts are dependent upon difficult to find environmental information about oceanography, meteorology, and sea ice for use in NEPA analyses. A Climatic Atlas provides a resource reference for analysts and the general public by making available detailed, integrated information on the environment. The last Climatic Atlas for the Alaska Beaufort and Chukchi seas was completed almost thirty years ago and needs to be updated. As a result of climate change, environmental conditions during some months have transformed significantly since the completion of the last atlas, especially with regard to sea ice.

Oceanographic, sea ice, and atmospheric data derived from previous field collections can be readily synthesized, summarized, and provided to analysts for quickly incorporating into the writing of environmental analyses. The information will be provided in the format of a digital Climatic Atlas that will provide a regionally integrated picture of the climatology, along with summary statistics that can be queried for specified regions of the Beaufort and Chukchi OCS.

Available measurements from high frequency radar, ADCP's, CTD's, gliders, ice profiling sonar, meteorological buoys, ships of opportunity and other instruments will be compiled and synthesized. Analysis of these data will provide an accurate depiction of the distribution and variation of water temperature, salinity, density, and wind speed and direction, as well as seasonal and interannual summaries of surface and subsurface currents, wave heights, wind speed and direction, and ice properties and drift velocities. Interpreted satellite imagery from the National Ice Center and other sources can provide the seasonal changes in ice conditions and the timing of freeze-up and break-up.

Objectives:

- Produce an interactive digital Climatic Atlas for the Beaufort and Chukchi seas that synthesizes oceanographic, sea ice and meteorological measurements, including: water temperature, salinity, and density, as well as seasonal and interannual summaries of surface and subsurface currents, wave heights, wind speed and direction, and ice properties and drift velocities.
- Provide analytical tools that will allow the user to easily extract and display data and summary statistics for specified regions of the Beaufort and Chukchi OCS.

Methods: This study will compile all available ADCP, CTD, ice profiler, high frequency radar, meteorological, and other data into a common dataset for the Chukchi and Beaufort seas. The period of analysis will be determined by data availability, but shall be no less than 10 years. The atmospheric, oceanographic, and sea ice datasets will be analyzed to establish their spatial and temporal interdependencies. Program code will be developed for the user to extract summary statistics needed by Alaska OCS Region NEPA analysts. The primary deliverable will be a dataset and analytical tools suitable for use with GIS applications and integration with other relevant environmental data, such as species distribution and habitat use. Potential partnerships with other federal agencies, including BSEE, NOAA-NODC, NOAA-NCDC, the Navy, NSF, etc., will be pursued for this study. This project will be coordinated with the proposed study “Data Interface Tools to Support Environmental Analyses: Interpretation of Existing Marine Mammal Data” and additional efforts supported by BOEM and other entities.

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Cook Inlet

Title: Status and Trends of Seabirds and Forage Fish 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 A 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. Large populations of marine birds are located in lower Cook Inlet, especially at colonies on Chisik, Gull and the Barren Islands. A variety of important forage fish species (herring, sand lance, smelts) are also abundant in marine waters of lower Cook Inlet, especially between the Barren Islands and Kachemak Bay. However, collection of seabird and forage fish data in lower Cook Inlet has been sporadic and not systematically reported for more than a decade. Results from this study will be used for NEPA analyses for future lease sales, Exploration Plans and Development and Production Plans.

Approx. Cost: (in thousands) \$480

Period of Performance: FY 2015-2019

Description:

Background: Seabird and forage fish studies were conducted in lower Cook Inlet during 1995-2000 with joint funding from BOEM (formerly MMS), USGS, and the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) in large measure because of concerns about our ability to assess the recovery of seabird populations following the *Exxon Valdez* oil spill. Results of this work been reported in over 40 publications, and synthesis of the work continues. The original project was designed to measure the foraging and population responses of six seabird species to fluctuating forage fish densities around three seabird colonies in lower Cook Inlet (LCI). These studies involved at-sea surveys for forage fish (hydroacoustics, trawling, seining) and some characterization of oceanography while measuring aspects of seabird breeding biology (egg and chick production, chick growth, population status and trends) and foraging behavior (diets, feeding rates, foraging time) at adjacent colonies. The most detailed data were collected on Common Murres (*Uria aalge*) and Black-legged Kittiwakes (*Rissa tridactyla*), the most commonly monitored seabird species in Alaska. The goal of the study was to achieve a better understanding of relationships between seabirds and forage fish in a variable environment, and to assess whether current environmental conditions were favorable to seabirds in the Gulf of Alaska (GOA). Results indicated that the upwelling of cold, nutrient-rich GOA waters at the entrance to the shallow LCI estuary supports a high density of juvenile pollock, sand lance, and capelin; which in turn are exploited by high densities of breeding seabirds (murre, kittiwakes, puffins, etc.) on the east side of LCI. Waters on the west side of LCI are oceanographically distinct (warmer, less saline, outflowing), and much less productive for forage fish and seabirds. Patterns of seabird foraging behavior, productivity and population change reflected patterns of forage fish

abundance and distribution, which in turn depended on local oceanography. Most seabird parameters varied with forage fish density in a non-linear fashion, and productivity was limited by food availability in some areas and years.

More than a decade has passed since these studies were completed, and little comparable work has been conducted during the interim. Anecdotal reports suggest that ecosystem changes have occurred (including a possible climate regime shift after 2000) that have influenced the timing of breeding and reproductive success of birds on Gull and Barren Islands. Assessment of food availability to the health of these bird populations in context to relative importance compared to contaminants, loss of nesting sites, anthropogenic disturbance, and whether these changes cumulatively have resulted in changes to the population trajectories observed in the 1990's remains unknown. This project proposes a return to lower Cook Inlet to gather new data on seabird demography and forage fish communities, as well as physical and chemical measurements to provide a benchmark for future studies on the effects of climate change.

Objectives:

- Assess forage fish species abundance (CPUE, catch composition) relative to results of historical studies around each of three seabird colonies.
- Measure reproductive success, chick growth and foraging success of murre and kittiwakes at Gull, Chisik and Barren islands, and compare with historical studies.
- Census murre and kittiwake populations on established monitoring plots, and conduct whole-island censuses at Gull, Chisik and Barren islands and analyze monitoring time series to estimate recent population trends.
- Resume banding studies to measure annual adult survival rates of murre and kittiwakes, and determine whether survival rates have changed since the 1990s.

Methods: In order to facilitate comparisons with data from prior studies, the consistent techniques for measuring food availability, seabird reproductive biology and feeding behavior will be employed. These techniques were developed from protocols established during APEX studies funded by BOEM and EVOSTC. In short, forage fish abundance will be assessed using mid-water trawl and acoustic surveys around each colony. Kittiwake and murre reproductive success (laying success, clutch size, hatching success, fledging success, productivity) and timing of breeding will be monitored as in the previous study. Plot and colony counts of total birds in attendance will be conducted at the prescribed times within the breeding season. Adult murre and kittiwakes will be color-banded and re-sighting will take place in subsequent breeding seasons.

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

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 Region 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 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, EP's and DPPs, and in post-sale and post-exploration decision making. The data will also provide an improved level of detail for coastal contingency planning, oil spill response activities, and habitat recovery efforts in the context of future offshore oil and gas and mineral development activities.

Approx. Cost: (in thousands) \$470

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 (RCAC) 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 (with funding by the EVOS Trustees, the Alaska Department of Natural Resources, Kenai Peninsula Borough, and the National Park Service). Cook Inlet RCAC 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-fly sections of the Katmai National Park coastline to conduct a pilot 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.

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.
- 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 the Gulf of Alaska (http://www.fakr.noww.gov/habitat/shorezone/goa_protocol.pdf). Any appropriate revisions to the protocols will be incorporated, based on surveys and mapping that have taken place since the last protocols were published (revisions due June 2013). 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). 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.

Revised Date: April 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Development and Assessment of Unmanned Aerial Systems for Estimation of Regional Abundance and Demographic Rates of Pacific Walruses

BOEM Information Need(s) to be Addressed: Large numbers of Pacific walruses (*Odobenus rosmarus divergens*) utilize areas of high resource potential in the OCS waters of the northeast Chukchi Sea. BOEM needs reliable estimates of abundance and demographic rates of Pacific walruses in the northeast Chukchi Sea for use in planning, management, and mitigation of potential environmental impacts from oil and gas activities. Abundance and demographic rates of walruses are also important for stock assessments under the Marine Mammal Protection Act (MMPA) and for extinction risk assessment under the ESA. This study will develop methodologies and assess the use of unmanned aerial systems (UAS) for estimation of abundance and demographic rates of walruses in the northeast Chukchi Sea. Results from aerial surveys of walruses would be used in pre-lease analyses for future Chukchi Sea lease sales as well as in post-sale and post-exploration BOEM decision making and mitigation.

Approx. Cost: (in thousands) \$1,000
plus Joint Funding

Period of Performance: FY 2015-2019

Description:

Background: Walruses are an ice associated pinniped inhabiting the OCS waters of the Bering and Chukchi Seas and are an important subsistence resource for the region. Over the past three decades the extent of sea ice habitat vital to walruses has declined, particularly during summer and autumn when walruses occur in the OCS waters of the Chukchi Sea. Walruses are a protected species under the MMPA and are considered warranted but precluded under the ESA. As part of a 2011 Multi-district Settlement Agreement, the U.S. Fish and Wildlife Service must make a decision by September 2017 on whether to propose the Pacific walrus for listing under the Endangered Species Act or remove it as a candidate species. Demographic estimates would be an important contribution to this decision, the results of which will be important for BOEM decision making. Furthermore, oil and gas activities in the OCS areas of the Chukchi Sea have increased dramatically in the last five years and this trend is expected to continue. Therefore, estimates of the number of walruses using the northeast Chukchi Sea would be important for regulatory and mitigation activities associated with oil and gas development in the region.

Past efforts to estimate abundance of walruses were based on manned aerial surveys. Manned flights have strict limitations since they must adhere to stringent requirements regarding wind, visibility, and minimum flight elevation due to safety and noise concerns. In recent years, there has been increasing interest in using UAS technology to study marine wildlife populations in the Arctic and UASs have been suggested as an

alternate survey platform for studying walruses in the northeast Chukchi Sea. For example UAS technology could be useful for estimating numbers of walruses occupying land based haulouts. When corrected for animals in the water and unavailable for survey, a regional abundance estimate could be produced. Furthermore UASs could potentially be used to estimate age ratios of walruses hauled out on sea ice that, when combined with other sources of information, can be used to estimate demographic rates such as fecundity and survival. A small number of limited field tests with other arctic marine mammals (e.g. ice seals and Steller sea lions) have been conducted and have provided initial insight into the levels of success that may be achieved using UAS technology. The results from these preliminary studies suggest that further investigation into the use of UAS technology for studying walruses is warranted. The study proposed here will explore the feasibility of using UAS technology for estimating regional abundance and conducting age ratio surveys for estimating demographic rates of walruses in the northeast Chukchi Sea. This information would be valuable for MMPA incidental take regulations and ESA Section 7 analyses as well as for developing regulatory and mitigation measures relative to oil and gas development in the OCS regions of the northeast Chukchi Sea.

Objectives:

- Evaluate detection rates and ability to identify walruses hauled out on sea ice and on land using available UAS technology.
- Assess the ability of UAS technology to identify age and sex composition of walruses hauled out on sea ice in the northeast Chukchi Sea for estimation of demographic rates.
- Evaluate the ability of UAS technology to enumerate walruses at land-based haulouts for estimation of regional abundance in the northeast Chukchi Sea.

Methods: This study will use a ship based approach to conduct aerial surveys of walruses hauled out on sea ice in the northeast Chukchi Sea utilizing UAS technology. The researchers will develop methods to collect data for determination of sex and age composition of walrus herds and total number of walruses hauled out at any one time. Sex and age composition estimates will be combined with other sources of information to estimate demographic rates using a maximum likelihood approach. Satellite radio tags will be applied to walruses hauled out on shore to estimate the proportion of the population in the northeast Chukchi that is currently hauled out during each coastal aerial survey. Data from repeated coastal surveys will be assimilated to quantify the regional abundance of walruses in the northeast Chukchi Sea. Methodologies developed here could facilitate use of UAS technology for many other study applications.

Revised Date: April 2013

SECTION 3.0 TOPICAL AREAS FOR FY 2016

This section presents a general forecast of significant topical issues and concerns to be addressed by studies for FY 2016 and beyond. In general, these topics conform to 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 within the ESP in Alaska. 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 2014 and FY 2015 address the topical areas described below. These will be re-assessed as part of the FY 2015 planning process.

As noted in Section 1.2.1 of this document, the *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017* (USDOJ, BOEM, 2012) pointed to a need for further development of scientific information regarding the sensitive habitats, unique conditions and important other uses, including subsistence hunting and fishing in the Arctic, as well as the oil and gas resource potential, prior to additional leasing. 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 incorporate forecast data.

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 Alaska OCS 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 "Continuation of Arctic Nearshore Impact Monitoring in the Development Area (cANIMIDA)." The summer of 2007 was the last field season for the cANIMIDA project. The planned 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 MMS set up the Beaufort Sea Monitoring Project (BSMP) in the 1980s 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 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 continued 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 (EFH) must be evaluated. In the Bering and Chukchi Seas, more information is needed to evaluate EFH in the Chukchi Sea as commercial fish species

move northward from the Bering Sea. Beaufort waters are also considered EFH 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 becoming 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.

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Fiscal Years 2014-2016 Studies Development Plan

Atlantic OCS Region

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ABBREVIATIONS AND ACRONYMS

| | |
|--------|--|
| AIS | Automatic Identification System |
| AMAPPS | Atlantic Marine Assessment Program for Protected Species |
| AWC | Atlantic Wind Connection |
| BOEM | Bureau of Ocean Energy Management |
| Call | Call for Information and Nominations |
| CFR | Code of Federal Regulations |
| COP | construction and operations plan |
| DOD | Department of Defense |
| DOE | Department of Energy |
| DOI | Department of the Interior |
| DWH | Deepwater Horizon |
| EA | environmental assessment |
| EEZ | Exclusive Economic Zone |
| EIS | environmental impact statement |
| EMF | Electromagnetic Field |
| FAU | Florida Atlantic University |
| FERC | Federal Energy Regulatory Commission |
| FVCOM | Finite-Volume Coastal Ocean Model |
| FY | Fiscal Year |
| HF | High Frequency |
| IA | Interagency Agreement |
| IOOS | Integrated Ocean Observing System |
| MHK | Marine Hydrokinetic |
| MMC | Multipurpose Marine Cadastre |
| MMPA | Marine Mammal Protection Act |
| MMS | Minerals Management Service |
| MOU | Memorandum of Understanding |
| NEAMAP | Northeast Area Monitoring and Assessment Program |
| NECOFS | Northeast Coastal Ocean Forecast System |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| nm | nautical mile |
| NMFS | National Marine Fisheries Service |

| | |
|-------|--|
| NOAA | National Oceanic and Atmospheric Administration |
| NOPP | National Oceanographic Partnership Program |
| NSL | National Studies List |
| OREP | Office of Renewable Energy Programs |
| OCS | Outer Continental Shelf |
| PAM | passive acoustic monitoring |
| PTT | Passive Platform Transmitters |
| RODEO | Real-time Opportunity for Development Environmental Observations |
| ROW | right-of-way |
| SAP | site assessment plan |
| USACE | U.S. Army Corps of Engineers |
| USCG | U.S. Coast Guard |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| VMS | Vessel Monitoring System |
| WEA | Wind Energy Area |
| WTG | Wind Turbine Generator |

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 Deepwater Horizon (DWH) oil spill, the proposal was removed from consideration.

Loss of sand from the Nation's beaches, dunes, and barrier islands is a serious problem that affects both the coastal environment and the economy. The artificial replacement of lost sand through renourishment cycles for beaches or coastal areas require quantities of sand that are not currently available from state sources. To date, the Bureau of Ocean Energy Management (BOEM), through the [Marine Minerals Program](#), has conveyed rights to about 73 million cubic yards of OCS sand for 38 coastal restoration projects in six states. These projects have resulted in the restoration of 202 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.

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 2012, BOEM reached out to this stakeholder 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 (MOU's) 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).

More than half of the country's identified offshore wind potential is located off the New England and Mid-Atlantic Coasts, where water depths generally deepen gradually with distance from the shore. On November 23, 2010, Secretary of the Interior Ken Salazar announced the "Smart from the Start" renewable energy initiative to accelerate responsible renewable wind energy development on the Atlantic OCS by using appropriately identified areas, coordinated environmental studies, large-scale planning and expedited approval processes.

There are generally four phases of renewable energy development on the OCS: planning; 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 or grant 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 COP (see 30 CFR 585.626).

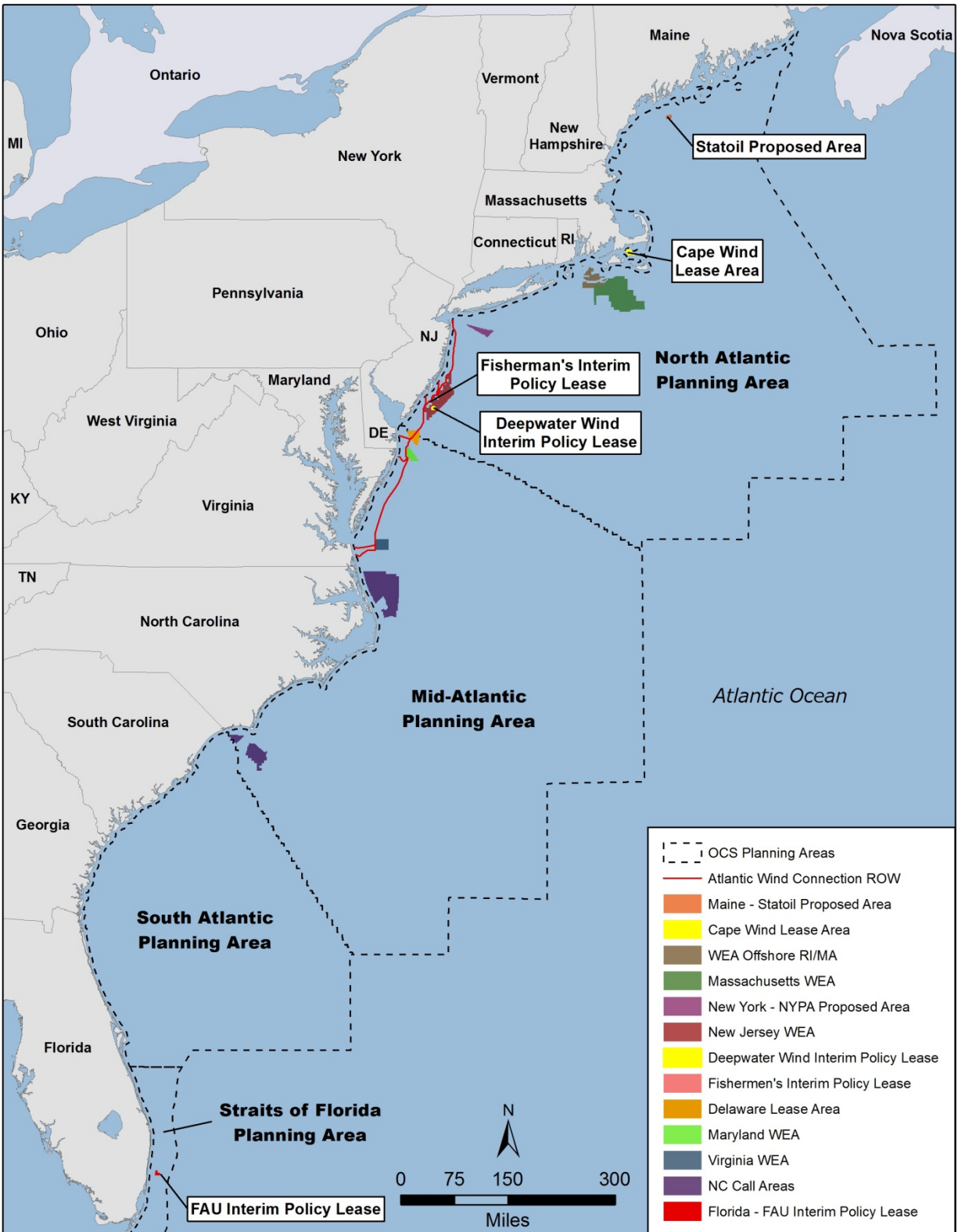
On February 7, 2011, Secretary of the Interior Ken Salazar and Secretary of Energy Steven Chu unveiled a coordinated strategic plan to accelerate the development of offshore wind energy, including funding to support offshore wind energy deployment to spur rapid, responsible development of this abundant renewable resource. As part of this plan, DOE announced [funding for seven projects](#), two of which are located in Federal waters in the Gulf of Maine and off the Virginia coast.

BOEM now has identified wind energy areas along the coasts of Maine, Rhode Island, Massachusetts, New Jersey, Maryland, Delaware, and Virginia (Figure 1). A non-competitive lease was issued for the Delaware wind energy area, and the competitive

leasing process was initiated for the Rhode Island and Virginia wind energy areas. Plans for identifying additional wind energy areas were announced along North Carolina. In addition, BOEM is considering research lease applications in Georgia and Florida. The Cape Wind Project, in Nantucket Sound, continues to move forward. With this activity comes the need for sufficient environmental information and new questions about the potential impacts.

1.2 Map of the Planning Area

Figure 1. Atlantic OCS Region Planning 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 is preparing an environmental impact statement (EIS) for potential seismic studies in the Mid- and South Atlantic Planning Areas. This EIS is also considering surveys necessary for the siting of renewable energy facilities.

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 seven to eight 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 2013, some funding for Superstorm Sandy recovery may be directed towards identifying sand borrow sites along New Jersey and New York. BOEM is currently coordinating the environmental review of about 25 projects that will occur over the next five years.

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 project 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. BOEM is finalizing an EA that analyzes the potential impacts of proposed lease issuance, site characterization surveys, and technology testing activities.

1.3.4 Wind Energy Activities

For the near term, wind energy activities are primarily focused on site characterization and site assessment activities. Four interim policy leases were issued (Bluewater Wind Delaware, Fishermen's Energy, Deepwater Wind and Bluewater Wind New Jersey

Energy) in November 2009. Bluewater Wind New Jersey Energy and Bluewater Wind Delaware relinquished their interim policy leases in 2012. We received and "approved" both Fishermen's Energy and Deepwater Wind's project plan in 2012. The leases expire in November 2014. There are currently three buoys on the federal OCS that have been authorized under BOEM's jurisdiction. All are located off the coast of New Jersey.

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.

1.3.5 Cape Wind Project

In October 2010, Secretary of the Interior Ken Salazar and 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. BOEM, in consultation with U.S. Fish and Wildlife Service (USFWS), recently approved the monitoring plan. 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. The result is a source of unsolicited applications that are submitted in addition to responses from requests for interest. Unsolicited applications for commercial wind energy leases have been received from the following states; Massachusetts, Maine, New Jersey, New York, Rhode Island, and Virginia. These applications can offer conventional monopile technology as well as floating wind turbines. The proposals also range from a few turbines to several hundred. Requests for research leases from the Department of Mines, Minerals and Energy of the Commonwealth of Virginia were recently received.

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 also received and granted a ROW 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. Additionally, BOEM requested study ideas from stakeholders with interests along the Atlantic coast in the fall of 2012. Letters and emails requesting input were sent to the over 600 members of the state task force groups and significant partners such as the Northeast Regional Ocean Council and the Mid-Atlantic Region Council on the Ocean. Over 30 ideas were submitted and these were reviewed against mission relevance and existing efforts. Several of these ideas are included in this plan.

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. BOEM is just beginning to build this foundation and future proposed studies will continue to fill in the gaps as they are identified.

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 (AMAPPS), 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 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 FY2014.

- 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 (Contract with Normandeau). This study will compile specie-specific data, calculate 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 (contracts with Normandeau).
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 will start in 2013 in the Northeastern US. If successful, this study will be extended in FY 2015.

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. 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. Baseline information is needed including the seafloor habitat and water column, especially regarding habitat affinity at the scale of an individual wind energy facility. Initial surveys and determination of the appropriate scale is now underway. Besides the seafloor habitat, other methods for surveying include ventless traps, designed for lobster, as well as trawls. The specific type of survey is determined by the fishery of critical importance within a region. The Virginia Institute of Marine Science is leading trawl surveys along the Atlantic Coast from Long Island to North Carolina. The surveys began in 2007 and cover an area close to the coast. Extending these surveys out to cover the wind energy areas would provide important information about important fisheries along the Atlantic coast.

One concern of local fishers is the effects of Electromagnetic Fields (EMF) on important fisheries such as lobster. BOEM funded a literature synthesis of existing knowledge about EMF and the potential environmental consequences on sensitive species. Some questions still remain such as the effects of a large direct current cable as well as field experiments demonstrating whether effects may be observed. An initial field study is underway in the Pacific Region with direct observations around “live” cables. However, the potential species that may be affected are different on the Atlantic coast with particular interest in the important lobster fishery in the Northeast.

1.4.4 Socio-Economic Studies

The siting of wind energy facilities ultimately depends on values and trade-offs. As part of the analysis, we generally focus on the potential negative effects and how these can be reduced or mitigated. Often, the positive effects are not brought to light. We propose to address the positive effects from offshore wind development for inclusion in future NEPA analyses. Another approach is to assess the values of local communities based on local uses of the ocean. This may be most easily done today through current mapping technologies that elicit geographic information from users of the ocean.

As construction becomes a reality, ports along the Atlantic seaboard will need to be able to accommodate the types of technology that will be used. This may involve significant modifications to the ports and environmental effects from these modifications. The Department of Energy funded a recently completed study to assess the capabilities of Atlantic ports and we propose to take this one step further to include the environmental consequences of port modifications.

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 effect historic properties through the destruction or alteration of properties that are located on or below the seafloor and also through the introduction of visual elements that may impact properties onshore. 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 (for example, the archaeology tract of the workshop).

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 (for example, the submerged paleocultural landscape study), studies that provide baseline information (for example, the Atlantic baseline study and the Battle of the Atlantic study), and studies that provide tools for managing information related to the identification of historic properties (for example, Outer Continental Shelf Interactive Registry of Archaeological Surveys). These studies all provide feedback into the guidance BOEM provides to developers.

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. Observations of wind turbines on land suggest that the turbines could alter, though

perhaps only slightly, the local environment by altering wind patterns on the microclimate scale. In the marine environment, this could lead to fog. A desk study is proposed to further address the concern. Knowledge about the physical environment is also needed to assess changes and provide information for optimal siting of offshore wind facilities. Wind resources and local ocean wave and current regimes also dictate the siting of offshore wind facilities. This environmental information is critical prior to leasing to ensure the potential risks are well understood. Important instrumentation such as HF radar, which is used to provide important information about ocean surface currents, may be affected by the rotating blades.

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, in coordination with NOAA and USFWS, funded the Atlantic Marine Assessment Program for Protected Species from FY 2009 through FY 2014. This program has collected vital information about the distribution and abundance of marine mammals as well as sea turtles and avian species. We propose to continue this collaborative effort for another five years with our NOAA partners. While these surveys are from boats and planes, new technologies are now being employed to monitor marine mammals. Passive acoustic monitoring would provide important information about the marine mammals as well as ambient noise. Additional information about bottle-nose dolphins would fill gaps in knowledge about this important species.

1.4.8 Deepwater Canyons

In response to a proposed lease sale off of Virginia for oil and gas activities, BOEM initiated a study of several canyons along the continental margin. NOAA is also collecting important information from other canyons. We are proposing that a symposium be held to share this new information with the public and identify additional information needs. Of interest, would be further investigations of the Hudson Canyon, which was not included in the initial investigations.

1.4.9 Environmental Factors

Environmental assessments are based on the evaluation of the impacts of activities on the known environment, with a focus on those impacts that are significant. At the core of this analysis is an understanding of what is actually impacting the environment and the duration of the activity. For example, during the installation of a monopile, there is disturbance on the seafloor from anchoring, from the installation of the monopile, noise produced during any pile driving, air emissions from the vessels during construction,

and potential discharges from the vessels, to name a few. Information about these activities including the level of disturbance or emission and the duration are used to evaluate the effects on the environment, both from the individual event and cumulatively. Without a real world example, best estimates are used to make these determinations. The challenge is large where the evaluations lack real world examples to draw from.

DOE recently made awards for seven renewable energy projects, including two within federal waters. These projects have a high likelihood of moving forward and offer the opportunity to collect real world information about the activities as they occur. While it may be possible to request information from the developer, often this information may not fully provide the required information. We are proposing to collect direct information during these activities to provide more accurate information on which to make our assessments. Some of the questions to be addressed are included in the study profile. We will be partnering with other Federal agencies to ensure the information collected is sufficient to meet their responsibilities. The opportunity may also be used to test various proposed monitoring equipment and conduct other experiments focused on the environmental alterations that will occur with development.

1.5 New Starts for FY 2013 and Ongoing Studies Table

Table 1 lists new studies planned to start in FY 2013 and ongoing studies, categorized by discipline. Profiles for the ongoing studies can be found at:

<http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Renewable-Energy/Renewable-Energy-Research-Ongoing-Studies.aspx>

Table 1. New Starts for FY 2013 and Ongoing Studies

| NSL # | Study Title | Planning Area(s) | Start FY | Partners |
|--|---|--------------------|----------|----------|
| New Starts | | | | |
| Habitat & Ecology | | | | |
| 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 |
| Social Sciences | | | | |
| AT-12-x10 | Atlantic OCS Cultural Resources Survey and Archaeological Inventory Geographic Information System | N.-, Mid.-, S. ATL | 2013 | |
| AT-13-04 | Development of a Historic Context for Shipwrecks Located on the OCS offshore the Mid-Atlantic Using a Cultural Landscape Framework | Mid.-ATL | 2013 | |
| Fates and Effects | | | | |
| AT-13-05 | Effects from EMF from a High Voltage Direct Current 640 kv Transmission Lines and AC/DC Transformer Substations on Marine Species, Radar, and Marine Vessel Radio | N.-, Mid.-, S. ATL | 2013 | |
| *Note: The procurement of any study is contingent upon availability of funding | | | | |
| Ongoing Studies | | | | |
| Air Quality | | | | |
| AT-11-03 | Synthesis, Analysis, and | N.-, | 2011 | |

| | | | | |
|-------------------------------|--|--------------------|------|-------|
| | Integration of Air Quality and Meteorological Data for the Atlantic Region | Mid.-, S. ATL | | |
| 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-11-05 | Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments | N.-, Mid.-, S. ATL | 2012 | |
| AT-12-02 | Determining Offshore Use by Diving Marine Birds Using Satellite Telemetry | N. ATL | 2012 | USFWS |
| AT-12-05 | Building a Database to Assess the Relative Vulnerability of Migratory Bird Species to Offshore Renewable Energy Projects on the Atlantic OCS | N.-, Mid.-, S. ATL | 2012 | |
| 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-10-02 | Pilot Study of Aerial High-Definition Video Surveys for Seabirds, Marine Mammals, and Sea Turtles on the Atlantic OCS | N.-, Mid.-, S. ATL | 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-10-x14 | Roadmap: Technologies for Cost Effective, Spatial Resource Assessments for Offshore Renewable Energy | N.-, Mid.-, S. ATL | 2011 | NOPP |
| Information Management | | | | |
| AT-11-02 | Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities | N.-, Mid.-, ATL | 2011 | |
| AT-12-03 | Atlantic Renewable Energy Workshop | N.-, Mid.-, S. ATL | 2012 | |
| AT-12-x11 | Literature Review: Environmental Risks, Fate and Effects of | N.-, Mid.-, S. | 2012 | |

| | | | | |
|--|---|--------------------|------|------|
| | Chemicals Associated with Wind Turbines on the Atlantic OCS | ATL | | |
| Marine Mammals and Protected Species | | | | |
| AT-10-x11 | Atlantic Marine Assessment Program for Protected Species (AMAPPS) | Mid.-, S. ATL | 2010 | NOAA |
| AT-10-x15 | Evaluating Acoustic Technologies to Monitor Aquatic Organisms at Renewable Energy Sites | PAC | 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 American Archaeological Sites in Submerged Environments | N. ATL | 2012 | |
| AT-12-04 | Atlantic Offshore Wind Development: Public Attitudes, Values, and Implications for Recreation and Tourism | N.-, Mid.-, S. ATL | 2012 | |
| 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 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 2014 and FY 2015.

2.2 Profiles of Studies Proposed for FY 2014 NSL

Table 2. Atlantic OCS Region Studies Proposed for the FY 2014 NSL

| SDP Page Number | Discipline | Regional Ranking | Study Title |
|---|------------|------------------|--|
| 21 | FE | 1 | Real-time Opportunity for Development Environmental Observations (RODEO) |
| 23 | FE | 2 | Evaluation of Beneficial Impacts from Offshore Renewable Energy Development |
| 25 | SE | 3 | Wind Energy Development on the Atlantic OCS: The Identification of Port Modifications and their Environmental and Socioeconomic Consequences |
| 29 | MM | 4 | Atlantic Marine Assessment Program for Protected Species |
| 33 | AQ | 5 | Microclimate Formation within Wind Turbine Arrays and Its Effects on Local Weather and Climate |
| 35 | HE | 6 | Information Management of Marine Bird Data for Offshore Renewable Energy Decision Making |
| 37 | HE | 7 | Trawl Surveys in the Mid-Atlantic |
| 39 | PO | 8 | Use of Northeast Coastal Ocean Forecast System in Offshore Wind Energy Resource Planning |
| 41 | MM | 9 | Determining Offshore Use by Marine Mammals and Ambient Noise Levels Using Passive Acoustic Monitoring |
| 43 | FE | 10 | EMF (Electromagnetic Field) Impacts on Elasmobranch (sharks, rays and skates) and American Lobster Movement and Migration |
| 45 | HE | 11 | Movement Ecology of Terns in New England |
| 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 2014-2016

Region: Atlantic

Planning Area(s): Mid-Atlantic

Title: Real-time Opportunity for Development Environmental Observations (RODEO)

BOEM Information Need(s) to be Addressed: BOEM is responsible for the approval of a construction and operations plan submitted by developers for wind facilities on the Outer Continental Shelf. The approval process includes the analysis of the environmental effects from the construction, operation, and decommissioning of these facilities. Real-time measurements of the construction and operation of the first facilities to be built will allow for more accurate assessments of the actual environmental effects. Without real time observations of the activities, best estimates based on perceived activities are used to make these determinations.

Approx. Cost: (in thousands) \$1,000 **Period of Performance:** FY 2014-2016

Description:

Background: The construction of the first turbine in the offshore environment offers an opportunity to address many of the environmental questions that are of concern to the public. Many Federal agencies have mandates to protect the environment and will need to know more precisely what wind development will involve. Through a collaborative effort with other Federal and state agencies, the construction and operation of offshore wind turbines can be studied to gain insight into the actual disturbances to the environment. Without these real-time observations, analyses are based on best guesses and scenarios that are conservative.

Analyses of the environmental consequences require knowledge or estimates of the duration and extent of the activity. For example, the extent of disturbance on the seafloor from anchors may be estimated to encompass a larger area than actually occurs. Vessels may use dynamic positioning, resulting in no disturbance from anchoring. An analyst relies on the best available information and assumptions about the activities based on previous experience. For offshore wind development, there is no previous experience, so the analyses and subsequent mitigation measures are based on an educated guess. These analyses would benefit from real-time, independent observations during actual construction activities.

The example of anchoring is only one aspect that is estimated. A full environmental analysis includes estimates of air emissions, sound produced by the activities, sea floor disturbance by cabling, and potential discharges from vessels, to name a few. The duration of these activities is also included in the analysis. Better estimates of these

activities will result in more realistic mitigation measures that appropriately reduce or eliminate the impacts. Without accurate information, developers may be required to take measures that are ineffectual.

Objectives: The objective of this study is to acquire real-time observations of the construction and operation of a wind facility to aid the evaluation of environmental effects of future facilities.

Methods: The study will involve partnering between Federal and state agencies to address the mutual need for information about construction and operations. Data will be collected through direct observations during construction and operation activities at a selected development location. The types of observations will be determined by the activity being monitored, but may include a chronological description of the activity, video recordings, use of other instruments such as passive acoustic monitoring to record sound, or other means. The Department of Energy recently funded several projects along the Atlantic Coast with the intent of construction occurring by calendar year 2017. One of these projects will be selected for evaluation and may either be in Federal or state waters.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Atlantic

Planning Area(s): North, Mid-, and South Atlantic

Title: Evaluation of Beneficial Impacts from Offshore Renewable Energy Development

BOEM Information Need(s) to be Addressed: BOEM is responsible for evaluating both the detrimental and beneficial effects of renewable energy activities on the Outer Continental Shelf. While extensive reviews have focused on the detrimental effects, BOEM needs to acquire additional information about the beneficial effects for incorporation in NEPA analyses.

Approx. Cost: (in thousands) \$150 **Period of Performance:** FY 2014-2015

Description:

Background: BOEM evaluates the environmental effects that may result from leasing for wind energy on the Atlantic Outer Continental Shelf as part of the assessment process. These evaluations focus on the potential detrimental effects from the proposed activities, however, NEPA analyses should also include beneficial effects (40 CFR 1508.8). The National Environmental Policy Act declares “a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man...” To that end, we should identify those activities which will promote a healthier environment as well as identify those that may do harm.

For offshore renewable energy, some of the beneficial effects result from the development of energy sources that do not consume energy (such as coal is consumed to produce electricity) and the lack of emissions during energy production for both air and water. Secondary benefits may include potential health benefits from a reduction in the burning of coal and resultant particulates as well as the reduction in greenhouse gas emissions, which are contributing to accelerated climate change. Other environmental benefits may include reduced water withdrawals and cooling water discharge, positive alterations of seafloor habitat, and job creation. A synthesis of these beneficial effects would be useful to incorporate in NEPA documents.

Objectives: Provide a synthesis of beneficial effects of offshore wind energy development for incorporation in NEPA analyses

Methods: The study would include a synthesis, evaluation, and discussion of the potential beneficial effects to the environment from offshore wind development along

the Atlantic Outer Continental Shelf and may take into account onshore development and European development. The synthesis would draw from existing environmental evaluations of the detrimental effects of various forms of energy production including coal-fired power plants and nuclear power plants and an evaluation of avoided consequences. The synthesis would include potential health benefits and other societal gains.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): North, Mid- Atlantic

Title: Wind Energy Development on the Atlantic OCS: The Identification of Port Modifications and their Environmental and Socioeconomic Consequences

BOEM Information Need(s) to be Addressed: The scale of offshore wind turbine components, towers and foundation structures limits overland transportation options and creates a need for port facilities that can handle very large loads. Not all East Coast ports are currently equipped to handle the needs of offshore commercial wind development and the modifications that are necessary to accommodate this new use. As the offshore wind energy industry develops along the East Coast, it will be important for Federal, state, and local stakeholders to understand the environmental and socioeconomic consequences of such development, including the impacts from port expansion and changes in port operations. Due to the potential impact a wind facility would have on individual ports and the surrounding area, project-specific EIS's that evaluate the potential environmental and socioeconomic consequences of wind facility construction and operation, would analyze the impacts associated with the expansion and use of port facilities. The information from this study will support these assessments.

Approx. Cost: (in thousands) \$270 **Period of Performance:** FY 2014-2015

Description:

Background: BOEM opened the door to commercial wind energy development on the OCS in the Mid-Atlantic with the publication of the Final environmental assessment for "Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland and Virginia" and the subsequent Calls for Information and Nomination in Maryland and Virginia. In addition, BOEM is moving forward with leasing in the North Atlantic, through the Cape Wind lease, the unsolicited request by Statoil North America Inc. (Statoil NA) for a commercial wind energy lease offshore Maine, the proposed unsolicited project offshore New York, the establishment of the Rhode Island/Massachusetts Wind Energy Area (WEA) and the Massachusetts WEA, and the issuance of the Delaware lease. BOEM is also moving forward in the South Atlantic through the North Carolina Call for Information and Nominations and the establishment of a state renewable energy task force in South Carolina. Onshore facilities to support activities on future leases would likely be located at existing ports near the areas proposed for leasing. Development activities will eventually lead to the expansion of ports to accommodate the size of

construction vessels, space required for staging and maneuvering turbine components, and cranes capable of handling the weight of the nacelles and other components. These requirements may lead to select ports becoming hubs. Some ports, such as the Port of Wilmington, already have plans to expand in support of offshore wind energy (Diamond State Port Corporation, 2010). Other ports, such as New Bedford, go even further with a plan to establish a Marine Commerce Terminal which would serve as a hub for the construction, assembly, and deployment of offshore wind energy facilities (See: <http://www.masscec.com/index.cfm/page/New-Bedford-Marine-Commerce-Terminal/pid/14565>).

The expansion and operation of port facilities can produce a variety of environmental impacts, such as impacts related to, emissions, expansion into undeveloped areas, vessel induced wake erosion, increased dredging, and discharges on air and water quality and coastal habitats. In addition, a variety of socioeconomic impacts may occur such as the increase in employment in construction related fields and the possible decrease in employment in other fields due to the changing characteristics and use of a port (i.e. a traditional fishing port changing to a wind energy hub). In order to fully understand, as well as to plan for, the broad spectrum of potential impacts of proposed offshore development associated with future commercial proposals, it is necessary to generate data pertinent to possible onshore facilities and their subsequent environmental and socioeconomic effects. This effort will build upon the following ongoing studies: “Energy Market and Infrastructure Information for Evaluating Alternative Energy Projects for OCS Atlantic and Pacific Regions” (expected completion spring 2013), “OCS Renewable Energy and Space-Use Conflicts and Related Mitigation”, and “Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development”. This study will also build on progress made under DOE’s research of market barriers, such as additional criteria for identifying potential hubs and identification possible improvements (See: http://www1.eere.energy.gov/windandhydro/pdfs/national_offshore_wind_strategy.pdf). In addition, the study should research the European experience and analyze how ports were altered to accommodate offshore wind energy development and what environmental and socioeconomic impacts resulted from those alterations. The USACE should also be used as a source for historical data on the environmental and socioeconomic impacts of past port improvements.

Objectives: The objectives of this study are to achieve an understanding of:

- Current port capacity, specifically ones that could handle offshore wind, as well as an understanding of the necessary modifications;

- Environmental and socioeconomic consequences from modifications to ports that support offshore renewable energy facility construction, as well as the consequences of alterations to port operations; and
- Effectiveness of potential mitigations measures for the environmental and socioeconomic impacts of port modifications to accommodate offshore renewable energy facility construction.

Methods: The study will take place in two phases. The North Atlantic OCS Planning Area will be assessed in phase 1. The Mid-Atlantic OCS Planning Area will be assessed in phase 2. For each phase the following assessment will take place.

This study will identify ports that have the ability to accommodate the type of vessels required for offshore wind development in the six BOEM WEAs offshore Massachusetts, Rhode Island, New Jersey, Delaware, Maryland and Virginia, in the area proposed for development by Statoil North America offshore Maine, and BOEM planning areas offshore North Carolina. This study will further refine the list of potential hubs based on additional port characteristics (e.g., distance to WEAs, regional expertise, reinforced quaysides, large staging areas, easy access, and facilities to move foundations) (see Kaiser and Snyder, 2010), existing proposals, and state initiatives. The study will not assess smaller ports that will only receive minor use during the build-up for wind energy development (i.e. site assessment and site characterization). The identification of potential wind energy hubs can be accomplished through desktop research.

For each of the potential hubs, the study will identify potential modifications that would be necessary to accommodate the activities associated with offshore wind energy facility construction. Environmental (e.g., air and water quality, and coastal habitats) and socioeconomic (e.g., land use changes, environmental justice issues, population changes, and strain on existing infrastructure, such as traffic congestion) consequences of individual improvements could then be extrapolated from analysis of similar port improvements and expansions. The European experience will be reviewed for this analysis. The potential changes to port facilities due to the Panama Canal expansion will also be analyzed. A port facility may already be undergoing expansion to accommodate larger Post-Panamax ships and thus may already be planning to expand in ways that could accommodate wind energy development needs (See: http://www1.eere.energy.gov/windandhydro/pdfs/national_offshore_wind_strategy.pdf) as well as state efforts (See MassCEC study: <http://www.masscec.com/index.cfm/cd/FAP/cdid/11693/pid/11151>). In addition, state and local stakeholders will be engaged as they will be the most affected by wind facility construction and operation. When considering port modification, various offshore wind technologies will be analyzed, including upright deployment of all topsides, suction bucket foundation, and horizontal deployment and winching with light vessels. The

cumulative impacts of modifications will be described. Mitigation measures will also be identified and an analysis of their effectiveness when implemented for similar projects should be conducted.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): North, Mid-, and South Atlantic

Title: Atlantic Marine Assessment Program for Protected Species

BOEM Information Need(s) to be Addressed: BOEM requires information about marine protected species (marine mammals and sea turtles) for consultations under the Endangered Species Act and Marine Mammal Protection Act. Stock assessments are used to calculate take requirements for industry permits. In addition, offshore observations of bird distributions is limited but growing. These surveys allow for concurrent collection of avian information and expansion of baseline knowledge about birds offshore.

Approx. Cost: (in thousands) \$7,500 **Period of Performance:** FY 2014-2018

Description:

Background: The Atlantic Marine Assessment Program for Protected Species (AMAPPS) is a collaborative program involving BOEM, U.S. Navy, NOAA Fisheries, and U.S. Fish and Wildlife Service (USFWS). The program focuses on collecting seasonal data on the abundance, distribution, and behavior of marine mammals, sea turtles, and seabirds throughout the U.S. Atlantic EEZ and providing spatially explicit information in a format that can be used by Federal decision makers with living marine resource responsibilities. Since its inception in 2010, AMAPPS has successfully conducted surveys of the entire Atlantic EEZ in each season and has begun conducting replicate seasonal surveys. AMAPPS also has supported tagging of 60 sea turtles, and additional collaborations have resulted in a total of 87 sea turtles tagged to date, with at least 30 more planned for subsequent years. A sea turtle identification guide has been developed for aerial surveys, and analyses of 2010 summer aerial survey and turtle tagging data have provided the first estimate of at-sea abundance of loggerhead sea turtles in the U.S. Atlantic. Analyses of 2011 summer aerial and shipboard survey data have led to updated abundance estimates for 18 cetacean species or species groups. Analyses are currently underway to estimate the abundance of harbor seals and seabirds, and modeling efforts are underway to develop spatially explicit models of seasonal density of various species to produce a decision tool for a variety of purposes, including evaluation of the potential for various human activities (e.g., alternative energy development and military readiness activities) to interact with and impact marine mammals, sea turtles, and/or seabirds. AMAPPS is also actively coordinating with other BOEM, NOAA, USFWS, U.S. Navy, and DOE funded efforts that are surveying and modeling the density, abundance, and distribution of marine mammals, sea turtles, and seabirds.

AMAPPS was initially conceived as a long-term research and monitoring program, and the first 5-year phase is drawing to a close in FY 2014. Although great strides have been made, and more are expected to be made by the end of FY 2014, in improving the base knowledge regarding the abundance and distribution of marine mammals, sea turtles, and seabirds, important information gaps remain. Given resource constraints, the first five years of AMAPPS have focused on conducting broad scale surveys and developing spatially explicit models, with an additional focus on tagging of loggerhead sea turtles, given their propensity for long-duration dives, with associated impacts on availability bias and abundance estimates. For the next 5-year phase (FY 2015-2019), core survey work will need to continue, particularly given the dramatic interannual differences in oceanographic conditions within just the first three years (2010-2012) of AMAPPS. Fine or finer scale surveys will also likely be required, along with continued efforts to integrate and cross-validate fine-scale and broad-scale survey results. Additional emphasis could be placed on tagging seabirds, cetaceans, and seals both to inform survey corrections and to gather information on behavior, seasonal movements, and habitat use. Also, future AMAPPS efforts may incorporate more passive acoustic survey and monitoring efforts to learn more about large whale behavior, movements and habitat use. Analytical and modeling results from the first phase of AMAPPS should help inform which of these various topics will be most fruitful to focus on during the next 5-year phase.

The primary tools for the assessment of population abundance and spatial distribution are aerial and shipboard line-transect surveys. These surveys typically employ visual detection of animals at the surface, though more recently passive acoustic monitoring has been incorporated into these surveys to improve detection of marine mammals. Within U.S. Atlantic waters, the NOAA Northeast and Southeast Fisheries Science Centers have jointly and independently conducted broad-scale aerial and vessel surveys to support stock assessments. Regional aerial surveys have primarily been used to assess marine mammals and turtles within waters over the continental shelf to just beyond the shelf break. The deeper waters of the continental shelf and the inner continental slope to the U.S. Exclusive Economic Zone (EEZ) are most typically surveyed using large vessels and provide data primarily on marine mammals and sea birds.

Objectives: The objective of this study is to improve the knowledge base of Federal agencies with living marine resource responsibilities through improved surveys of marine mammals, sea turtles, and avian species. This will be accomplished by the following:

- collect broad-scale data over multiple years on the seasonal distribution and abundance of marine mammals (cetaceans and pinnipeds), marine turtles, and sea birds using direct aerial and shipboard surveys of coastal U.S. Atlantic Ocean waters;

- collect similar data at finer scales at several sites of particular interest to NOAA partners using visual and acoustic survey techniques;
- conduct tag telemetry studies within surveyed regions of marine turtles, pinnipeds, seabirds to develop corrections for availability bias in the abundance survey data;
- collect additional data on habitat use and life-history, residence time, and frequency of use;
- explore alternative platforms and technologies to improve population assessment studies; and
- assess the population size of surveyed species at regional scales; and develop models and associated tools to translate these survey data into seasonal, spatially explicit density estimates incorporating habitat characteristics.

Methods: The AMAPPS program will update the available data for marine mammals, turtles, and seabirds, and address critical information gaps in their assessments. The primary spatial scope of the program includes the U.S. western North Atlantic Ocean coast from the shoreline to the U.S. EEZ. Waters of major estuarine systems (e.g., Delaware Bay, Chesapeake Bay, and Pamlico Sound) may also be covered during aerial surveys. Within the larger area, there are a number of locations where fine-scale visual and/or passive acoustic surveys will be completed to provide enhanced resolution of densities by season. These data will also provide additional information for testing of the density estimation models to be developed under the 6th objective. Fine-scale surveys will be incorporated into the survey effort, as appropriate.

Seabird data will be collected in several ways. Ongoing coastal aerial sea duck and seabird surveys will be expanded spatially (northward and seaward to -30 nm), and seasonally to provide detailed estimates of seabird abundance and distribution. Seabird observers will also be deployed on NOAA survey vessels conducting marine mammal and turtle line transect surveys as well as on other NOAA fishery cruises as Platforms of Opportunity to obtain data on offshore distribution and abundance of seabirds. For seabird surveys conducted from vessels, surveys should go to the shelf break. Data collection for the first 5-year phase of AMAPPS began during summer 2010 with aerial surveys in the Northeast and Southeast Atlantic Regions.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): North, Mid- Atlantic

Title: Microclimate Formation within Wind Turbine Arrays and Its Effects on Local Weather and Climate

BOEM Information Need(s) to be Addressed: Commercial wind facilities could have 100 turbines or more in a relatively small area of the OCS. The installation of these turbines could result in localized changes in the microclimate of the area, potentially resulting in fog or “sea smoke.” This type of localized alteration has potential environmental consequences that need to be analyzed as part of the NEPA process.

Approx. Cost: (in thousands) \$750

Period of Performance: FY 2014-2016

Description:

Background: During the public comment periods of the Cape Wind Energy Project the public expressed concerns that Wind Turbine Generators (WTG) can create their own microclimate in Nantucket Sound. A microclimate is a small, local area having distinct weather or weather effects. Studies have been conducted that validate this concern. The studies conclude that when local meteorological conditions are favorable a microclimate can occur, most likely of fog or “sea smoke”, within a wind turbine array. A microclimate can be formed by artificial vertical mixing in the atmosphere caused by the WTGs. This vertical mixing can lead to turbulence in the wake of the wind turbine array. The formation of a microclimate has the potential to impact marine life, commercial and recreational activities, and navigation in the vicinity of a wind energy facility.

Objectives: The objective of this study is to determine the frequency of local meteorological conditions conducive to creating a microclimate within a wind turbine array in order to properly analyze the environmental consequences resulting from the installation of a wind energy facility.

This study shall:

- Adapt a regional climate model and using a nested modeling method develop a fine grid to assimilate the microclimate and local climate;
- Develop a numerical approach applicable to understand microclimate in a wind turbine array;

- Integrate numerical analysis of microclimate process into local climate model;
- Generate and evaluate the variation of local climate by installing the wind turbine arrays through long term modeling runs.

Methods: The evaluation will be made using the following process:

- Coordinate with the Gulf of Mexico Region on their new Interagency Agreement study with National Center for Atmospheric Research on the meteorological model in the Gulf using the Weather Research and Forecasting model;
- Determine the local meteorological conditions conducive to creating a microclimate within a wind turbine array;
- Determine the frequency and longevity of such conditions;
- Analyze the meteorological variables of a microclimate resulting from the installation of a wind energy facility; and
- Analyze the long-term weather and climatic impacts of microclimate formation.

A computer model will be used to determine the various climate and meteorological conditions of the Atlantic OCS in potential Wind Energy Areas identified in the North and Mid-Atlantic Planning Areas for the different seasons of the year. This model output should include variables such as sea surface temperature, air temperature, relative humidity, surface wind velocity, wind velocities aloft, water vapor, pressure, turbulence, etc. A wind turbine array consisting of approximately 100 turbines will be evaluated and this case will be used to model the same various climate and model conditions to simulate what will likely happen with respect to microclimate formation throughout the North and Mid-Atlantic Planning Areas during the different times of the year. The frequency of such climate and meteorological phenomenon taking place in the different locations will also be determined.

Methods to be considered for analysis include those mentioned in the following:

Brower, Michael C., and Nicholas M. Robinson, The openWind Deep-Array Wake Model - Development and Validation. May 2012. Available online at:
http://www.awsopenwind.org/downloads/documentation/DAWM_WhitePaper.pdf

Emeis, S. "Meteorological Explanation of Wake Clouds at Horns Rev Wind Farm." Dewi Magazin No. 37 August 2010: 52-55. Available online at:
http://www.dewi.de/dewi/fileadmin/pdf/publications/Magazin_37/07.pdf

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): North, Mid- Atlantic

Title: Information Management of Marine Bird Data for Offshore Renewable Energy Decision Making

BOEM Information Need(s) to be Addressed: The development of offshore renewable energy facilities has the potential to impact bird species. Information management of the data collected by marine bird surveys is key to being able to manage the decisions related to offshore energy proposal reviews. Positions dedicated to developing and maintaining the integrity of databases housing marine bird data in addition to conducting the analyses and syntheses necessary to support the review of offshore energy proposals will allow USFWS and BOEM to use the most recent and best available information decision-making.

Approx. Cost: (in thousands) \$880

Period of Performance: FY 2014-2019

Description:

Background: With the passage of the Energy Policy Act of 2005, BOEM was delegated responsibilities for alternative energy activities on the Outer Continental Shelf. This responsibility includes offshore wind energy projects. Experience from onshore wind development suggests that the careful siting of facilities is critical to minimize impacts to bird species. In light of this, the USFWS, in cooperation with and support from BOEM, USGS, NOAA and other organizations, has generated a vast array of marine bird biological data over the past six years. Resource stewardship and public accountability obliges the USFWS and BOEM to reap the full benefit of these investments, both for use internally and by our conservation partners. However, the full benefit can only be achieved with effective and efficient long-term data management, including data sharing, as well as the capacity to conduct data analyses. Furthermore there is demand for access to this data, both within the USFWS and BOEM and by our agencies' partners, all who are having to make decisions about offshore energy projects and fulfill their responsibilities under the National Environmental Policy Act, the Endangered Species Act, the Migratory Bird Conservation Act and other legal requirements. Meeting these needs will require sustained institutional support of data management and data syntheses and organizational commitments to developing a culture that fully embraces knowledge management, data sharing, and collaboration with partners.

In 2007, BOEM funded a study to compile existing observational datasets of seabirds and shorebirds titled "*Compendium of Avian Information.*" This study resulted in a comprehensive collection of observations along the Atlantic coast that date back to

1906. The resulting dataset has served as a starting point to identify the presence and distribution of avian species as well as identify areas where data are lacking. BOEM funded a follow-on study to add data collected more recently and to conduct analyses into the correlation between bird distributions and oceanographic features. A summary of the many field efforts that began in 2005 and continue today is now available through the Marine Cadaster, a web-based system to display geospatial information to support renewable energy siting decisions.

The current database represents the most comprehensive accumulation of observations available along the Atlantic coast and is invaluable as a foundation for future field efforts. However, the database is most valuable if it is readily accessible to the public through a web interface and is continuously maintained. BOEM is already incorporating the requirement that investigators submit their data to the compendium as a repository for sharing and compiling observations. The long term maintenance requires dedicated funding to ensure that it is maintained. This study will establish an agreement with USGS to maintain the database for the next five years and provide for sufficient funding to ensure adequate staffing.

Objectives: Provide access and updating for the avian compendium to support wind energy siting decisions as well as other seabird research activities along the Atlantic coast.

Methods: An agreement will be established with USGS to define the requirements for making the database available on the web and ensure adequate staffing to ensure that the valuable datasets are available to the public for the next five years. The agreement will:

- Keep the marine bird cadaster database populated with the most current survey information.
- Develop and populate a database to house information from individual tracking studies.
- Conduct QA/QC of all data residing and populating the Atlantic marine bird databases.
- Perform the necessary data analyses and syntheses as indicated by USFWS and BOEM when reviewing and making decisions on offshore wind or other energy proposals.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): Mid-Atlantic

Title: Trawl Surveys in the Mid-Atlantic

BOEM Information Need(s) to be Addressed: Baseline information about fisheries collected by trawl surveys is necessary to evaluate the potential effects from wind energy development along the Atlantic Coast.

Approx. Cost: (in thousands) \$500 **Period of Performance:** FY 2014-2015

Description:

Background: Wind Energy Areas (WEAs) have been, or are in the process of being identified throughout the North and Mid-Atlantic planning areas. The WEAs will be the first areas offered for leasing for wind energy development. BOEM may require lessees to collect some baseline fisheries data within their lease area, which may be a small portion of the wind energy area. At present there is a lack of systematic baseline fishery surveys of the mid-Atlantic wind energy areas to compare with, or put in context, the site-specific results of the lessees. This fisheries baseline information is not only important for the evaluation and assessment of a lessee's construction and operations plan, but also necessary for consultations with the NMFS pursuant to the essential fish habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act.

This project would extend the collection of trawl surveys that have been collected by the Virginia Institute of Marine Science and NOAA further from shore. There is a lack of standard regional baseline fishery data that extends seaward to areas for potential wind energy development along the Atlantic OCS. The historical trawl surveys have primarily been broad scale (stock level) or designed for other specific purposes in areas that do not overlap with potential WEAs. For example the NOAA Fisheries semi-annual (Fall and Spring) bottom trawl survey is at a scale that may include only a couple of survey stations that overlap with the WEAs. Additionally, the Northeast Area Monitoring and Assessment Program (NEAMAP), does not fully overlap with the WEAs.

This study would assess and characterize fishery resources in existing and proposed WEAs from New York to North Carolina. This survey will collect data allowing the selection of appropriate control study sites and setting a baseline of species presence and abundance as well as detecting seasonal trends. This study may include analysis of previously collected data of similar type (e.g. NEAMAP and NMFS survey data) as well as new data collection and analysis.

Objectives: The objective of this study is to establish baseline fishery resource characteristics at regional/WEA scales. This data would allow for improved siting, impact assessments, and provide a baseline to evaluate project-scale fishery surveys submitted by lessees.

Methods: The study would perform a semi-annual bottom trawl survey in the mid-Atlantic WEAs using the standard NEAMAP survey protocols. These protocols, including the use of a survey platform provided by the fishing industry and, therefore, produce results that are accepted by the fishing industry. These protocols also include using a 30 square nautical mile distribution of survey stations, subsampling the priority commercial species for total length, sex and maturity, and stomach content(see [The NEAMAP Trawl Survey @ VIMS - YouTube](#)) .

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): North Atlantic

Title: Use of Northeast Coastal Ocean Forecast System in Offshore Wind Energy Resource Planning

BOEM Information Need(s) to be Addressed: For emerging areas of offshore wind resource energy development, BOEM requires adequate assessment of the impact future wind energy facilities will have on small-scale coastal and regional offshore physical environmental processes. Incorporating individual wind turbines and wind energy resource facilities within a validated modeling system for the US North Atlantic Ocean that includes 30 years of data for hindcasting scenarios and forecasting capabilities will allow BOEM to use detailed simulations to more accurately assess the impacts that proposed wind energy facilities may have on affected environments (as mandated by the National Environmental Policy Act [NEPA]). The modeling proposed in this study will allow us to better assess the affect offshore turbines may have on larval transport and may assist with tracking spills related to ship allision.

Approx. Cost: (in thousands) \$325

Period of Performance: FY 2014-2016

Description:

Background: The Northeast Coastal Ocean Forecast System (NECOFS), developed at the Marine Ecosystem Modeling Dynamics Laboratory at the University of Massachusetts-Dartmouth, is an integrated atmosphere/surface wave/ocean model system designed for the US northeastern coastal region covering a computational domain from central New Jersey to the eastern end of the Nova Scotia Shelf. Forecast variables include surface wind, air pressure, precipitation/evaporation, surface heat flux, ocean currents, water temperature and salinity, and significant wave heights and frequencies. The core of this system is the Finite-Volume Coastal Ocean Model (FVCOM) developed by Chen et al. (2006a-b). FVCOM features an unstructured grid in the horizontal plane and a terrain-following coordinate in the vertical plane. NECOFS presently includes two nested domains: 1) the FVCOM GOM3 domain covers the New England Shelf, Georges Bank, the Gulf of Maine, and the Scotian Shelf region and has a spatial resolution varying from 0.5 – 1.0 km in coastal regions (around Georges Bank and along the shelf break) to 10 – 15 km in the open ocean; and 2) the Mass Coastal FVCOM is a grid covering waters surrounding Massachusetts (including Plum Island Sound/Merrimack River, Mass Bay, Cape Cod Bay, Nantucket Sound/Shoal and Buzzards Bay) with a horizontal resolution that varies from 10 m in estuaries to 1 km over the Massachusetts inner shelf. A subdomain may be developed within FVCOM with a boundary connected to NECOFS. This subdomain could have a horizontal resolution

of 1 m or even less. FVCOM is an unstructured grid finite-volume model, and one of the advantages of this model is its flexibility in grid sizes. Grid size of the model could easily be adjusted based on need.

Objectives: The objective of this study is to determine the mesoscale effects of offshore wind resource facilities on coastal and oceanic environmental conditions and habitat. This study will use the hindcasting and forecasting capabilities of NECOFS to provide comprehensive temporal and spatial simulations of the impact of wind energy resource facilities on proposed areas of offshore wind energy development. We propose to develop a sub-domain FVCOM that includes proposed turbines with a boundary connected to NECOFS.

Methods: This project will use a sub-grid FVCOM with a refined grid. We will first construct a subdomain in the study area with a horizontal resolution of up to 1 m around each proposed turbine. This sub-grid model will have a grid transition away from the turbine area to the NECOFS grid. This approach will allow us to resolve the turbines accurately and model the area with the boundary connected to NECOFS. An example of this approach is the development of a subdomain model to assess inundation in Scituate Harbor (MA) where the resolution is about 2 m and the model is connected to NECOFS over the inner shelf of the western Massachusetts coast. We will use the same approach to develop a subdomain model for turbine studies. We will run the subdomain model without and with turbines for conditions of normal weather, hurricanes, and Nor'easters. The objectives of these experiments are to examine how oceanic responses will change after turbines are installed, particularly for bottom stress and turbulent mixing. We will compare conditions with and without turbines in the high-resolution sub-domain model experiments to provide a quantitatively estimation of environmental changes after turbines are installed.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): Mid-Atlantic

Title: Determining Offshore Use by Marine Mammals and Ambient Noise Levels Using Passive Acoustic Monitoring

BOEM Information Need(s) to be Addressed: Geographic information describing marine mammal presence, distribution and seasonality is needed for siting and environmental permitting of offshore wind energy projects. In addition, information regarding baseline noise levels is needed in order to determine the potential impacts from underwater noise that may occur during construction and operation of offshore wind energy facilities upon marine mammals and other aquatic species.

Approx. Cost: (in thousands) \$1,800 **Period of Performance:** FY 2014-2017

Description:

Background: While there are marine mammal data collection efforts ongoing currently, including the Atlantic Marine Assessment Program for Protected Species (AMAPPS) (funded by BOEM), the Biodiversity Research Study (funded by DOE), and the Virginia Aquarium study (funded by VA), these studies suffer from the traditional detection biases of limited duration and geographic coverage. To help fill the gaps, Maryland is interested in collaborating, and possibly cost-sharing, with BOEM on a passive acoustic monitoring study for the offshore Maryland Wind Energy Area (WEA). Passive acoustic recordings allow for continuous monitoring of sound producing animals and can provide information on the daily cycles of behavior, seasonal occurrences and regional distributions of marine animals. This baseline data on marine mammals and ambient noise levels will be useful to BOEM and developers during the offshore wind energy leasing process and the subsequent construction and operation phases. This study idea was proposed by Maryland Department of Natural Resources and would be conducted in coordination with other efforts they are funding.

Objectives: The goals of this work are to provide an assessment of the species and geographic distributions of marine mammals present in the vicinity of the Maryland WEA and to provide a baseline of ambient underwater noise. Passive acoustic monitoring (PAM) can provide species presence information, and an array of multiple PAM systems can also provide location information via triangulation. Thus, with sufficient data, PAM can be used for presence-absence modeling and location-based analyses. The objectives of this study are to produce:

- A database of species calls and times for marine mammals,

- Estimated locations of North Atlantic Right Whale and other species calling bouts,
- Statistical analysis of location data, and
- Spatially explicit noise statistics to define baseline levels of underwater ambient noise.

Methods: Passive acoustic monitoring instruments would be deployed on the seafloor to collect ambient sound as well as marine mammal presence. The array design would maximize coverage in and near the Maryland wind energy area and ideally, would result in baseline information that could be used for post-construction evaluations. In addition, a sensor mounted on a Wave Glider or other appropriate mobile device would be tested for determining pre-construction sound. High frequency acoustic recording packages will be used on both platforms, to provide broadband data. Data would be collected continuously for one year, with a possible extension for additional years.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): North Atlantic

Title: EMF (Electromagnetic Field) Impacts on Elasmobranch (sharks, rays and skates) and American Lobster Movement and Migration

BOEM Information Need(s) to be Addressed: While BOEM has funded reviews on the current understanding of potential effects of EMF on marine organisms; to date there has not been any field-based studies examining effects of EMF on elasmobranchs and lobster species in the Northeast. Commercial fishermen in the region have consistently voiced their concern regarding potential effects of EMF emitted from submarine cables on commercially targeted fish species. Further investigation into this topic would assist BOEM in future NEPA analyses of other proposed projects in the region, as well as show a commitment from BOEM to the concerns raised by fishermen.

Approx. Cost: (in thousands) \$900

Period of Performance: FY 2014-2019

Description:

Background: The effects of EMF emitted from submarine cables on marine organisms is of high concern to commercial and recreational fishermen throughout New England. While there are some studies, particularly from Europe, that indicate buried alternating current cables have little to no measurable effects on marine species, there is still concern for important US commercial species. Of particular interest in the Northeast, where wind development is most likely to occur first, are the commercially important American Lobster (*Homarus americanus*) and elasmobranchs (skates, etc.). While there are existing submarine cables (e.g. Nantucket Island), no direct field studies have been conducted to confirm that the network of cables that will exist with large wind facilities may have an effect. The Coastal Resources Management Council - Rhode Island has specifically identified this type of study as important for their local commercial fishermen.

Objectives: The focus of this research is on determining the actual emissions associated with the cables associated with offshore wind farms and any response by sensitive receptor organisms including the American Lobster and elasmobranch species (skates, etc.).

Methods: This study would use a multi-task approach involving both field and lab-based investigations:

1. Field surveillance monitoring (ambient and cable related) measured using an ROV equipped with EMF measuring instrumentation;
2. Experimental studies to assess the response of receptor organisms including: baited cameras to observe behavior in the field near the cable and at control sites; and laboratory experiments to quantify the type of response that each target species had to different levels of EMF. The quantified behaviors would then be used to define the type and level of response seen in the baited video studies.

Mark and recapture of commercially important crustacean species, mainly the American Lobster, to track the movement of lobsters over installed cables. The proposed mark and recapture study would catch and tag lobsters working in coordination with local lobster fishermen, relocate them to areas across the cable route, and measure the recapture rate before and after cable installation. The results of this study will help inform fishermen and regulators on what the actual effects of EMF are on this important fishery.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): North Atlantic

Title: Movement Ecology of Terns in New England

BOEM Information Need(s) to be Addressed: New England represents one of the largest concentrations of breeding Common Terns and the endangered Roseate Terns in the North western Atlantic. The movement ecology of terns in the region is poorly understood, particularly from their largest breeding colony in the region, Great Gull Island, to a post-breeding staging area on Cape Cod. Understanding the movement ecology of terns in the area is critical to understanding potential conflicts with wind energy leasing and permitting decisions.

Approx. Cost: (in thousands) \$200

Period of Performance: FY 2014-2016

Description:

Background: The breeding ecology (e.g., trends in colony size, reproductive effort) of both Common and Roseate Terns is well understood from the monitoring efforts conducted on Great Gull Island in Long Island Sound - and Monomoy Island - in Nantucket Sound. Mass Audubon found that large concentrations of both tern species concentrate along Cape Cod in the fall. However, specific migratory routes, phenology of migration, and foraging flights are poorly understood. Presumably birds nesting at Monomoy Island forage throughout Nantucket Sound while birds from Great Gull Island may migrate through Rhode Island Sound, Block Island Sound, and Nantucket Sound..

Although there are currently preliminary plans to use nanotag technology to monitor tern movements in this region, nanotag technology is ineffective at monitoring large scale movements at distances >10 km from land-based receiving stations.

Alternatively, GPS tags could be used to monitor movements of terns throughout the region during the breeding and non-breeding seasons to obtain an accurate assessment of their movement ecology. This study idea was proposed by the Coastal Resources Management Council - Rhode Island and will be conducted in coordination with them.

Objectives: Describe the movement ecology of Common and Roseate Terns in New England, including foraging flights from breeding colonies, post-breeding dispersal movements to staging grounds, and movements to wintering areas.

Methods: During the first year, Common Terns (pilot species) will be outfitted with miniature GPS tags at the breeding colony. Tags are estimated to last for about 4-6 months and able to obtain thousands of locations (e.g., hourly location data) per tag

within in 10 meters its actual location. Tags will be attached to breeding adults and those adults will be recaptured the next breeding season to obtain data. The methods and lessons learned from the first year will be evaluated before a decision is made to use the technology this on Roseate Terns.

Revised Date: March 29, 2013

2.3 Profiles of Studies Proposed for FY 2015 NSL

Table 3. Atlantic OCS Region Studies Proposed for Fiscal Year 2015 NSL

| SDP Page Number | Discipline | Study Title |
|--------------------------------|------------|---|
| 49 | FE | Describing Marine Bird Distribution and Movement Patterns on the South Atlantic OCS |
| 51 | FE | Expanding NanoTag Tracking to Determine Offshore Movements of Small-Bodied Birds |
| 53 | FE | Commercial Shipping and Fishing Vessel Activity Effects on Seabird Distribution and Abundance on the Atlantic OCS |
| 55 | FE | Impact Assessment of Offshore Wind Turbines on High Frequency Coastal Oceanographic Radar |
| 57 | IM | Symposium to Showcase the Research on Mid-Atlantic Submarine Canyons and to Investigate the Implications of Energy Development |
| 59 | MM | Establishing Baseline Data on Coastal Bottlenose Dolphin Status and Health for Use in Environmental Assessments |
| 61 | HE | Exploration and Research of Hudson Canyon Hard Bottom Habitats |
| 63 | HE | Spatial Ecology, Movement Patterns, and at-Sea Habitat Use of Nearshore Seabirds: Addressing Needs for Renewable Energy Development |
| 65 | HE | Acoustic Mapping and Characterization of Sensitive Hardground and Live Bottom Habitat on the Southeastern US Shelf |
| 67 | HE | Surveying for Marine Birds off the Southern Atlantic Coast and Gulf of Mexico |
| 69 | SE | Quantitative Assessment of Spatially Explicit Social Values Relative to Wind Energy Areas |
| Discipline Codes | | |
| FE = Fates & Effects | | HE = Habitat & Ecology |
| IM = Information Management | | MM = Marine Mammals & Protected Species |
| SE= Social & Economic Sciences | | |

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): South Atlantic

Title: Describing Marine Bird Distribution and Movement Patterns on the South Atlantic OCS

BOEM Information Need(s) to be Addressed: The development of offshore wind facilities has the potential to impact bird species. As interest in offshore wind energy development grows in Federal waters off the southeast U.S. coast, BOEM has an urgent need to determine fine-scale movements and migratory pathways used by many marine bird species in the area. Survey data can help determine distribution and abundance of birds in the offshore environment within a specific time period, but often cannot elucidate movement patterns. Satellite tracking has been used effectively to obtain this information for diving bird species in the mid-Atlantic, and should be expanded to other avian taxa in the southeast to inform siting decisions of offshore facilities and to assess risk.

Approx. Cost: (in thousands) \$1,800 **Period of Performance:** FY 2015-2016

Description:

Background: In 2012, BOEM funded a project to satellite-track three priority species of diving birds (Surf Scoter, Northern Gannet, and Red-throated Loon) that were representative of taxa found in Federal mid-Atlantic waters during migration and winter. The project has begun to provide researchers with a better understanding of how marine bird species use the offshore environment in the area. Now, specific information about movement patterns is needed for marine bird species frequenting Federal waters off the southeast U.S. coast (North Carolina south to Georgia). FWS has many species of conservation concern, The following list of species represent a diversity of marine bird taxa found in the area throughout the year and are priorities for satellite tagging and tracking: Greater Shearwater, Cory's Shearwater, Common Loon, Red-throated Loon, and Black-capped Petrel. Currently, little information exists on the occurrence and movements of these species in Federal waters from North Carolina to Georgia despite the new interest in potential construction of wind energy facilities in the area. This project would fill many of these information gaps. The proposed species for this region may change due to results from BOEM funded study "Assessing the Relative Vulnerability of Migratory Bird Species to Offshore Renewable Energy Projects on the Atlantic OCS."

Objectives: The primary objective will be to describe the occurrence and movement patterns of up to five marine bird species representing three taxonomic groups with diverse life history strategies.

Methods: Approximately 15-25 birds per species will be captured each year in breeding colonies (Black-capped Petrel) and offshore wintering and migratory areas (shearwaters and loons). Aerial and shipboard survey data from prior studies (e.g., Compendium of Avian Information) will be used to identify a suite of potential capture offshore locations. Each animal will be tagged with satellite Passive Platform Transmitters (PTTs; implanted of external harnesses). PTTs will be programmed to send coordinates multiple times per day. The estimated battery life for the PTTs is greater than one year.

Revised Date: April 1, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): North and Mid-Atlantic

Title: Expanding NanoTag Tracking to Determine Offshore Movements of Small-Bodied Birds

BOEM Information Need(s) to be Addressed: The development of offshore wind facilities has the potential to impact bird species. Survey data can help determine distribution and abundance of birds in the offshore environment within a specific time period, but often cannot elucidate movement pathways and fine-scale movements, which are also critical pieces of information in planning offshore wind facilities. NanoTag tracking can be used with small-bodied birds to provide such information, which cannot be obtained in other ways.

Approx. Cost: (in thousands) \$1,485 **Period of Performance:** FY 2015-2017

Description:

Background: In order to site offshore wind facilities in areas where they will have the lowest impacts on birds, there is a need to collect distribution and behavior information (e.g., flight paths and timing) from a broad suite of species that use offshore waters. Aerial- and boat-based surveys have been performed in recent years to determine distribution of birds in Federal waters of the U.S. Atlantic. While surveys can provide a “snapshot” of bird distribution for some species, timing and pathways of fine-scale movements may be missed. Such information gaps can be filled by tracking individual birds. For small-bodied birds, precision tracking techniques are limited. NanoTag tracking is currently the most precise method for tracking priority bird species that are too small for satellite tags.

During the last year, biologists from agencies and academic institutions recommended the creation of an “Atlantic Flyway Monitoring Network” of NanoTag stations to determine how birds are using offshore environments (foraging areas, migratory pathways, etc.) across a wide area of the Atlantic Flyway. To date, NanoTag techniques have been used with songbirds in many locations, and seabirds and shorebirds in the Gulf of Maine and Cape Cod. In 2013, BOEM funded a one-year pilot study (AT-13-01) to use NanoTags to track the movements of Common Terns and American Oystercatchers in Eastern Nantucket Sound. Expansion of the technology to more locations and species will dramatically increase the utility of the technology for determining movement patterns of many small bird species.

Objectives: Expand the understanding of occurrence and movement patterns of priority small-bodied birds in offshore waters to a broader geographic area.

Methods: Research for this study would be conducted in cooperation with the USFWS and state agencies. The following details the methods for each area:

1) **North Atlantic:** Install 12 NanoTag stations in the Gulf of Maine, including stations on Integrated Ocean Observing System (IOOS) offshore buoys (<http://www.ioos.gov/>). Tag 50 Common Terns per year for 3 years, and 50 individuals each of up to 4 other priority species per year including Arctic Tern, Semipalmated Sandpiper, Atlantic Puffin, and priority migratory songbirds. The proposed species for this region may change due to results from BOEM funded study “[Assessing the Relative Vulnerability of Migratory Bird Species to Offshore Renewable Energy Projects on the Atlantic OCS.](#)” Field work and data analyses will be conducted by project partners with expertise in capture, tracking and spatial analyses of coastal and marine species, including University of Maine, USFWS Maine Coast Islands National Wildlife Refuge, and Acadia University.

2) **Mid-Atlantic:** Install 12 NanoTag stations on Long Island Sound and Rhode Island, including stations on IOOS buoys. Tag 50 American Oystercatchers and Common Terns per year for 3 years, and 50 individuals each of up to 4 other priority species per year including Least Tern, Semipalmated Sandpiper, and priority migratory songbirds. As above, the proposed species for this region may also change. Field work and data analyses will be conducted by project partners with expertise in capture, tracking and spatial analyses of coastal and marine species, including University of Massachusetts, University of Rhode Island, and USGS.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

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.

Approx. Cost: (in thousands) \$150

Period of Performance: FY 2015

Description:

Background: The launching of the Secretary’s “Smart from the Start” wind energy initiative for 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. It is believed that these behaviors explain some of the observed avian hot spots on maps produced using data from the USGS Compendium of Avian Occurrence (M08PG20033). 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 (2009-2011) that spans the entire Atlantic OCS. 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 ongoing study "Marine Vessel Traffic and Wind Energy Development Infrastructure on the OCS Risk Analysis."

Predictive 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 Multi-Purpose Marine Cadastre and other public data portals.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): All

Title: Impact Assessment of Offshore Wind Turbines on High Frequency Coastal Oceanographic Radar

BOEM Information Need(s) to be Addressed: With the advent of lease issuances for offshore wind energy areas, BOEM must assess the impact wind turbines may have on the high frequency (HF) coastal oceanographic radar system used operationally by the U.S. Coast Guard for search and rescue and by NOAA for oil spill monitoring and response. The permitting process for radio frequency interference requires an assessment of the effects of offshore wind turbine blade rotation on HF coastal radar signals. This study proposes to perform simulations and in situ measurements to quantify the negative impacts of rotating wind turbines to HF radars currently deployed along the Atlantic coast.

Approx. Cost: (in thousands) \$500

Period of Performance: FY 2014-2015

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.oceans12mstieehamptonroads.org/index.cfm>), indicates that interference from the rotating turbine blades is likely to occur and will require some mitigation techniques. Because this study is a simulation, the complete effects are still to be determined.

The signature and impact of the rotating blades on HF radar processing has never been 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 these critical missions. The NOAA Integrated Ocean Observation System office has indicated that this is a significant issue of concern for their HF radar program.

Objectives: This study will achieve the following objectives:

1. Detailed characterization of the negative impacts of offshore wind turbines on HF radar current and wave processing from both simulated and in situ data, and

2. Analysis of 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.

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.

Field tests of HF radar in the vicinity of offshore wind turbines will be conducted. HF radar will be installed and will collect data in coastal areas where offshore wind turbines are currently in operation. 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, we 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 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): Mid-Atlantic

Title: Symposium to Showcase the Research on Mid-Atlantic Submarine Canyons and to Investigate the Implications of Energy Development

BOEM Information Need(s) to be Addressed: Deep submarine canyons are some of the diverse offshore ocean habitats that characterize the Mid-Atlantic region. They support a rich diversity of marine life, including valuable commercial and recreational fisheries. BOEM needs to document the ecological and physical characteristics of the Mid-Atlantic submarine canyons before they can determine the potential impacts of offshore energy activities that may occur near the canyons, including geological and geophysical surveys; development of deep water wind and wave energy projects; oil and gas exploration and development; and construction of transmission lines.

Approx. Cost: (in thousands) \$200

Period of Performance: FY 2015

Description:

Background: The shelf break and slope off the northeastern US support a diversity of habitats including more than 70 canyons ranging from depths of ~100m to ~3500m. Many scientists and managers believe the canyons provide a refuge for a variety of fauna including species of corals, fish and other animals. While some canyons have been studied previously, most are poorly known and are of high interest to agencies with research and management responsibilities. This symposium would create an opportunity to focus on the state of scientific understanding of the Mid-Atlantic ocean submarine canyons and showcase the significance of these little known but important habitats and their communities. The symposium would highlight and build on recent studies on the canyons, including Federal and regional initiatives such as the series of Atlantic Canyons Undersea Mapping Expeditions; NOAA Deep Sea Coral Research and Technology Program; the Mid-Atlantic and New England Fisheries Management Council Habitat Committee and Habitat Development Plans; Mid-Atlantic Regional Council on the Ocean's (MARCO) Habitat Action Team efforts to prioritize ocean habitats for protection; and others. This symposium would also create an excellent opportunity for experts to develop a needs assessment based upon today's knowledge that would help expedite BOEM and other governmental permitting for ocean energy in the Mid-Atlantic.

Objectives:

Objective 1: *Provide a venue to exchange knowledge and seek innovative collaborations and partnerships among scientists, decision-makers, and others regarding the Mid-Atlantic deep submarine canyons.*

A key element of the symposium would be to showcase the completed and ongoing research on Mid-Atlantic canyons being undertaken by Federal and state agencies, leading researchers, academia, industry, and other organizations. This would include information on the biological and biophysical features, their bio-tech and pharmaceutical potential, and human uses. Additionally, the symposium would draw attention to the most up-to-date technologies in ocean exploration.

Objective 2: *Collect and consolidate the existing data on the submarine canyons.*

Prepare a white paper that describes existing information – biological, physical, ocean energy and pharmaceutical potential, and secondary and cumulative issues – on the submarine canyons.

Objective 3: *Conduct a needs assessment and analysis based on the results of the white paper, consultations with scientists and managers and symposium participants to identify significant data and knowledge gaps.*

This process would identify critical research and exploration needs for the Mid-Atlantic and would impart a sense of shared responsibility for its future. The findings should be widely distributed and presented in such a manner that it could be readily used to guide future scientific and management investments.

Methods: Substantive planning would be needed to ensure that the symposium serves as a forum for building awareness of the importance of the canyons to the Mid-Atlantic region. The symposium would involve the development of written and online materials that could be used to educate and inspire symposium attendees as well as the general public. The Mid-Atlantic Regional Council on the Ocean, Federal agency representatives (e.g., BOEM, NOAA), regional fisheries management entities, and key NGO, industry, and scientific leaders within the region should be engaged in the planning process. This would include assisting with the development of the symposium objectives and content; garnering support from a variety of sectors for the goals of the symposium; ensuring the engagement of key leaders, stakeholder, and practitioners; and connecting with targeted media relations and marketing.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): Mid- and South Atlantic

Title: Establishing Baseline Data on Coastal Bottlenose Dolphin Status and Health for Use in Environmental Assessments

BOEM Information Need(s) to be Addressed: BOEM needs baseline data on Marine Mammals for identification of vulnerable stocks for National Environmental Policy Act (NEPA) analysis, and provide information needed for consultation with NMFS pursuant to the Marine Mammal Protection Act (MMPA) prior to leasing and permitting decisions.

Approx. Cost: (in thousands) \$1,500 **Period of Performance:** FY 2015-2017

Description:

Background: The oil spill and associated response activities that resulted from the explosion of the Macondo well highlighted the critical need for baseline information on affected ecosystems. For marine mammals, understanding the impacts of this spill was hampered by a lack of baseline information on their abundance and spatial distribution, population structure, and population health. Baseline data are invaluable for assessing impacts of oil spills; but they are also critical for prospective planning for energy exploration, development, production, and/or transport associated not only with gas and oil, but also wind, wave or tidal energy, or development of sand and gravel resources. All of these energy development and production endeavors involve potentially disruptive activities such as seismic surveys, pile driving, or increased vessel traffic that could impact marine mammals. The proposed study will build on a previous BOEM study “Atlantic Marine Assessment Program for Protected Species” and will cover coastal dolphin stocks in the Mid- and South Atlantic Regions not previously assessed. We will also integrate additional information on stock structure, population health status, and habitat characteristics to develop a measure of vulnerability for the coastal stocks that may be used for identification of vulnerable stocks for NEPA analysis, and provide information needed for consultation with NMFS pursuant to the Marine Mammal Protection Act (MMPA) prior to leasing and permitting decisions.

The BOEM-funded Atlantic Marine Assessment Program for Protected Species (AMAPPS) study established population abundance and spatial distribution for multiple marine mammal stocks in the Atlantic planning regions. In the Mid- and South Atlantic, AMAPPS provided aerial survey abundance information for shelf waters, but ship-based surveys were only conducted over deeper waters of the continental shelf and slope to the

U.S. EEZ; consequentially biopsy samples and environmental data were not collected for dolphin stocks off North Carolina or in the South Atlantic Planning Region.

Objectives: This study will focus on coastal dolphin stocks from North Carolina to central Florida and will:

1. Conduct genetic analyses to better delineate stocks; this will address whether the 4 currently delimited coastal stocks constitute discrete stocks as defined under the MMPA.
2. Gain an understanding of the range of the stocks through satellite telemetry; this will establish stock range and boundaries to support future MMPA consultations.

All four coastal stocks will be targeted for remote biopsy sampling, providing skin samples for genetic analyses and skin/blubber samples for analysis of contaminant exposure and stress and reproductive hormones. In addition, two stocks will be selected for capture-release sampling, which will provide in-depth health evaluations (physical exam, blood sampling, diagnostic ultrasound), audiometric tests to assess potential hearing loss, and attachment of satellite-linked tags. The health information will be integrated with existing data on habitat characteristics to develop a vulnerability index for each stock.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): Mid-Atlantic

Title: Exploration and Research of Hudson Canyon Hard Bottom Habitats

BOEM Information Need(s) to be Addressed: Knowledge of the distribution and sensitivity of unique biological habitats in deep water is necessary for management decisions regarding consideration of potential oil and gas leasing and development in the Atlantic region as well as floating renewable energy structures. Study results will help to define mitigations and need for avoidance of hard bottom areas and associated sensitive coral communities in deepwater. The Hudson Canyon area was not included in a recent BOEM study. In addition, surveys and investigations of archaeology targets in the lease area will provide preliminary information for avoidance of these resources.

Approx. Cost: (in thousands) \$1,000 **Period of Performance:** FY 2015-2017

Description:

Background: Information regarding the physical, biological and ecological characteristics of the offshore Hudson Canyons is needed. The Canyon has been studied but the current level of available information is limited. The question of what impacts energy activities (oil and gas, offshore wind development) will have on the Canyon cannot be answered without having a baseline knowledge of the area as it is now. BOEM has funded a study titled: *Exploration and Research of Mid-Atlantic Deepwater Hard Bottom Habitats and Shipwrecks with Emphasis on Canyons and Coral Communities*. This study would be expanded to include Hudson Canyon. It is well known that there are many locations with significant areas of hard bottom in the mid-Atlantic deepwater, particularly associated with canyon features. These habitats can include significant populations of corals (including gorgonians). These areas would be well represented on seismic surface anomaly geophysical maps but there are no significant seismic survey data in this area at this time. Early studies from the late 1970s and through the early 1980s (many funded by Minerals Management Service (MMS) (now BOEM) have documented many canyon areas including significant boulders and rock outcrops, some with high relief with a high diversity of associated attached communities. Megafauna associated with canyons were shown to be different and more diverse than on surrounding continental slope habitats. Previous studies were often limited by surface-towed camera systems that could not maneuver closely into the highest relief (and presumably the highest density communities) along canyon outcrops. Additional exploration and sampling of canyon communities as well as exploration for other areas of potential significant hard bottom areas is needed for informed decisions

regarding the distribution of hard bottom communities and the sensitivity of associated biological communities to impacts.

Objectives: The objective of this study is to gather baseline information about Hudson Canyon to inform decisions about offshore energy development.

Methods: Similar to deepwater studies in the Gulf of Mexico, this project will require the use of sophisticated submergence facilities capable of high resolution bottom imagery as well as extensive sample collection. This could include autonomous underwater vehicles for mapping as well as imagery (e.g. Woods Hole *Sentry*) as well as manned submersibles. A high-end Remotely Operated Vehicle will also fulfill most, if not all study needs. A towed bottom camera sled as was used in the early 1980's would not be desirable as high relief hard bottom areas could not be sampled. Large-scale mapping will be required to define substrate type and distribution of significant hard bottom areas both associated with canyons as well as more distant slope areas. Some older industry seismic data may be usable as well as more recent multibeam data. Independent mapping could be done on a less expensive vessel without the cost of submergence facilities. Focused studies on selected communities will collect samples as well as incorporate process studies to determine community composition, complexity and sensitivity to impacts. Surveys and in-depth investigations including imagery of potential shipwreck sites is also a component of the project.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): South Atlantic

Title: Spatial Ecology, Movement Patterns, and at-Sea Habitat Use of Nearshore Seabirds: Addressing Needs for Renewable Energy Development

BOEM Information Needs to be Addressed: Information is needed to assess potential interactions between nearshore seabirds and renewable energy structures in the region. 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. 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.

Approx. Cost: (in thousands) \$2,500 **Period of Performance:** FY 2014-2017

Description:

Background: This study addresses information needs for the Eastern Brown Pelican and Royal Tern which each breed in colonies on barrier islands throughout the South Atlantic Planning Area. The study would complement an ongoing study in the Gulf of Mexico (IAA no. M12PG00014; Eastern Brown Pelicans: Dispersal, Seasonal Movements, and Monitoring of polycyclic aromatic hydrocarbons (PAH) and Other Contaminants in the Northern Gulf of Mexico) being conducted in which Brown Pelicans are being tagged with satellite transmitters in the Gulf's Western, Central and Eastern planning area to assess at-sea habitat use and movement patterns in relation to oil and gas development. Brown Pelicans and Royal Terns have been understudied in the area and therefore our understanding of population trends, reproductive success and, most importantly for the purposes of this study, habitat use at sea is very limited. The most recent estimates of breeding populations for each species for the area were developed for the recently drafted South Atlantic information synthesis for BOEM. There are an estimated 6,000 – 8,000 pairs of Brown Pelicans nesting in the area, and > 50% of these nests occur in South Carolina. There are an estimated 15,000 – 20,000 pairs of Royal Terns nesting in South Carolina, Georgia, and north Florida, and > 50% of these nests also occur in South Carolina.

The potential for macro-scale exposure of Brown Pelicans and Royal Terns to structures offshore appears to be substantial in the south Atlantic because both species are abundant during all phases of the annual cycle. Colonies are distributed regularly throughout the coastal area (i.e., they are not clumped in one or two areas; Jodice et al. in review). Both species commonly migrate through and winter in the area as well. Our understanding of fine-scale habitat use is, however, 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 if the structures 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: The proposed study will determine at-sea habitat use, movement patterns, and migration paths of adult Brown Pelicans and Royal Terns throughout the south Atlantic coast and throughout the annual cycle. By tagging birds at breeding colonies we also will be able to assess the spatial connection between at-sea locations and colonies and hence develop an improved understanding of risks and threats on a per colony basis.

Methods: We will capture and mark ca. 100 adults of each species at nesting colonies throughout the south Atlantic coast. Satellite transmitters of appropriate size and type will be deployed on each bird, and will be programmed to signal more frequently during peak migration. Assuming standard performance of satellite units, location data will be transmitted on a daily basis for 1 – 2 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 and compared within seasons among regions and within regions among seasons. Migration routes will be mapped. All of the above data will be used to 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 to provide environmentally based risk assessments for each species.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

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.

Approx. Cost: (in thousands) \$2,200 **Period of Performance:** FY 2015-2018

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 Southeast Area Monitoring and Assessment 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.

To overcome this data deficiency in the South Atlantic, the Governor's South Atlantic Alliance is proposing a South Atlantic regional collaboration (North Carolina, South Carolina, Georgia, Florida) to map benthic habitats in key priority areas on the continental shelves seaward of each state. 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. This effort would extend work already being conducted for North Carolina. The advantage

of the regional collaboration is to 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.

These proposed activities would complement significant existing efforts by our collaborators in northern South Carolina and at least two of the North Carolina 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. Data collection would occur using the 90' University-National Oceanographic Laboratory System research vessel RV Savannah, operated by the Skidaway Institute of Oceanography, for offshore areas, and using a new, purpose-built, 50' research catamaran, operated by Coastal Carolina University, for nearshore areas.

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.

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Atlantic

Planning Area(s): South Atlantic, Eastern Gulf of Mexico

Title: Surveying for Marine Birds off the Southern Atlantic Coast and Gulf of Mexico

BOEM Information Need(s) to be Addressed: The development of offshore renewable energy facilities has the potential to impact bird species. The data collected in this study is needed to help define the presence or absence of various bird species offshore. This information will be critical in decisions regarding placement of offshore facilities.

Approx. Cost: (in thousands) \$675

Period of Performance: FY 2014-2018

Description:

Background: The launching of the Secretary’s “Smart from the Start” wind energy initiative for the Atlantic OCS is aimed at facilitating the prioritization, siting and leasing of new projects. The South Atlantic Region is becoming an area of major interest for renewable energy development, particularly offshore North and South Carolina. Experience from onshore wind development suggests that the careful siting of facilities is critical to minimize impacts to bird species. Although much effort has been expended on documenting seabird distribution and abundance in the Northwest Atlantic (Surveying for Marine Birds in the Northwest Atlantic (NT-09-03)), comparable information is lacking in the South Atlantic Region. This information was identified during discussions in two workshops: “Fish and Wildlife Service Marine Bird Science and Offshore Wind Workshop” and the “BOEM Atlantic Wind Energy Workshop” held in 2011. Similar gaps have been identified in the BOEM study titled “South Atlantic Information Resources: Data Search and Literature Synthesis.”

Objectives: The objectives are to: 1) identify what seabird species are present/absent; and 2) determine areas where they tend to congregate and areas where they are absent or scarce.

Methods: This study will be similar to the BOEM study “Surveying for Marine Birds in the Northwest Atlantic”

(http://boem.gov/uploadedFiles/BOEM/Environmental_Stewardship/Environmental_Studies/National/NT0903.pdf) with comparable annual costs. BOEM envisions working directly with USFWS through an interagency agreement. The study requires partnering with the NOAA National Marine Fisheries Service (NMFS) to conduct surveys for seabirds off the coast of the south Atlantic. Surveys in the Gulf of Mexico will

be conducted opportunistically on the same trip. Initial contact with NMFS laboratory in Pascagoula, MS and Miami, FL, indicates space is available on their survey cruises that cover the Gulf of Mexico through the Florida Keys and up to Cape Hatteras, NC.

Surveys would be conducted by trained observers with vision-enhancing equipment. Birds will be identified to species, where possible, including where, in what season, and where they tend to congregate. Given that NOAA vessels will be used, it is anticipated that extensive environmental data (surface temperature, chlorophyll, salinity, etc.) will be collected in a manner similar to the AMAPPS project. Other collected information includes distance from shore, water depth, and bottom type where clusters are found. The data will be uploaded into the USGS Compendium of Avian Occurrence (M08PG20033) and will be used in other the BOEM studies including “Predictive Mapping of Seabird Distribution and Abundance on the Atlantic OCS.”

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

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 these place-based values in our nation's seascapes will help developers and agencies anticipate and effectively plan for stakeholder support or opposition during alternative energy development. Value suitability analysis can help developers and project managers meet informational needs related to quantifying, predicting and successfully managing stakeholder engagement in marine alternative energy projects.

Approx. Cost: (in thousands) \$400

Period of Performance: FY 2015-2017

Description:

Background: At present, 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 study, "Identification of Outer Continental Shelf Renewable Energy Space-Use Conflicts and Analysis of Potential Mitigation Measures," consolidated existing data, and collected new data, as needed, to document the spatial footprint of ocean uses for both the Pacific and Atlantic Coasts. Findings from this and other studies have bolstered our ability to identify potential space-use conflicts and possible mitigation measures. However, data allowing for the identification and assessment of spatially relevant social values that motivate people to support or oppose development projects are sorely lacking. The proposed study would fill this gap.

For this study, the term "values" represents the moral or philosophical framework that shapes a person's ideals and attitudes and, more importantly, motivates action. Environmental sociologists have found that people generally fall into one of a few environmental value orientations. Knowing these values orientations have helped researchers and resource managers predict attitudes and, additionally, collective action in an environmental context. Social values, specifically values associated with place-based attachment, have been generally noted as an important factor in motivating local action to oppose alternative energy projects.

The present study proposes collection of spatially-explicit, value orientation data that is relevant to areas planned for alternative energy development. The goal is to gain a better understanding about which values are most highly correlated with specific locations in a region proposed for development, and to develop models to predict who is more likely to support and oppose alternative energy projects, and why. The proposed study would help BOEM and developers understand and negotiate the cultural landscape of areas targeted for alternative energy projects.

This project is proposed for states with Wind Energy Areas in the Mid-Atlantic region (Maryland and Virginia), although this approach could be used in all regions, at multiple spatial scales, or with particular stakeholder groups. Collection and analysis of this type of social data would allow for objective assessment of which areas across the seascape are valued by the public and/or stakeholder groups (and to what degree/intensity), how and why, along with how different areas compare both in terms of uses and values. The data required to conduct such an analysis are:

- value profiles—identification of the environmental value typology of stakeholders, as well as the type of sociocultural value(s) attached to a place or space;
- value rankings by geographic location—the intensity of a group’s attachment (i.e., level of concern) to particular areas within a given space;
- demographic profiles—the demographic and socioeconomic characteristics of focal communities or stakeholder groups; and
- use patterns---the spatial and temporal characteristics of human usage of specific areas: purpose of use, frequency of use, timing of use, etc.

The products from the proposed project would include a standard report. Additionally, all data, including tabular datasets and a geodatabase, would be provided.

Objectives: The objective of the study would be to provide decision-makers with an enhanced understanding about the relationship between marine space use, the type and intensity of value attachments to specific spaces, and the motivation of particular stakeholder groups to support or oppose alternative 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 to answer value-orientation and other questions on a survey, as well as to complete a mapping exercise. Mapped data would then be digitized and joined with survey data and, additionally, 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 attributed to spaces in proposed Wind Energy Areas;
2. Identify the presence, density, frequency, intensity and diversity of values for areas;
3. Identify the statistically significant relationships between social and environmental attributes of interest in a wind energy context;
4. Develop models to predict motivation for action based on value orientations; and
5. Identify conflicts related to the co-location of landscape values, human use/activities, environmental characteristics, and proposed siting of wind energy arrays.

Revised Date: March 29, 2013

SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2016

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 CMSP 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 2016, a significant amount of baseline data should be available for evaluation. Some questions may be answered, but 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 is developing 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. 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. As turbines become taller, there may be impacts to visual flight rule plane operations particularly in the Northeast where fog is common which would also impact economics to 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 understood or 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 (MHK) 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 marine 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, 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

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.

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BOEM Environmental Studies Program

Fiscal Years 2014-2016 Studies Development Plan

Gulf of Mexico OCS Region

U.S. Department of the Interior
Bureau of Ocean Energy Management
Gulf of Mexico OCS Region
New Orleans, LA
2013

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Abbreviations and Acronyms

| | |
|--|---|
| AMAPPS Approx. | Atlantic Marine Assessment Program for Protected Species approximate |
| BOEM BOEMRE BLM BRD BSEE | Bureau of Ocean Energy Management Bureau of Ocean Energy Management, Regulation and Enforcement Bureau of Land Management Biological Resources Division, U.S. Geological Survey Bureau of Safety and Environmental Enforcement |
| CAA CAMx CEQ CETMAP CMAQ CMI CZMA | Clean Air Act Comprehensive Air Quality model Council on Environmental Quality Cetacean and Sound Mapping Program Community Multipurpose Air Quality model Coastal Marine Institute Coastal Zone Management Act |
| DOCD DOI DWH | Development Operations Coordination Document Department of the Interior Deepwater Horizon |
| EA EEZ EFGB EFH EIS EP EPA ERMA ESA ESP | Environmental Assessment Exclusive Economic Zone East Flower Garden Banks Essential Fish Habitat Environmental Impact Statement Exploration Plan U.S. Environmental Protection Agency Environmental Response Management Application Endangered Species Act Environmental Studies Program |
| FEMA FGB FGBNMS FWS FY | Federal Emergency Management Agency Flower Garden Banks Flower Garden Banks National Marine Sanctuary U.S. Fish and Wildlife Service Fiscal Year |
| G&G GCCESU GIS GM GMU GOM GOMR | Geological and Geophysical Gulf Coast Cooperative Ecosystem Studies Unit Geographic Information System growth marks George Mason University Gulf of Mexico Gulf of Mexico Region |
| HAPC | Habitat of Particular Concern |
| LGS | Louisiana Geological Survey |

| | |
|----------|--|
| LSU | Louisiana State University |
| MAFLA | Mississippi, Alabama, and Florida |
| MAMES | Mississippi-Alabama Marine Ecosystem |
| MMPA | Marine Mammal Protection Act |
| MMS | Minerals Management Service |
| MOU | Memorandum of Understanding |
| MPA | Marine Protected Area |
| NAAQS | National Ambient Air Quality Standards |
| NEPA | National Environmental Policy Act |
| NGO | non-governmental organizations |
| NHPA | National Historic Preservation Act |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NOAA/OER | Ocean Exploration & Research |
| NPZD | nutrient-phytoplankton-zooplankton-detritus |
| NRDA | Natural Resource Damage Assessment |
| NRL | Naval Research Laboratory |
| NSL | National Studies List |
| NTL | Notice to Lessees |
| OA | ocean acidification |
| OCS | Outer Continental Shelf |
| OCSLA | Outer Continental Shelf Lands Act |
| PC | Peveto Channel |
| ppb | parts per billion |
| PSBF | Potentially Sensitive Biological Features |
| RESTORE | Resources and Ecosystems Sustainability Tourism Opportunities and Revived Economy Act |
| ROV | Remotely Operated Vehicle |
| SCAT | Spill Cleanup Assessment Team |
| SCL | straightline carapace length |
| SDP | Studies Development Plan |
| SIA | Social Impact Assessment |
| SMOKE | Sparse Matrix Operator Kernel Emissions |
| SOI | Schmidt Ocean Institute |
| SOS | Special Ocean Site |
| SPAW | Special Protected Areas and Wildlife |
| SPSE | Sandy Point Southeast |
| TABS | Texas Automated Buoy System |
| TIMS | Technical Information Management System |
| ULL | University of Louisiana at Lafayette |
| USGS | U.S. Geological Survey |
| VOC | Volatile Organic Compounds |
| WFGB | West Flower Garden Banks |
| WRF | weather research and forecasting |

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 leasing and resource management functions on the OCS for the Gulf of Mexico Region (GOMR) and the Atlantic Region OCS areas, a total of 430 million acres in seven planning areas (see map in Section 1.2). Currently there are ~ 6,700 active leases in the Gulf of Mexico and ~4,000 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 production in that area.

The Gulf of Mexico (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 Gulf of Mexico. Efforts to stop the flow and mitigate potential landfalls of oil along the coastline included the use of various containment devices and siphons, dispersants used on the surface and at the wellhead, controlled burns, oil skimming, a network of booms established along the coastline to protect sensitive marshlands, and construction of a series of protective sand berms between Louisiana's barrier islands to prevent oil intrusion into sensitive marshlands. Two relief wells were drilled, one of which intercepted the well at a depth of several thousand feet below the mudline to ultimately kill the well.

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 unknown. While other damaging oil spills have occurred (e.g., 1989 Exxon Valdez, 1979 Santa Barbara oil spill, 2009 Timor Sea spill, etc.), the DWH spill was the largest oil spill in American history, and its environmental and social impacts may exceed those of all previous spills in U.S. waters. Because of this spill, new environmental studies are necessary to assess the impacts and long-term recovery of the Gulf region and its natural and cultural resources.

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, and installation of pipelines. The new five-year program (2012-2017) 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 under Congressional moratorium 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.

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 90 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 Gulf of Mexico's coastal, marine, and human environments while other studies propose to fill information gaps not related to the DWH oil 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 2012, the final report, *Ultra-Deepwater Circulation Processes in the Gulf of Mexico*, was published.

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 Gulf of Mexico onshore coastal areas. We expect to publish the final report, *Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling*, in 2013. A final report for a Gulfwide emissions inventories is expected to be published in 2013 as well. For Fiscal Year (FY) 2013, the following three new studies will be awarded: a Gulfwide emissions inventory for year 2014, an adaptation of the weather research and forecasting (WRF) model to the Gulf of Mexico, and updating the exemption level approach for post-lease reviews of plans. New information needs include cumulative impacts modeling and analysis of OCS emissions.

1.4.3 Fates and Effects

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). MAFLA and MAMES are just a few examples of BOEM studies that collected baseline information or examined the fates and effects of oil and gas activities in the OCS of the GOM; 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.

Before the DWH oil spill, BOEM considered revisiting the areas examined in past studies to determine typical parameters and possibly compare these measurements to the results of past studies. BOEM was also interested in focusing on new issues that have arisen since past studies, such as ocean acidification, and considering new methodologies and techniques for characterization. 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.

Oil in the Sea (National Research Council, 2003) notes that "Much more needs to be learned about how petroleum interacts with marine sediment..." (pg. 4) and "Much more needs to be learned about oil-sediment interaction..." (pg. 59). 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. Of particular interest is how oil and dispersed oil might interact with sediment particles or undergo sedimentation in deepwater environments. Previous studies have focused on the existence and persistence of dispersed oil plumes in the GOM, but little attention has focused on how the oil has interacted with sediments. A new 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. This study is a cooperative agreement with Auburn University through the GCCESU.

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. 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. Updated information on topographic features and live bottoms is essential in order for BOEM to protect these resources. 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 for FY 2014 propose to extend the Flower Garden Banks Long-Term Monitoring Program, collect a baseline of ocean acidification measurements at the coral reefs on these Banks, determine the effectiveness of "zero discharge" mitigations on deepwater benthic communities, and assess the evolution of dredge pits over time. Partnerships with other agencies continue to play an important role in the environmental studies process.

In addition to field research, BOEM 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. New studies for FY 2015 propose to develop a gulf-wide ecosystem model for simulating plankton prey and high-trophic habitat variability and to develop seasonal marine mammal density models for the northern Gulf of Mexico.

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. Recent (and upcoming) GOM programmatic consultations that may result in new protected species studies include geological and geophysical (G&G) activities and explosive removals of platforms.

Following the DWH spill, BOEM requested reinitiation of ESA consultation with both the National Marine Fisheries Service (NMFS) and the Fish and Wildlife Service (FWS) (July 30, 2010). NMFS responded with a letter to BOEM on September 24, 2010. FWS responded with a letter to BOEM on September 27, 2010. The reinitiated consultations are not complete at this time though BOEM and NMFS have implemented interim project-specific consultation procedures.

Following the success of the *Sperm Whale Seismic Study*, additional cetacean studies have followed. These include the *Sperm Whale Acoustic Prey Study* (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 is just getting 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 research in partnership with the National Oceanic and Atmospheric Administration (NOAA) on Loggerhead sea turtles, as well as development of seasonal marine mammal density models for the northern Gulf of Mexico.

1.4.6 Social Sciences and Economics

The consequences of the DWH oil spill and its aftermath are the primary focus of this planning effort. However, in the GOMR, normal operations of the offshore industry rather than accidental events have been the primary driver of its social and economic consequences and this is likely to remain the case in the future. 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, since current industry effects must be disentangled from those past, and past ones 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.

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 that changes in its sectors generate its future effects, 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.

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 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 currently impact OCS industry and an analysis of potential OCS-related impacts to environmental justice.

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 energy development. 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.

BOEM has several ongoing and recently completed studies that expand our knowledge of the types of resources that are likely to be encountered on the OCS. One nearly finalized CMI study tested the hypothesis that prehistoric sites can be recognized in the remote sensing record by attempting to positively correlate physical remains with suspected sites identified through sub-bottom profiler records. Another study, *Archaeological Analysis of Submerged Sites on the Gulf of Mexico Outer Continental Shelf*, assisted BOEM in determining if targets identified for avoidance are actually associated with archaeological resources and provided information on the extent of debris fields associated with historic shipwreck sites. This study won the Department of the Interior's (DOI) Partners in Conservation Award in 2011. These data aid in the analysis of the effectiveness of BOEM's permit mitigations. BOEM continues to seek to understand the nature of cultural resources on the seafloor in various types of environments in order to effectively avoid harming them as a result of its permitted actions.

Current information needs include understanding the impacts of the oil spill and associated clean-up activities on coastal prehistoric sites in Louisiana. Impacts to archaeological resources are not addressed as part of the Natural Resource Damage Assessment (NRDA) process; therefore, studies such as this will fill significant information gaps for the Bureau and future NEPA analyses. Information gathered through this study will also benefit the State of Louisiana.

Future needs will continue to include understanding the impacts of the DWH oil spill and subsequent spill response activities on submerged cultural resources. One new study procured in 2012, *Analyzing the Potential Impacts to Cultural Resources at Significant Sand Extraction Areas* (GM-12-04), will investigate potential impacts to offshore sand resources and shipwrecks associated with dredging activities to support coastal restoration and protection projects in Louisiana. Another new study being procured in FY 2013, *A Comparative Analysis of an Oil Spill on the Biota Inhabiting Several Gulf of Mexico Shipwrecks* (GM-13-03), will investigate impacts to shipwrecks and their associated biota from exposure to oil and chemical dispersants and microbial activity. This effort is being undertaken through a multi-agency Federal partnership between BOEM, BSEE, and the U.S. Naval Research Laboratory (NRL), a cooperative agreement with George Mason University (GMU), and a competitive contract to be awarded later this fiscal year.

1.5 New Starts for FY 2013 and Ongoing Studies Table

Table 1 lists new studies planned to start in FY 2013 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 2013 and Ongoing Studies

| NSL # | Study Title | Planning Area(s) | Start FY | Partners |
|---|---|------------------|----------|--------------------|
| New Starts | | | | |
| Air Quality | | | | |
| GM-13-01 | National Ambient Air Quality Standards (NAAQS) Exemption Level Study | C&W | 2013 | |
| GM-13-02 | Year 2014 Gulfwide Emissions Inventory Study | C&W | 2013 | |
| 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 | |
| Marine Mammals & Protected Species | | | | |
| 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 | |
| Social & Economic Sciences | | | | |
| GM-13-03 | A Comparative Analysis of an Oil Spill on Biota Inhabiting Several Gulf of Mexico Shipwrecks | C | 2013 | NRL BSEE GMU |
| GM-13-06 | An Analysis of the Impacts of the Deepwater Horizon on the Seafood Industry | GW | 2013 | |
| *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 |

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|------------------------------|--|-----|------|-----|
| GM-08-04 | Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling | GW | 2008 | |
| GM-10-02 | Year 2011 Gulfwide Emissions Inventory Study | GW | 2010 | |
| Fates & Effects | | | | |
| GM-92-42-129 | A Study of Long-Term Trends in Environmental Parameters Along the Louisiana/Mississippi Outer Continental Shelf Using Ocean Color Remote Sensing Data | C | 2006 | LSU |
| 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-92-42-104 | Short-Term Movement, Home Range, and Behavior of Red Snapper Around Petroleum Platforms in the Northern Gulf of Mexico as Determined by High Resolution Acoustic Telemetry | C | 2003 | LSU |
| GM-92-42-105 | Assessing Trophic Linkages Between Platforms and Pelagic Fishes Using Ultrasonic Telemetry and Active Acoustics | C | 2003 | LSU |
| GM-92-42-117 | Determining the Geographic Distribution, Maximum Depth, and Genetic Affinities of Corals on Offshore Platforms, Northern Gulf of Mexico | C&W | 2004 | LSU |
| GM-92-42-118 | Digital Conversion and Selected Analysis of Dive Video From Fifteen Dive Seasons | C&W | 2004 | LSU |
| GM-05-03 | Investigations of Chemosynthetic Communities on the Lower Continental Slope of the GOM | C&W | 2005 | |

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|------------------------------|---|-----|------|------|
| 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-92-42-128 | Platform Recruited Reef Fish, Phase II: Do Platforms Provide Habitat that Increases the Survival of Reef Fishes? | GW | 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 GOM Continental Slope Study Seafloor Photographs | GW | 2008 | LSU |
| GM-08-03 | Exploration and Research of Northern GOM Deepwater Natural and Artificial Hard Bottom Habitats with Emphasis on Coral Communities: Reefs, Rigs and Wrecks | C&W | 2008 | |
| GM-09-02 | Long-Term Monitoring at the East and West Flower Garden Banks (2011-2014) | C | 2009 | NOAA |
| GM-09-01-07 | New Invasive Marine Species Colonizing Oil/Gas Platforms in the Northern GOM: Verification and Examination of Spread | C | 2010 | LSU |
| GM-09-01-08 | Biomass and Mass-Balance Isotope Content of Seep Populations on the Upper Slope GOM Determined from Archived Samples | C | 2010 | LSU |
| 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 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 GOM | C&W | 2011 | NOAA |

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|---|---|-------|------|------|
| GM-11-01b | Deep-Water Reconnaissance of PSBF's Surrounding Shelf-Edge Topographic Banks in the Northern GOM | C&W | 2011 | LSU |
| GM-12-x10 | Abundance and Distribution of Commercially Important Estuarine Dependent Species Populations within the GOM | 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 GOM | 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 <i>Tubastraea Micranthus</i> 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 Natural History | GW | 2012 | 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 | EcoSpatial Information Database – U.S. Atlantic Region | AW | 2009 | |
| GM-09-x21 | South Atlantic Information Resources: Data Search and Literature Synthesis | S-ATL | 2009 | |
| GM-09-01-01 | Administration of the LSU Coastal Marine Institute (2009-2013) | GW | 2010 | LSU |
| GM-12-06 | Information Transfer Meetings and Other Workshops | GW | 2012 | |
| Marine Mammals & Protected Species | | | | |
| GM-09-05 | Sperm Whale Acoustic Prey Study | GW | 2009 | NOAA |
| GM-10-04 | The Movement and Habitat Associations of Sea Turtles in the Gulf of Mexico | GW | 2010 | NOAA |

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|---------------------------------------|---|-----|------|--------|
| GM-11-03 | Sperm Whales and Bottlenose Dolphins in the Gulf of Mexico | GW | 2011 | NOAA |
| 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-92-42-119 | New Wave Current Information System (WAVCIS) Ocean Observing Station on Ship Shoal | C | 2005 | 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 | E | 2009 | CICESE |
| GM-10-03 | Lagrangian Study of the Deep Circulation in the GOM | 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 GOM | GW | 2011 | |
| 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 | GW | 2006 | |

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|------------------------------|--|-----|------|-----|
| | Community Study | | | |
| 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 GOMR | GW | 2009 | LSU |

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|--|---|-------|------|----------|
| 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 | |
| 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-09-04 | Archaeological Analysis of Submerged Sites on the Gulf of Mexico OCS | C&W | 2009 | |
| GM-09-10 | Inventory and Analysis of Archaeological Site Occurrence on the Atlantic OCS | AW | 2009 | |

| 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 | |
| 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 Natural Resource Damage Assessment (NRDA) studies may not address particular resources and their impacts from the oil spill.

The FY 2014-2016 Studies Development Plan (SDP) includes profiles for new studies within the disciplines of air quality, habitat and ecology, information management, 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 2014 and beyond. However, ongoing studies in the GOMR can be found on the web at:

<http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/Gulf-of-Mexico-Environmental-Ongoing-Studies.aspx>.

2.2 Profiles of Studies Proposed for the Fiscal Year 2014 National Studies List (NSL)

Table 2. BOEM Gulf of Mexico Region Studies Proposed for the Fiscal Year 2014 NSL

| SDP Page Number | Discipline | Regional Ranking | Study Title |
|-----------------------------|------------|---|---|
| 23 | AQ | 1 | Cumulative Impacts Modeling in the Gulf of Mexico Region |
| 25 | AQ | 2 | Trends Analysis of OCS Emissions in the Gulf of Mexico |
| 27 | HE | 3 | Investigation of Pre-Riser Discharge from Wells within Proximity to Deep Water Benthic Communities for Plans with a “Zero Discharge” Mitigation |
| 29 | SE | 4 | Testing and Assessment of the Effects of an Oil Spill on Coastal Archaeological Sites |
| 31 | PO | 5 | Coral Reef Ocean Acidification Sentinel Site in the Flower Garden Banks National Marine Sanctuary |
| 33 | SE | 6 | Coastal Land Loss and Oil & Gas Infrastructure |
| 35 | HE | 7 | Assessment of Mud-Capped Dredge Pit Evolution on the OCS, Peveto and Sandy Point SE Borrow Areas |
| 39 | HE | 8 | Long-Term Monitoring at the East and West Flower Garden Banks: 2014-2017 |
| 41 | SE | 9 | Geo-Spatial Analysis of OCS Petroleum Effects on Gulf Coast Communities |
| 45 | HE | 10 | Long-Term Ecosystem Monitoring of the Deep Gulf of Mexico, Phase 1: Deep Water Coral Sites Impacted by the 2010 Deepwater Horizon Oil Spill |
| 47 | IM | 11 | Synthesizing and Quantifying Environmental Effects on the Gulf of Mexico |
| Discipline Codes | | | |
| AQ = Air Quality | | FE = Fates & Effects | |
| IM = Information Management | | HE = Habitat & Ecology | |
| PO = Physical Oceanography | | MM = Marine Mammals & Protected Species | |
| | | SE= Social & Economic Sciences | |

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Central and Western

Title: Cumulative Impacts Modeling in the Gulf of Mexico Region

BOEM Information Need(s) to be Addressed: Estimates of potential cumulative impacts of offshore air emissions on onshore air quality are required by the Outer Continental Shelf Lands Act (1334 (a)(8)). This information will be used by BOEM and various Federal and State agencies to support compliance with the Clean Air Act (CAA) and the Outer Continental Shelf Lands Act (OCSLA). This impacts analysis will be used in NEPA Environmental Impact Statements to describe the effects (if any) of oil and gas development in the Gulf on onshore air quality.

Approx. Cost: (in thousands) \$2,000 **Period of Performance:** FY 2014-2015

Description:

Background: Under the CAA, the U.S. Environmental Protection Agency (EPA) is required to set the National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The EPA has set NAAQS for six criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM_{2.5} and PM₁₀), and sulfur dioxide (SO₂).

The CAA requires the EPA to periodically review the science upon which the standards are based and the standards themselves. In 2008, the EPA lowered the NAAQS for the 8-hour ozone to 75 parts per billion (ppb). In 2010, the EPA has also issued two new 1-hour standards, one for NO₂ and another for SO₂.

The changes to the ozone NAAQS standard, the additional short-term standards, and the continuing needs of addressing ongoing particulate matter (PM_{2.5}) standards and regional haze regulations makes it necessary for BOEM GOMR to re-assess impacts of offshore activities to the air quality of the Gulf States. An air quality model capable of conducting an air impact analysis requires various input datasets, including emissions sources, meteorology, and pre-existing pollutant concentrations. This project proposes development of these major input datasets, which would be applied to an air quality model such as the Community Multipurpose Air Quality model (CMAQ) or the Comprehensive Air Quality Model (CAMx), will help to assess the cumulative air quality impact of offshore oil and gas activities. Past studies addressed air quality impacts from offshore to onshore areas were completed in 1995 and in 2005. Because of changes in the NAAQS, previous BOEM studies no longer support current NAAQS standards. Additionally, BOEM needs to assess other pollutants.

Offshore emissions, including platform sources, drilling rigs, support vessels, and others, are already calculated for calendar year 2011 from the 2011 Gulfwide Emissions Inventory Study, which will be final in July 2013. Onshore emissions inventories are

available through the EPA. Preprocessing of these emissions, possibly using the Sparse Matrix Operator Kernel Emissions (SMOKE) processor will be completed in this study.

Meteorological data will also have to be processed for the GOMR grid. Nested, finer resolution grids should be used over non-attainment areas and the Class I areas (Breton Wilderness, Saint Marks Wilderness, Chassahowitzka Wilderness, and Bradwell Bay). The meteorological and emissions datasets would be used in a regional air quality model, such as CMAQ or CAMx. The results would assist in defining the cumulative impacts of all pollution sources induced by OCS activity, including the formation of secondary fine particulate matter (PM_{2.5}) and ozone, plus visibility impacts analysis for the Class I areas. This study will be coordinated with work in the Alaska OCS Region to avoid duplication of efforts and ensure consistency with similar approaches.

Objectives:

- To assess air quality impacts to States from offshore OCS activities.
- To test the hypothesis that secondary PM_{2.5} and ozone are not significant for cumulative impact analyses.
- To conduct visibility analysis for the Class I areas
- To apply the results to demonstrate compliance under the NEPA and CAA for EIS's and EA's prepared by BOEM.

Methods:

1. To develop a resolution grid over the GOMR with finer, nested grids over non-attainment areas and the Class I areas: Breton Wilderness, Saint Marks Wilderness, Chassahowitzka Wilderness, and Bradwell Bay.
2. To preprocess emissions and meteorological datasets sufficient as input to a regional air quality model.
3. Conduct air quality modeling by applying the input datasets to a USEPA-approved model, such as CMAQ or CAMx.
4. Conduct visibility analysis for the Class I areas.
5. Assess the results to identify the background impact and the cumulative impact of proposed OCS activities to meet the project objectives.

Revised Date: March 1, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Central and Western

Title: Trends Analysis of OCS Emissions in the Gulf of Mexico

BOEM Information Need(s) to be Addressed: This emissions trends analysis will be helpful in NEPA Environmental Impact Statements (EIS's) to describe the effects (if any) of oil and gas development to onshore air quality. Geographically displaying the emissions will allow for better assessment of local impact (if any) and maps produced could be used in the NEPA EIS's.

Approximate Cost: (in thousands) \$400 **Period of Performance:** FY 2014-2015

Description:

Background: Under The Outer Continental Shelf Lands Act (OCSLA), BOEM is required to comply with the National Ambient Air Quality Standards (NAAQS) so that offshore activities do not significantly impact the air quality of any State (1334 (a)(8)).

The changes to the ozone NAAQS standard, the additional short term standards, and the continuing needs of addressing ongoing particulate matter (PM2.5) standards and regional haze regulations makes it necessary for BOEM GOMR to re-assess impacts of offshore activities to the air quality of the Gulf States. Therefore, BOEM has conducted several GOMR emissions inventories since 2000, including calendar years 2000, 2005, 2008, and 2011 (available July 2013). GOMR emissions inventories of OCS sources (platform and non-platform) include estimates of carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen oxides (NO_x), particulate matter (PM₁₀ and PM_{2.5}), hydrocarbons (VOC), carbon dioxide (CO₂), methane (CH₄), and nitrous oxides (N₂O).

Limited emissions trends analysis has been performed on this data. This study will perform detailed trends analysis of all GOMR 2000, 2005, 2008, and 2011 emissions data, including the platform and non-platform data. Not only will the trends analysis look at the level of the total pollutant as a time series analysis, but also how much of each pollutant for each year is emitted from the various sources offshore. Another variable is location. As more of GOMR production shifts from shallow to deepwater, emissions trends analysis for all the years should be performed based on varying depth categories. Also, geographically displaying the 2000, 2005, 2008, and 2011 emissions data will help to see trends, which will help BOEM assess impacts to onshore air quality. Any geographical software will have to be compatible with BOEM's Technical Information Management System (TIMS) database, which uses ArcGIS 10.

Lastly, this study will provide BOEM with a software package so that BOEM can add future year's emissions datasets. The software should perform statistics and emissions trends analysis and will geographically display these future emissions.

Objectives:

1. To perform detailed emissions trends analysis on all GOMR 2000, 2005, 2008, and 2011 emissions data, including platform and non-platform data.
2. To perform detailed emissions trends analysis of highest contributor of each pollutant, varying depth categories, and drilling versus production emissions.
3. To conduct geographical trend analysis.
4. To develop a software package that BOEM can use for future emissions databases, will automatically perform statistics and emissions trends analysis and will geographically analysis of future emissions.

Methods:

1. Using a statistical package, perform detailed emissions trends analysis on all GOMR emissions data.
2. Perform emissions trends analysis on variables such as highest contributor, depth location, and type of emissions.
3. Geographically analyze the emissions data using ArcGIS 10 software.
4. Developing a software package that will allow for input of future BOEM emissions formats (in ACCESS).

Revised Date: March 1, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Investigation of Pre-riser Discharges from Wells within Proximity to Deep Water Benthic Communities for Plans with a “Zero Discharge” Mitigation

BOEM Information Need(s) to be Addressed: Recently, BOEM biologists have applied a non-recurring mitigation to plans in deep water requiring “zero discharge” when drilling a well less than the required distance (2,000 feet) from hydrocarbon seeps, hard bottoms, and known or probable deepwater benthic communities. “Zero discharge” is defined as having no discharge at sea (drill muds and cuttings) from a well once the initial spudding of a well is complete and the riser has been installed. All material extracted from the well after the installation of the riser will be collected on a barge and shipped back to land for disposal. Recent “zero discharge” mitigations have been applied to permits with the additional requirement of a follow up Remotely Operated Vehicle (ROV) survey to investigate the sedimentation that has occurred surrounding the well and at the nearby sensitive benthic feature.

The information regarding sedimentation as a result of initial spudding followed by “zero discharge” is imperative to BOEM in order to determine if the mitigations being applied are sufficient to protect sensitive deepwater benthic communities in the proximity of a drilled well. The information gained from this study will then be used to determine if a “zero discharge” mitigation should be added to the BOEM Notice to Lessees (NTL) for Deepwater Benthic Communities (NTL 2009-G40).

Approx. Cost: (in thousands) \$2,000 **Period of Performance:** FY 2014-2016

Description:

Background: A past study of four deepwater wells in the GOM investigated the extent of both pre-riser cuttings splays on the seafloor and surface released cuttings depositions (CSA, 2006). Those results have influenced the guidance in BOEM NTL 2009-G40 for distance of wells from seafloor features that provide habitat for deepwater benthic communities. The proposed study will focus on well sites permitted with the “zero discharge” mitigation and analyze the distance and thickness of spudding deposits on the seafloor prior to the installation of the riser. The investigation would determine the appropriateness of the use of “zero discharge” because it would indicate if cuttings directly discharged on the seafloor were reaching sensitive benthic communities within 2,000 feet of a well. Currently, a few permits have included the “zero discharge” mitigation and operators are required to submit a follow up ROV video to show that deepwater benthic communities less than 2,000 feet from the well were not impacted. ROV footage was requested in the mitigation as a follow up to initial ROV footage collected by the operator identifying the presence of a deepwater benthic community. The proposed study expands upon the current “zero discharge” mitigation by collecting additional information (described in the methods section). This new information will be

pertinent to determining if this “zero discharge” mitigation is appropriate and if it should be more widely used in deepwater.

Objectives: The objectives of the study are to:

- Determine the extent and thickness of drilling deposits in deepwater before the riser is installed in the well.
- Determine the minimum allowable distance a possible deepwater benthic community should be from a well that is drilled using the “zero discharge” mitigation.
- Determine the appropriateness of including “zero discharge” into BOEM NTL’s as an option for drilling wells closer than 2,000 feet from a hydrocarbon seep, hard bottom, or known/probable deepwater benthic community.

Methods: In order to determine the extent, thickness, and biological impact of drilling discharges on the seafloor prior to the installation of the riser side scan sonar data, sub-bottom profile data, and ROV video will be analyzed. In addition, seafloor current speed and direction will be collected, as well as sediment samples to be tested for drilling fluid tracers (barium and synthetic based drilling fluid). The study will be conducted at well sites which have the “zero discharge” mitigation applied to their permit. Currently two plans (S-7565 and N-9579) have this mitigation applied to their permits, and the mitigation could be applied to a few additional permits in which the “zero discharge” possibility was discussed with operators during meetings prior to plan submittals. The plans for which permits with the “zero discharge” mitigation were granted had a baseline ROV video of the sensitive habitat and the mitigation required a follow up ROV video to show the deepwater benthic community was not impacted. This study will expand upon the “zero discharge” mitigation requirements (ROV video of the sensitive habitat to determine if there was impact from the pre-riser discharges) and obtain detailed information on distance and thickness of the pre-riser discharge, influence of seafloor currents on dispersal of cuttings, and drilling fluid tracer analysis. The distance and thickness of the pre-riser discharges will be determined by side scan sonar, sub-bottom profile imagery, and drilling fluid tracers in the sediment. The seafloor currents will be measured to determine the influence of currents on the direction of the dispersal of the cuttings. The ROV video will be collected to see if sediment is visible on the deepwater benthic community nearby to determine if pre-riser cuttings reached the habitat.

Because there is no guarantee that a permitted well with the “zero discharge” mitigation (existing and future) will be drilled within the timeframe of this study, recently drilled wells permitted with outdated regulations may be substituted for analysis. For example, wells permitted before 2010 (when NTL 2009-G39 became effective) where a possible deepwater benthic community is just outside the 1,500 foot buffer, could be studied. Prior to 2010, a 1,500 foot buffer, instead of the 2,000 foot buffer, was required between sensitive features and wells. The same data would be collected at these sites as would be done for “zero discharge” permit sites. All of the information collected during this study will help BOEM determine if the use of a “zero discharge” mitigation is appropriate and should be incorporated into the revised NTL 2009-G40.

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Central

Title: Testing and Assessment of the Effects of an Oil Spill on Coastal Archaeological Sites

BOEM Information Need(s) to be Addressed: Nearly three years after the DWH oil spill, the immediate and long-term impacts on cultural resources and archaeological sites in the coastal zone remain unknown. It has long been assumed in GOMR EIS analyses that should a spill contact a prehistoric archaeological site, damage might include loss of radiocarbon-dating potential, direct impact from oil-spill cleanup equipment, and/or looting. Other unanticipated effects could occur that might diminish or destroy the site's future research potential. At present, these consequences are based upon pure speculation and an imperfect understanding based upon incomplete research conducted in Alaska over 20 years ago. As a result a serious information gap exists in understanding the full implications of the effects of a reasonably foreseeable accidental event. In addition to providing much-needed information to BOEM for its NEPA analysis, the information is of importance to the State of Louisiana, which has sought information from BOEM in the past on the effects of the offshore program on its coastal archaeological resources and lacks the means through other avenues to obtain data on the effects of the oil spill on these resources. The study will provide the State of Louisiana with critical information relative to resource management and remediation.

Approximate Cost: (in thousands) \$300 **Period of Performance:** FY 2014-2017

Description:

Background: As a result of the cultural resources investigations conducted during the DWH oil spill, Spill Clean-up Assessment Team (SCAT) archaeologists surveyed more than 5,000 kilometers of shoreline in the states of Louisiana, Mississippi, Alabama, and Florida (HDR, 2011). The investigations identified 32 previously recorded and 45 newly recorded sites that exhibited signs of oiling; 18 of the previously recorded and 31 of the newly recorded sites (61%) are located in Louisiana. Nearly all of the prehistoric sites effected by the DWH spill are located in Louisiana; mostly in an around the Mississippi Delta and Barataria Bay in Iberia, Plaquemines, Jefferson, Lafourche, St. Bernard, and Terrebonne parishes. The Louisiana State Historic Preservation Office maintains records of all reported archaeological sites discovered during site assessment and clean-up efforts in the wake of the DWH oil spill in 2010. BOEM uses this data in the NEPA documents to estimate the potential effects of coastal oil spills for a specific proposed action. While site monitoring and remediation associated with the DWH spill response has documented the presence of oil at many sites, there has been no systematic attempt to assess the effects on archaeological resources, formation processes, or conservation. Restoration of coastal landscapes and ecosystems will further impact archaeological sites, making these finite cultural resources endangered features of an increasingly-altered environment. Previously, the only data on which to base assumptions regarding the effects of a major oil spill on archaeological resources was derived from the Exxon

Valdez spill in Alaska in 1989, which is not an analogous environment to the Gulf Coast. By undertaking this study now, the characteristics of coastal oil spills will serve as a baseline to which future effects can be compared. BOEM would be better able to respond to questions about the effects of oil spills on archaeological resources with this study.

Objectives: The goals of this project are to assess the effects of oil on prehistoric cultural resources on the southeastern Louisiana dating from the Late Woodland and Mississippi periods (ca. A.D. 700-1700). Sites to be investigated and assessed will be selected from those previously recorded as potentially eligible for listing on the National Register of Historic Places and impacted by the 2010 oil spill. These sites have produced evidence for Bayou Petre phase Mississippian ceramics, as well as local Coles Creek and Plaquemine material culture. Additional previously unknown sites documented by shoreline assessment teams will be considered for investigation.

Methods: Means should be developed to assess impacts to prehistoric sites from oiling in terms of site preservation, effects to radio-carbon dating, and implications for research costs. Application of archaeometric techniques such as neutron activation analysis and absorbed residue analysis will examine the effects of oil and other contaminants in the archaeological record. In addition, analysis should be conducted to determine if the oil present at the sites can be fingerprinted to a source after the passage of time. In order to address issues of importance to the Louisiana Division of Archaeology, neutron activation analysis and accelerator mass spectrometry will complement ceramic and lithic analyses in providing a more precise chronology of regional culture history and extra-regional interactions. Field methods will consist of systematic surface collection, mechanized and hand-operated coring and augering, and excavation of 1-by-1-meter test units in up to five (5) previously recorded sites to record stratigraphic profiles and obtain well-provenienced archaeological samples. Excavations will further examine the effects of oil on taphonomic and site formation processes, generating recommendations for site remediation, resource management, and archaeological conservation. The study is proposed as a cooperative agreement with the University of Louisiana at Lafayette (ULL), a member institution of the Gulf Coast Cooperative Ecosystem Studies Unit (GCCESU). ULL, located in southern Louisiana, provides the necessary regional archaeological expertise to accomplish the goals of the project.

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Central and Western

Title: Coral Reef Ocean Acidification Sentinel Site in the Flower Garden Banks National Marine Sanctuary

BOEM Information Need(s) to be Addressed: BOEM scientists require an understanding of multiple stressors on an ecosystem to conduct environmental analyses required by NEPA. Coral reef communities are expected to be uniquely impacted by climate change stressors, including ocean acidification (OA). This study (in partnership with NOAA) will provide important baseline data related to OA at Flower Garden Banks National Marine Sanctuary (FGBNMS) for helping assess potential climate-related impacts in comparison to those from oil and gas industry activities. Specifically, the study will provide an assessment of carbonate-chemistry variability (e.g., pH, pCO₂, alkalinity, etc.) at the banks for establishing an OA-related baseline against which to interpret potential future changes in coral reef health.

Approximate Cost: (in thousands) \$600 **Period of Performance:** FY 2014-2019

Description:

Background: Ocean acidification, or the ongoing increase in acidity of the Earth's oceans, is one possible outcome of climate change which has the potential to seriously threaten ocean health. Anthropogenic releases of carbon dioxide into the atmosphere since the mid-18th century have resulted in an increase of atmospheric CO₂ concentrations, with the ocean absorbing a significant fraction of this CO₂. However, when CO₂ is absorbed by seawater, chemical reactions occur that reduce both seawater pH and the concentration of carbonate ions in a process known as "ocean acidification" (OA) (NOAA, 2010). Coral reef ecosystems are of unique concern because their ability to precipitate calcium carbonate and net accretion rates may be impacted by OA. Experimental observations beginning in the 1990's have suggested that declining levels of calcification will occur with increasing ocean acidification.

BOEM requires information on multiple stressors, including climate-related, to assess potential impacts of the oil and gas industry in fulfillment of its NEPA obligations. If baseline conditions were observed to change, such as at Flower Garden Banks, due to climate change, then that changing baseline would need to be accounted for in order to resolve potential oil and gas industry impacts, such as from oil spills. BOEM and its predecessors have studied the Flower Garden Banks for several decades (since the 1970's), making this coral reef ecosystem a sensible choice for establishment of an OA sentinel site in GOM offshore waters. It also complements NOAA's current OA plans for the region. The historic physical, chemical, and biological measurements at this location will aid in determining an optimal location for a sentinel site in the FGBNMS and will contribute background for future observed changes in this ecosystem.

Objectives: The objectives of this 5-year study are as follows:

- To establish an OA sentinel site at the Flower Garden Banks and integrate with the proposed Coral Reef Ocean Acidification Network in the Gulf of Mexico.
- To provide an initial time series of measurements for understanding diel and seasonal variability in OA-related parameters at the banks.
- To develop methods for reconstructing historical carbonate chemistry conditions at the site.

Methods: In coordination with BOEM, the FGBNMS has agreed to help support and develop this project, including contributions of ship time and diver support. The first four years of the study will be used for field work, including establishing mooring location, instrumenting and deploying the mooring, and data collection, and the fifth year will be dedicated to data analysis and report writing. Historical physical and biological datasets from the banks will be used to determine the best choice of sites for the OA mooring. The minimum core measurements at OA monitoring sites include pCO₂, pH, O₂, chlorophyll, turbidity, temperature, and salinity. All of these measurements will be monitored from the mooring at two depths (near-surface and near-bottom). Consideration will be given to whether redundant measurements (such as of temperature and salinity) are required, if these parameters are being measured nearby, depending on for example equipment expense and the importance of ensuring these measurements are accurately collected. The autonomous observations will be validated and supplemented on a bimonthly basis through a discrete sampling campaign conducted aboard the FGBNMS vessel, the R/V *Manta*, or other available vessels.

The time series of data will be analyzed to establish diel and monthly variability in carbonate chemistry at the banks, in connection with other time series data collected in the region, such as physical measurements from the Texas Automated Buoy System (TABS). As well, an approach for modeling aragonite saturation values at this site as a function of more commonly collected hydrographic and chemical data will be explored, and potentially applied to reconstructing historical carbonate chemistry conditions in this region. Deliverables will include an OA-related dataset that can be used in NEPA analyses, interim and final reports, conference presentations, and peer-reviewed journal articles. Coordination will continue to be explored with NOAA to establish this sentinel site as a long-term monitoring location and a node of the proposed Coral Reef Ocean Acidification Network in the Gulf of Mexico.

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

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 from 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) \$275 **Period of Performance:** FY 2014-2015

Description:

Background: Coastal land loss in Louisiana is an ongoing threat to the people and industry of that region. The USGS projects that coastal Louisiana has undergone a net change in land area of about 1,883 square miles (mi²) from 1932 to 2010 (Couvillion et al., 2011). Louisiana has lost 25 percent of its 1932 land area, or if viewed at a constant rate, one football field per hour since 1932. In a 2004 report, the USGS projected total land loss of 674 sq mi (1,746 sq km) before 2050 (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). Potential questions include: 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? Are interruptions in production because of land loss or storm surge factored in the decision making or planning processes? Questions of sustainability and resilience are being raised more loudly and clearly since the large-scale land loss, and destruction of property, natural assets, and human life that resulted from Hurricanes Katrina and Rita in 2005. The current CMI and BOEM-funded study, *Socio-Economic Responses to Coastal Land Loss and Hurricanes: Measuring Resilience among Outer Continental Shelf Related Coastal Communities in Louisiana*, is currently exploring larger sustainability focused questions, but this study will be designed to be smaller and much more focused. The Social Sciences Unit is adding a new strategy to the Studies Plan that incorporates smaller, focused studies (Emerging Issues) for later use in a Living Fact Book to be housed online as an adaptable, easily accessed public resource.

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. 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, databases and maps (coordinated with BOEM staff to use existing study maps if possible), annotated bibliographies, transcribed discussions, and a final report will be submitted.

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Central

Title: Assessment of Mud-Capped Dredge Pit Evolution on the OCS, Peveto and Sandy Point SE Borrow Areas

BOEM Information Need(s) to be Addressed: Alterations to seafloor topography from dredging OCS sediment resources have the potential to affect oil and gas infrastructure or other resources of concern located proximal to dredge pits. Direct impacts from dredging are well understood and mitigated for through BOEM’s environmental review and coordination throughout the sand leasing process. However, our understanding of long term changes in borrow pit geometry is poor; especially for some recent cases in the Gulf of Mexico where targeted sand resource deposits underlie muddy overburden resulting in relatively deep pits with a “muddy cap” (pit walls are characterized by cohesive muds overlying unconsolidated sands). While dredge pit evolution is expected (e.g. expansion of pit beyond extent of dredging activity) and mitigations 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 funding toward better understanding how mud-capped pits evolve and potential impacts to infrastructure and/or resources of concern located adjacent to the pit (Narin et al., 2005; 2007). However, site-specific data required to make accurate predictions and empirical measurements to test and validate predictive models were only available for one of the sites studied. This study will build on BOEM’s investment toward better understanding this problem by filling data gaps identified in and refining predictive models developed during previous studies or development of a new modeling framework. It will also evaluate the effectiveness of mitigations applied to existing dredge pits (e.g. setback distances from pipelines) 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.

Approximate Cost: (in thousands) \$750 **Period of Performance:** FY 2014-2017

Description:

Background: Much of the northern Gulf of Mexico shelf is characterized by a dominantly muddy seafloor with a paucity of restoration-quality sand in close proximity to shore. Large sand shoals occur on the shelf but their distance from shore has been cost prohibitive as an option for most restoration projects. However, discrete sand deposits associated with ancient rivers that flowed across the shelf during lower sea-level positions do occur closer to shore on the OCS. The channels were filled with sandy sediments as sea-level rose, and ultimately buried by recent mud deposition associated primarily with the Mississippi River. These shelf channel sands have been targeted for coastal restoration projects resulting in significant cost savings over more distal deposits. These savings ultimately benefit the project’s effectiveness and sustainability since greater quantities of sand can be placed for lower cost. Because target sand

deposits in these cases underlie a muddy overburden, a relatively deep dredge pit is produced that has walls composed of cohesive muds overlying sands. Because of these two unique characteristics—and the complexities inherent to predicting cohesive sediment (muds) dynamics versus more straightforward and better understood non-cohesive sediment (sand) behavior—the long term evolution of these pits is not well understood relative to their more common sand-only counterparts.

Predictive numerical models have been developed specifically for how BOEM-authorized OCS mud-capped dredge pits evolve in response to physical forcings including hydrodynamics, sediment dynamics, and local pit wall/seafloor stability (Narin et al., 2004; 2005). Model development was primarily based on empirical measurements at the Peveto Channel (PC) dredge pit offshore Holly Beach, Louisiana. After model validation with real-world measurements (e.g. time series of bathymetric surveys capturing dredge pit geometry and evolution), the models were employed to predict pit evolution at the Sandy Point Southeast (SPSE) proposed dredge pit. SPSE has similar stratigraphy to PC (both were relict channel fill sands with muddy overburden) and was planned to be utilized for construction of the Pelican Island (Louisiana) Restoration Project. Unlike the PC site, no site-specific empirical data were available as input for SPSE model predictions, and the hydrodynamics and geology differ from PC because of SPSE's location in the Barataria Bight where the modern Mississippi river delta results in complex wave climate and current circulation patterns, and proximity to the river provides increased sediment supply. Dredging at SPSE was completed in November 2012 and post-dredging bathymetric survey data indicate that within the first month, there may have been rapid initial adjustment of some pit walls where topographic changes have occurred extending up to 100 m beyond the dredge template. It is hypothesized that this initial adjustment reflects local mass wasting (collapse or slump) of upper cohesive deposits comprising pit walls into the pit and that this initial response to the temporary disequilibrium conditions introduced by dredging will not continue at this rapid rate as pit infilling occurs (suspended sediment supplied by the MS river and erosion and transport of the adjacent shelf muds) and side slopes stabilize. This newly excavated muddy-capped pit at SPSE provides a unique window of opportunity to test model predictions and effectiveness of assigned mitigations, monitor pit geomorphic evolution, develop monitoring protocols, and refine predictive capability for future projects.

Objectives: This study will

- quantify and greatly enhance our understanding of mud-capped dredge pit evolution through development of an geomorphic evolutionary model, primarily with respect to pit slope processes and equilibration, pit infilling rates and source of infill sediment, and overall pit morphodynamics
- refined or newly developed and validated predictive numerical and/or statistical model(s) for dredge pit evolution
- assess effectiveness of existing mitigations such as setbacks for pit margin erosion, slope design, cut depth versus water depth, pit orientation and geometry, etc.

- provide recommendations for pit monitoring protocols and suggested mitigations based on empirical measurements and refined numerical model.

Methods: This study will focus on two mud-capped OCS dredge pits in the Gulf of Mexico, PC and SPSE. PC was excavated in 2002 and site specific data were collected to study the evolution of that pit over a period of 2 years following excavation and models predicting pit evolution were developed. New geophysical (multibeam or swath bathymetric and side-scan sonar, subbottom profiler), sedimentologic/geotechnical (vibracores, grab samples), and physical oceanographic (bottom boundary layer observational) data will be collected at PC to assess present pit morphology and assess accuracy of model predictions. A similar suite of data will be collected at SPSE. Additionally, physical oceanographic parameters (e.g. waves, currents, suspended sediment concentration, etc.) will be measured seasonally and complimentary time-series (seasonal to semi-annual) of bathymetric datasets will be collected at SPSE to track pit evolution over a 2 year field effort. These data and other information will also be employed to better understand infilling rate and source(s) of sediment filling the pit (e.g. along-shelf bedload, pit slope mass wasting, suspended Mississippi/Atchafalaya River sediment). Effectiveness of assigned setback buffers will be assessed over the short term based on observational data.

Existing and newly acquired observational data will be analyzed and employed to refine existing the numerical modeling framework for pit evolution and potentially develop improved numerical and/or statistical models with the goal of developing a tool that can be used to better evaluate proposed dredge pit scenarios. Existing modeling framework (including input parameters and assumptions related to cohesive sediment transport and physics) will be evaluated to determine if a new modeling framework is needed to successfully accomplish objectives. The potential for development of a simplified empirical or statistical model, over the 1D and quasi-3D numerical models used in earlier studies will also be evaluated. Once developed, the model(s) will also be applied to predict pit evolution over the long term and determine if further mitigation or monitoring is necessary.

Based on findings from conceptual and numerical/statistical model development of dredge pit morphologic and sedimentologic evolution, a monitoring protocol to track pit evolution will be developed and potential mitigations on future muddy capped pits will be suggested.

Revised Date: March 22, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico
Planning Area(s): Western
Title: Long-Term Monitoring at the East and West Flower Garden Banks: 2014-2017

BOEM Information Need(s) to be Addressed: BOEM tracks the health of the Flower Garden Banks (FGB) reef to detect natural changes in the ecosystem and identify any anthropogenic effects that could be caused by offshore oil and gas activities. Ongoing monitoring at the FGB is used to validate and to sustain our contention that the lease stipulations provide effective mitigation of impacts to the offshore environment and particularly, these sensitive and unique biological features.

Approximate Cost: (in thousands) \$300 **Period of Performance:** FY 2014-2017

Description:

Background: The FGB are two seafloor mounds approximately 110 miles southeast of Galveston, Texas. These are the largest topographic features on the continental shelf of the northern GOM, with thriving coral reefs covering over 350 acres.

This is a continuation of a series of previous monitoring efforts begun in 1988 to develop a long-term database related to the environmental health of the East and West FGB. However, because oil and gas activity in the area has decreased as deepwater drilling has increased, and because the Banks have been stable with no significant changes since the long term monitoring began, the sampling frequency is being reduced to every other year to reflect the decreased activity in the area and stability of the Banks. The continuation of this monitoring will be used to validate and to sustain our contention that BOEM lease stipulations provide effective mitigation of impacts to the offshore environment in general and to these sensitive and unique biological features. The East and West FGB have received a variety of protective special area designations including the following:

- National Marine Sanctuary (NOAA National Ocean Service) and is defined as a Marine Protected Area (MPA);
- Habitat Area of Particular Concern (HAPC) for Essential Fish Habitat (EFH) (NOAA Fisheries);
- Special Ocean Site (SOS) (Environmental Protection Agency);
- Listed under Special Protected Areas and Wildlife (SPAW) Protocol (10/2012)

Objectives: This effort will continue the long-term monitoring at the East and West Flower Garden Banks to detect any subtle, chronic effects from natural and man-induced activities that could potentially endanger community integrity. Costs of the monitoring have been shared with the NOAA Flower Garden Banks National Marine Sanctuary (FGBNMS) since 1996; each agency currently provides one-half of the funding.

Methods: This study will be conducted jointly by BOEM and the FGBNMS through an Inter-Agency Agreement. NOAA and BOEM will each cover half the cost of the project. The FGBNMS will conduct the work using their dedicated research vessel. Field sampling will occur every other year, beginning in 2014 and repeating in 2016. Reports will be finalized in alternating years; the interim report in 2015 and the final report in 2017. The monitoring will be consistent with past BOEM topographic features monitoring, as well as the previously required lease stipulation monitoring for activities located within the old 1-mile zone of the FGB (now a 4-mile zone is in effect). Techniques are similar to most other coral reefs monitoring studies. Observations shall be made to evaluate coral colonies, accretionary growth, and general community health. Continuously recording water quality instrumentation was added to the ongoing study in 2001. These instruments will be maintained and data analyzed for a variety of water quality parameters.

Study sites of 100m x 100m were established in 1988. There are two sites, one at the East Flower Garden Bank (EFGB) and one at the West Flower Garden Banks (WFGB). Eight methods are used to measure community health on each of the banks:

1. **Random Transects:** sixteen transects of 10m length are located in a stratified random manner with four transects randomly located in each quadrant of the study site. Sequential images are analyzed along the length of the transect.
2. **Repetitive Quadrats:** forty photographic stations are permanently located in each study site. Nine deep stations are located adjacent to the EFGB study site in depths from 110 to 130 feet. Photographs cover 8 square meters.
3. **Lateral Growth Stations:** sixty permanent stations are located in each study site for photography of lateral encrusting growth of the coral, *Diploria strigosa*. Photos are compared with the previous year to measure the amount of lateral growth.
4. **Accretion:** sclerochronology is used to measure the thickness of accretion on the reef bi-annually. Cylindrical cores of the coral, *Montastraea faveolata*, are taken, thin slices are cut, and they are x-rayed to highlight the layers of varying density. This allows measurement of vertical growth from one growing season to the next.
5. **Video and Invertebrate transects:** two transects of 100m length are surveyed visually and with video at each study site. Visual surveys are done for sea urchins and lobsters. Video surveys are for characterization of the general health of the reef and for incidence of disease.
6. **Twenty-four stationary fish surveys** are performed to estimate community composition, density, and size.
7. **Water Quality:** data logging instruments are placed on each bank to record water quality parameters over time. Quarterly water samples are taken at three depths on each reef.
8. **Qualitative observations** of general health, disease, and change in the reef add to the assessment.

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Geo-Spatial Analysis of OCS Petroleum Effects on Gulf Coast Communities

BOEM Information Need(s) to be Addressed: The information organized at the level of county aggregations (BOEM-defined impact areas) will support Gulf Region socioeconomic assessments for EIS's and EA's and for Coastal Zone Management consistency findings. The analysis of spatial relationships, population and population change, environmental factors, and OCS-related infrastructure will support the assessment of cumulative impacts by identifying non-OCS factors that drive much of these relationships. By assessing the OCS-related risked environment, this study will also support environmental justice analysis mandated by Executive Order 12898.

Approximate Cost: (in thousands) \$400 **Period of Performance:** FY 2014-2016

Description:

Background: While true for United States society in general, the Gulf Coast is especially notable for its amalgam of numerous and varied ethnic groups—Native Americans, Cajuns, African Americans, Germans, Irish, Italians, Creoles, Isleños, Croatians, Vietnamese, Laotians, and Latinos to name some of the many. Some have resided there for centuries or have come into being there; others have arrived more recently—after World War II, or Vietnam, or Hurricane Katrina—or are still arriving. The Gulf Coast is notable for this rich mix, because—even in the 21st century—particular ethnic groups are strongly associated with many of its communities and businesses, and because this population and these associations are very much in a state of flux. The reasons for this are rooted in its environment. Particularly in Louisiana, but also elsewhere in the Gulf, wetlands, bayous, and limited deepwater access encouraged a pattern of small, distinct and specialized settlements along the coast together with a few cosmopolitan seaports. The coastal and maritime environment is also rich in natural resources—particularly fisheries and petroleum—which draw people to the region and anchor their communities and has led to the current patterns of dispersed settlements, rural industrialization, and the strong economic, social, and cultural ties that link communities to their environment and industries. In coastal Louisiana and eastern Texas, and also in other places along the Gulf Coast, communities and families have members that work in both the fishing and petroleum industry; many people strongly identify with both.

The environment is rich and draws people and industry to the coast and anchors them there; in some ways it has also been a curse. The most basic problem is coastal land loss and inundation due to subsidence, erosion, and sea-level rise, which is an ongoing threat to communities and their industries and is particularly severe in Louisiana. The USGS projects that coastal Louisiana has undergone a net change in land area of about 1,883 square miles from 1932 to 2010. In the last two decades, several coastal

communities have been depopulated and, with OCS support infrastructure largely located in coastal parishes, continued coastal land loss poses a significant threat to that industry and the people whose daily life is structured by its presence. Hurricanes are an enormous problem; besides destroying lives and property, they accelerate land loss. The 2005 hurricane season substantially altered relationships between coastal peoples and their environments and industries, causing population loss and changes to the composition of populations and workforces. While shocks to the petroleum industry were short-term, shocks to the less well capitalized fishing industry were not. Finally, the industries that have been nurtured by the rich coastal environment and that support the coastal populations also come with problems, fluctuating employments in some petroleum support industries, for example, or a declining fishing industry. Industrialization brings environmental impacts from land use and planned and unplanned releases of material into the environment. Just as OCS-support industries generate employment, they also generate environmental risks.

NEPA asks, what are the positive and negative socioeconomic consequences of an action and how are these distributed among the affected populations? The recent changes to the socioeconomic baseline, the causes of these changes, and the geo-spatial relationships between that population and OCS infrastructure must be understood to answer these questions. Under NEPA, assessments of environmental justice consider whether or not low income or minority populations may be disproportionately and negatively affected by a government action or decision. The EPA is the lead agency for environmental justice and recommends that it be addressed through geo-spatial analyses—by comparing the income and ethnic distributions of a population that may be affected by an action with those of a larger, surrounding population.

Objectives: The overall goal is to further GOMR socioeconomic assessments by developing a better understanding of relationships between coastal populations and OCS-related onshore support. This study will:

- Describe and map recent changes (i.e., post 2005) in Gulf Coast populations and assess the causes of these changes,
- Describe and map onshore OCS-related support infrastructure and the risks associated with it,
- Assess, at multiple geographic levels, the relationships between these risks on subsets of the population, and
- Develop a robust and efficient method/model for the analysis of potential OCS-related impacts to environmental justice in the GOMR.

Methods: The results of the data search and synthesis will be used to update baseline socioeconomic information to detail changes that have been occurring since the 2005 hurricane season (e.g., ongoing changes to population distributions in Plaquemines Parish) and since the DWH oil spill and its aftermath has raised significant new questions regarding the geographical distribution of the benefits and burdens of the OCS program (e.g., regarding waste disposal). Besides incorporating relevant information from publicly available government, non-governmental organization

(NGO), and industry reports, trade and academic journals, etc., the research team will synthesize BOEM- and USGS-supported Gulf Region research on onshore OCS support industries and infrastructure, on communities and community resiliency, and on the socioeconomic consequences of the OCS industry, hurricanes, and the DWH oil spill. The resulting syntheses and data will be organized to: 1) support baseline descriptions and analysis for recently updated Economic Impact Areas (county aggregations used to assess socioeconomic impacts in the GOMR), and 2) support this study as a whole. This study will build on previous BOEM-supported geo-spatial analyses of the relationships among populations, onshore infrastructure, and risk. To date, two BOEM sponsored studies have applied a geo-spatial methodology for addressing environmental justice concerns raised by the onshore consequences of OCS leasing actions. The first developed, for St. Mary Parish, a geo-spatial methodology by mapping the physical reach of potential hazards associated with different types of infrastructure (e.g., ports, pipelines, highways, petrochemical plants, etc.). The second study refined the methodology by comparing types of petroleum development (e.g., onshore vs. offshore), risk over time (e.g., population change vs. infrastructure change), and potential impacts on selected land uses (e.g., wild foods).

To facilitate the regular use of this approach in BOEM assessments, important issues remain to be resolved. Some are practical—issues related to incorporating the approach into a user-friendly Geographic Information System (GIS) system. Some are methodological—questions related to how to address possible impacts to land uses versus human populations and how to operationalize distinctions between normal versus accidental operations and up- and down-stream effects. This effort will be used to evaluate approaches to assessing the distribution of risk among the affected populations and potential OCS impacts to environmental justice, particularly spill-related impacts, and potential issues to address that were not considered in the two previous BOEM studies. The research team shall also conduct a review of infrastructure types to determine incremental changes to their associated risked environments that are generated by new OCS sale-related demands. Based on both evaluations, the research team will conduct an environmental justice analysis that updates the previous studies and that extends the analysis to other coastal areas of the Gulf. Finally, to facilitate the application of results, the research team shall develop a tool for estimating OCS lease sale-related potential impacts to coastal populations. As part of these efforts, the research team will develop a geo-spatial database that supports the analysis of questions related to the distribution of risks to communities at the county-level, and at one or more geographic levels. This database will include, but not be limited to, current data on demographics, infrastructure, and onshore OCS-related activities and will incorporate relevant geo-spatial data from reports and from datasets produced by BOEM- and USGS-supported research.

Revised Date: March 28, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Central

Title: Long-Term Ecosystem Monitoring of the Deep Gulf of Mexico, Phase 1: Deep Water Coral Sites Impacted by the 2010 Deepwater Horizon Oil Spill

BOEM Information Need(s) to be Addressed: BOEM is charged with environmentally responsible development of offshore oil and gas reserves. Part of the agency's responsibility in offshore development requires the protection of sensitive deepwater benthic communities (deepwater corals and chemosynthetic communities) from routine oil and gas activities by regulating the distance of activities from the habitats. Although the regulations are put in place to provide enough distance to protect the habitats from routine activities, accidental events, such as an oil spill, may impact areas beyond the separation distances required by BOEM. Therefore, BOEM must determine the possible impacts of accidental events to sensitive biological habitats as part of the NEPA process. There is currently no program to monitor future baseline conditions of sensitive deepwater habitats or future conditions of the limited number of deepwater coral habitats known to have been impacted by the DWH oil spill event.

Approx. Cost: (in thousands) \$2,000 **Period of Performance:** FY 2015-2019

Description:

Background: The oil and gas industry has been operating in deepwater since the 1970s. Little is known about the effects of continuous deepwater operations on deepwater benthic habitats (deepwater corals and chemosynthetic communities) or the effects of accidental oil and gas events on these habitats. Many organisms that live in the deep Gulf are extremely old and take a very long time to develop. Studies have indicated that chemosynthetic animals, especially tube worms can be as old as 400 years old (Powell, 1995; Fisher, 1995) and deepwater black coral in the GOM can be over 2,000 years old (Prouty et al., 2011). Establishing a long-term monitoring 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 of accidental events may be on these habitats. Because a large-scale Gulf-wide long-term monitoring program will take some time to put in place, a Phase 1 study focusing on a limited number of deepwater coral communities believed to be impacted by the DWH oil spill is proposed here to obtain some much needed information on recovery of impacted deepwater coral communities and to respond to public comments for NEPA documents concerning effects of oil on these communities. Following the DWH event, a severely damaged deepwater coral community was discovered during the BOEM/NOAA OER Lophelia II study to the southwest of the wellsite in lease block MC 294 where the majority of corals had tissue damage and were covered in brown flocculent material (White et al., 2012). Another damaged coral site was later discovered in MC 297 (Boland, personal communication). Limited visits to the damaged coral sites have documented the progress of continued deterioration or improvement of the coral health but these efforts

will likely not continue past 2013. Subsequent monitoring will be beneficial to determine if these damaged corals have the ability for full or partial recovery from oil exposure, or if some number of individuals in the community will be lost.

Objectives: The purposes of this study are threefold:

- To fill the gap in knowledge of deepwater coral community structure and possible impacts to those habitats as a result of offshore oil and gas activities through long-term monitoring efforts for BOEM NEPA documents.
- To examine the impacts of the DWH oil spill on deepwater coral communities that were damaged as a result of the oil spill and compare it to healthy deepwater coral communities of similar makeup. Deepwater shipwrecks in the same vicinity will also be considered as additional impact monitoring objectives.
- To contribute to a greater Gulfwide monitoring effort which would result as a follow up to another profile currently being considered for 2015 (*Workshop on Developing a New, Leveraged Approach to Long-term Monitoring in the Gulf of Mexico Using Stations*). The deepwater coral stations proposed in this study would provide locations for long-term monitoring that will be revisited to collect data to benefit a Gulfwide monitoring effort.

Methods: This study will examine the long-term impacts of the DWH spill on a multiple deepwater coral communities that were damaged during the incident. ROVs will be used to video tape, take still photographs, and collect coral, sediment, and water quality samples in and around the damaged areas in order to determine the impact to the corals and evaluate possible continued decline of the community or its recovery. The damaged sites (MC 294 and 297) will be compared to healthy deepwater coral sites of similar community make-up (several healthy sites were already identified in White et al., 2012).

This study is anticipated to be an interagency collaboration with USGS and possibly NOAA's Office of Exploration and Research. In addition, USGS and possibly NOAA would contribute funds to this effort. USGS and NOAA have worked with BOEM on similar deepwater coral studies in the past (*Lophelia II*) and the partnership would be beneficial to all parties.

This Phase 1 study will also contribute to a larger scale long-term monitoring effort in the GOM. A workshop is concurrently being proposed for this Studies Development Plan in which additional stations for long-term monitoring representing a variety of habitats will be identified in the GOM, many of which may be in deepwater and will include consideration of chemosynthetic communities, soft bottom habitats, shipwrecks, and *Lophelia* communities suitable for additional long-term monitoring efforts. The current study can be expanded to a rotational multi-habitat long-term monitoring effort that would collect physical, biological, and chemical data to contribute to BOEM's GOM dataset and allow continued evaluation of potential cumulative impacts from offshore energy and mineral development.

Revised Date: April 17, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Synthesizing and Quantifying Environmental Effects on the Gulf of Mexico

BOEM Information Need(s) to be Addressed: The NEPA (1969) (42 U.S.C. 4321-4347) is the foundation of environmental policymaking in the United States. The intent of the NEPA process is to help public officials make decisions based on an understanding of environmental consequences and take actions that protect, restore, and enhance the environment. The NEPA established the Council on Environmental Quality (CEQ) to advise agencies on the environmental decision making process and to oversee and coordinate the development of Federal environmental policy. The CEQ issued regulations (40 CFR 1500-1508) in 1978 implementing NEPA. The regulations include procedures to be used by Federal agencies for the environmental review process. In accordance with NEPA, BOEM prepares environmental documents on various actions related to the OCS Program. These documents may be EA's or EIS's, depending upon the nature of the action in question or the significance of potential impacts associated with the action. One resource that NEPA documents consider is water quality. Within water quality, sediment quality is also addressed for both coastal and offshore waters. Since these are virtually ubiquitous resources, their quality affects other resources such as the biota living in the water and sediments.

Activities that could impact coastal and offshore waters and sediments include the broad categories of offshore oil and gas activities, 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 (e.g., urbanization, agricultural practices, coastal industry, and municipal wastes). Many of these categories noted above would have some of the same specific impacts (e.g., vessel traffic would occur for all of these categories listed above except natural processes). NEPA documents are constantly evaluating the state of the water and sediment quality in the GOM, routine and possible accidental impacts from federal offshore oil and gas activities, and the cumulative effects of federal oil and gas activities within the context of the additional broad impact categories noted above. However, some of the best references to assist in the development of the coastal and offshore waters sections of the NEPA documents are somewhat dated. Additionally, quantitative data that puts federal oil and gas activities into context with other activities, or that quantifies the incremental impact of federal oil and gas activities when added to other actions (i.e., cumulative impact information), is limited. Thus, a new synthesis of information on federal oil and gas inputs, fates, and effects on water and sediment quality in the GOM that puts this information into quantitative context with other activities is greatly needed.

Approximate Cost: \$300

Period of Performance: FY 2014-2016

Description:

Background: BOEM Gulf of Mexico Region NEPA documents are constantly evaluating the state of the water and sediment quality in the GOM, routine and possible accidental impacts from federal offshore oil and gas activities, and the cumulative effects of federal oil and gas activities within the context of the additional broad impact categories noted above. One published compilation that is particularly helpful in addressing some of this information is *Oil in the sea III: Inputs, Fates, and Effects* (National Research Council, 2003). Additionally, the literature review, *Environmental Risks of Chemical Products Used in Gulf of Mexico Deepwater Oil and Gas Operations* (Boehm et al. 2001, OCS Study MMS 2001-011), is also very useful. However, these documents are somewhat dated especially as post-DWH literature and data become available. A more recent, but more limited, pre-DWH industry report is published by the American Petroleum Institute entitled “Analysis of U.S. Oil Spillage” (Etkin, 2009, API Publication 356). Thus a new, non-industry quantitative synthesis of information on oil and gas inputs, fates, and effects on water and sediment quality in the GOM is needed. Furthermore, detailed *quantitative* information is especially needed to put information on federal oil and gas activity inputs, fates, and effects on water and sediment quality in the GOM into context along with the inputs, fates, and effects of other activities. In other words, in this synthesis an approach must be resolved to not only distinguish between possible environmental effects from the offshore oil and gas industry from other anthropogenic or natural effects such as state oil and gas development, the fishing industry, onshore industries, oil seeps, river or atmospheric inputs etc..., but also to identify the quantitative contribution that each source makes to each noted impact. Contributions from sources such as vessel bilge and ballast water have decreased recently due to regulations passed after the publication of *Oil in the sea III: Inputs, Fates, and Effects* (National Research Council, 2003), and more is known about the contribution of legacy sources such as sunken vessels leaking oil. These are just a few examples of factors that will have to be considered in the development of a new quantitative synthesis of factors affecting the water and sediment quality of the GOM.

In addition to a standard report, the products of this effort should include at least one peer-reviewed paper, a Reference Manager and Endnote readable database of references used, any electronic copies of references or data used as allowed by copyright law, electronic copies of any calculations conducted and BOEM readable electronic files of any model generated data along with input files.

Objectives: The objective of this study is to generate a new synthesis of information on oil and gas inputs, including chemicals used in the oil and gas industry, fates, and effects on water and sediment quality in the GOM and to put this information into *quantitative* context along with inputs, fates, and effects of other activities that affect the water and sediment quality of the GOM. The quantitative contribution of each source to each impact should be described.

Methods: This project is not intended to entail any new field or laboratory research. Instead, this project should look to thoroughly search for and synthesize information from available peer-reviewed literature, state government, and federal government publications or publicly available data. Mined data may be used in calculations or

modeling efforts to fill in information gaps and place the data into a more relevant, detailed, and quantitative context. Data from technical or professional societies may be considered if it is the only available source of such information, can be vetted in an appropriate manner, and is clearly referenced in the final products. Both pre- and post-DWH oil spill literature should be evaluated. The contractors should look to the offshore and water quality sections of BOEM's GOMR EIS's, as well as sections on hydrocarbon inputs to the GOM, spills, operational wastes and discharges, and other related sections for guidance. The NEPA, *Oil in the Sea III: Inputs, Fates, and Effects* (National Research Council, 2003), and *Literature Review, Environmental Risks of Chemical Products Used in Gulf of Mexico Deepwater Oil and Gas Operations* (Boehm et al. 2001, OCS Study MMS 2001-011) should also be considered when determining essential data. The contractor may also consult the industry report published by the American Petroleum Institute entitled *Analysis of U.S. Oil Spillage* (Etkin, 2009, API Publication 356). However, it is expected that the results of this synthesis will improve greatly upon whatever is found in the noted documents. This project should focus solely on the GOM.

Revised Date: January 14, 2013

2.3 Profiles of Studies Proposed for the Fiscal Year 2015 NSL

Table 3. BOEM Gulf of Mexico Region Studies Proposed for the Fiscal Year 2015 NSL

| SDP Page Number | Discipline | Study Title |
|---|------------|---|
| 53 | SE | An Analysis of the Fiscal Impacts of the OCS Industry in the Gulf of Mexico |
| 55 | SE | An Assessment of OCS-Related Onshore Transportation Industries and Operations in the Gulf of Mexico Region |
| 59 | SE | Analysis of BOEM Site 15598, De Soto Canyon Area, Gulf of Mexico |
| 61 | SE | Archaeological Investigations of Buried Magnetic Anomalies in High Traffic, High Loss Areas |
| 65 | HE | Characterization of Size at Age and Growth Dynamics for Loggerhead Sea Turtles in the Gulf of Mexico (NOAA) |
| 69 | HE | Comprehensive Nearshore and Offshore Avian Surveys in the Gulf of Mexico |
| 73 | HE | Development of Seasonal Marine Mammal Density Models for the Northern Gulf of Mexico (NOAA) |
| 75 | SE | Effects of the OCS Industry on Tourism in the Gulf of Mexico: Extensions of Previous Research |
| 77 | SE | Impacts to Wooden Shipwreck Remains from Exposure to Crude Oils, Chemical Dispersants, and Hydrocarbonoclastic Bacteria |
| 81 | PO | Mississippi Delta Mudslide Mapping, Hazard Susceptibility Assessment, and Monitoring Program |
| 83 | SE | Review of New and Emerging Remote Sensing Technologies |
| 85 | PO, HE | Simulating Planktonic Prey and Higher-Trophic Habitat Variability in the Gulf of Mexico |
| 87 | HE | Spatial and Temporal Historical Time-Series Analysis of Benthic Infaunal Data in the Northern Gulf of Mexico OCS (NOAA) |
| 89 | SE | Subsistence Production, Exchange, and Use in Coastal Gulf of Mexico: Description and Assessment |
| 91 | IM | Texas Coastal Land Loss from 1992 to 2010 |
| 93 | IM | Workshop on Developing a New, Leveraged Approach to Long-Term Monitoring in the GOM Using Stations |
| 97 | IM | Workshop on Future Directions in Understanding Bio-Physical Oceanographic Interactions in Mid- to Deep Waters of the Gulf of Mexico |
| 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 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: An Analysis of the Fiscal Impacts of the OCS Industry in the Gulf of Mexico

BOEM Information Need(s) to be Addressed: The fiscal contributions of the OCS leasing program to federal and state governments are some of the fundamental reasons for the program's existence. These fiscal contributions, as well as the issue of equitable sharing, are key parts of the analysis of the BOEM 5-Year Programmatic EIS and associated decision-making documents. The fiscal impacts of the OCS Program are also addressed in Gulf of Mexico Region (GOMR) Environmental Impact Statements (EIS's). Fiscal effects are important themselves; they are also often important sources of indirect socioeconomic effects. This is the case for the OCS leasing program in the Gulf, where tax receipts and other revenues generated by OCS-related activities are major program benefits to the affected counties/parishes and states, and where the public expenditures which the program requires are important burdens. However, due to the complexity and region-specific nature of fiscal impacts, the GOMR currently lacks an approach for the systematic analysis of these impacts.

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

Description:

Background: The fiscal consequences of the OCS program are significant. These effects are largely shaped by the interaction of federal law and each state's revenue and allocation mechanisms. There are also a number of indirect fiscal impacts on local communities that are shaped by their economic composition and position in supporting oil and gas activities along the GOM. Past BOEM research has touched on this subject. For example, the study, *Spatial Restructuring and Fiscal Impacts in the Wake of Disaster: The Case of the Oil and Gas Industry Following Hurricanes Katrina and Rita*, described (but did not estimate) the revenue implications for parishes where petroleum industry presence declined. Also, several social indicator studies, such as *Developing Indicators to Measure Socioeconomic Impacts of OCS Activities*, have (or are seeking) local economic measures that reflect OCS-related activity—including measures of public fiscal health. However, given the complexity of OCS fiscal effects and the various channels in which they arise and take shape, an extensive and focused research project needs to be undertaken in order to fully understand the sources, size, and trends of fiscal impacts of the OCS program in the GOM. In 2007, such a study was launched under the CMI agreement with LSU, *State and Local-Level Fiscal Effects of the Offshore Petroleum Industry* (GM-07-08). However, due to conflict of interest issues that arose between LSU researchers, the State of Louisiana, and BOEM, this study is incomplete and has been closed. It has provided useful data that can be applied to future research but it has completed little analysis.

The GOMR is also engaged in an effort to strengthen its regional-level socioeconomic impact analysis. To date, this effort has focused on (1) the redefinition of geographic impact areas to better reflect the onshore geographic distributions of OCS-related economic activities; (2) analyzing the sensitivity of these areas to changes in OCS-related activities based on the composition of regional/local economies and inter-sector trade patterns; and (3) the definition of focal areas for socioeconomic impact analysis based on their participation in, and sensitivity to, OCS-industry activities. This study of fiscal impacts is a natural complement to these ongoing efforts since the indirect fiscal impacts arising from the OCS program will be more accurately estimated and will be organized around more appropriate geographic aggregations of local areas.

Objectives: The objectives of this study are to strengthen BOEM estimates of the overall economic fiscal contributions of the OCS leasing program to affected Gulf States and to provide the understanding and tools needed to assess regional-level fiscal impacts.

Methods: The study will identify and define direct mechanisms by which OCS-related funds are distributed to states and their political subdivisions. It will also estimate the various indirect revenue impacts which accrue to the states and their political subdivisions and, to the extent possible, identify the linkages between these and OCS activities. It will also identify and describe the direct and indirect public expenditures required to support OCS activities and identify and/or develop methodologies to allocate these expenditures in specific geographic locations and their political subdivisions. Finally, this study will develop and describe a methodology to estimate the total and net fiscal effects of the OCS program in the Gulf of Mexico that will support future scenario-based BOEM analyses.

The study will employ the following methods:

1. Develop a literature review to provide a detailed description of the various fiscal effects and an evaluation of methodologies to estimate magnitudes of these effects.
2. Identify and define the various direct and indirect fiscal impacts on state and local government and their relationships to OCS activities.
3. Where possible, develop time series measures to quantify trends in fiscal contributions to various geographic regions.
4. Analyze selected county/parish-level budgets and estimate the fiscal impacts of OCS-related activities on selected public services institutions (e.g., education, health-care, and public works).
5. Develop a model that will predict the fiscal impacts arising from specified levels of exploration and development activity.

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

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 consistency 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., Bureau of Economic Analysis (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, 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, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Central

Title: Analysis of BOEM Site 15598, De Soto Canyon Area, Gulf of Mexico

BOEM Information Need(s) to be Addressed: Information concerning a recently-discovered colonial or exploration era archaeological site in the deep waters of De Soto Canyon (the first of its kind found on the OCS) is needed to inform BOEM's NEPA analysis of the Eastern Gulf. Also, since the site pre-exists the formation of the United States, information is needed to determine if the site remains the property of a foreign government, which could influence BOEM's consultation requirements under Section 106 of the National Historic Preservation Act (NHPA) for future plan approvals. In addition, BOEM is required under Section 110 of the NHPA to identify and protect historic properties and avoid unnecessary damage to them. Information obtained will assist BOEM 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)). While it is not feasible for BOEM to conduct investigations to identify and characterize the many hundreds of potential shipwrecks reported to the agency every year, this particular site represents a unique, unusually early, and rare example whose preservation is paramount. Finally, although the site has been briefly imaged by an ROV, insufficient information has been obtained to assess National Register eligibility. An understanding of its age, national origin, ownership, and mission are critical to BOEM's NEPA analysis and consultation responsibilities. It thus becomes extremely important to fully understand its present condition, physical extents, and future research potential in order to appropriately design future avoidance, management, and long-term monitoring strategies in an area subject to future oil and gas development.

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

Description:

Background: In February 2012, BOEM was notified by Shell Oil of the discovery of a sidescan sonar target that appeared to have the characteristics of a sunken shipwreck. The target lies in over 7,600 feet of water in the De Soto Canyon Area and was assigned BOEM target number 15598. During the following December, BOEM was approached by the Schmidt Ocean Institute (SOI) through NOAA's Ocean Exploration and Research (NOAA/OER) requesting targets to investigate during a shake-down cruise for their newly acquired research vessel the R/V *Falkor*. Two targets in De Soto Canyon were provided to SOI for inspection by ROV. The first target, 15598, proved to be the largely buried remains of a wooden hulled vessel. Associated with the ship's hull were a number of glass bottles of a type commonly identified as English "onion bottles" dating from the late seventeenth or early eighteenth century, making this possibly the oldest shipwreck ever found on the Federal OCS.

The history of the Gulf of Mexico during the hypothesized date range of the vessel's sinking spans such important events in American history Robert Sieur de La Salle's failed expedition to find the mouth of the Mississippi River; Pierre Le Moyne, Sieur d'Iberville's colonization of Louisiana, the establishment of Fort Louis de la Mobile in 1702; and the founding of Natchitoches in 1714 and New Orleans in 1718. The video data collected during the single brief visit provided a tantalizing glimpse into the wealth of information that is present on the surface of the site and potentially beneath the seafloor. The nature of preservation of the site and the uniqueness of the artifact assemblage marks Site 15598 as potentially one of the most historically significant shipwrecks sites ever discovered in the Gulf of Mexico and its further study can shed light on important aspects of human history relevant to formation of the U.S.

Objectives: The primary objective of the study is to thoroughly document the present condition of the visible remains of Site 15598 before any BOEM-permitted oil and gas activity occurs in the area and to determine its historical significance. A second major objective of the study would be to involve and engage the public in the importance and excitement of scientific discovery through live "telepresence" technology, 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.

Methods: The investigation will seek: A) to obtain an accurate photogrammetric map of site 15598, placing the artifacts in their spatial context and accurately mapping the visible remains of the hull; 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 organization of the vessels crew and role of the vessel in the global economy and international relations. The investigation is dependent upon securing: a) a ROV equipped with high resolution video and digital still cameras, the ability to recover fragile artifacts, and accurate positioning capabilities; and b) a dynamically positioned ship to serve as the ROV platform. It is expected that the successful offeror will charter the R/V Nautilus or similarly equipped research vessel with telepresence technology. The work of vessel such as R/V Nautilus, is partly funded by providing educational broadcasts live over the internet to dozens of schools, museums, and aquariums across the country and millions of people around the world. Utilization of these vessels represents a significant cost savings over other commercially available platforms, which makes it advantageous to time the study to take advantage of the vessel's availability. Funding for the long term conservation and curation of artifacts recovered through the study would need to be obligated as the first step in the project, and an agreement with a curation facility that meets the federal curation standards would have to be in place.

Revised Date: March 1, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Western

Title: Archaeological Investigations of Buried Magnetic Anomalies in High Traffic, High Loss Areas

BOEM Information Need(s) to be Addressed: BOEM requires, in water depths of less than 200 meters, both side-scan sonar and magnetometer geophysical survey to mitigate potential impacts to archaeological resources on or buried beneath the seafloor. As of November 29, 2012, there were 1,377 side-scan sonar targets and 13,178 magnetic anomalies with potential archaeological significance within this bathymetric zone, all of which require avoidance by oil and gas industry activities. Only 2,087 of the magnetic anomalies, however, are associated with a side-scan sonar target, meaning that the vast majority of magnetic anomalies represent unidentified buried magnetic features with no seafloor surface expression.

Because of current survey lane spacing requirements (between 50 and 300 meters, depending on lease block), the intensity and duration of a magnetic anomaly may not represent the true magnetic profile of a buried magnetic source (e.g., the magnetometer may pass over the edge, as opposed to the center of the source). Additionally, because of the lack of a requirement to base magnetic anomaly spatial identification on total magnetic field contours rather than on-line anomaly locations, it is highly likely that, in many cases, multiple magnetic anomalies represent a single magnetic source.

Information obtained from this study will assist BOEM in revising NTL requirements so that buried magnetic anomaly identification resulting from archaeological survey more accurately represents potential buried archaeological remains. Additionally, because of the coverage gaps resulting from current survey requirements, BOEM is forced to be highly conservative in the interpretation of anomalies which, Gulf-wide, results in many false positives and unnecessary avoidances while at the same time potentially missing real archaeological resources. This will enable the development of more accurate and potentially smaller areas of avoidance for industry activities, while ensuring that identified archaeological sites are assigned appropriate avoidance zones.

Approximate Cost: (in thousands) \$300 **Period of Performance:** FY 2015-2017

Description:

Background: Identification of buried magnetic anomalies as potential archaeological resources is based on the type of magnetometer used, intensity and duration of the magnetic anomaly, the characteristics of the magnetic signature (when the magnetic field is contoured), the composition and structure of the near-surface seafloor, and the experience of the archaeologist in working with magnetometer data. Once a magnetic anomaly is identified as a potential archaeological resource, for BOEM-related activities it is rarely investigated unless it adversely impacts planned industry activities, meaning

the majority of these anomalies have not been confirmed in the field as archaeological in origin.

At the same time, the quality of the locational information of approximately half of the vessels known to have wrecked within the GOM is fair to very poor. It is known that many of these vessels identified in historic literature and other reported accounts sank while seeking the safety of established protected ports such as Galveston, Texas. These ports are often located at the mouths of rivers, those which deposit considerable quantities of sediment within their deltaic systems. Most of these historic shipwrecks, so far unidentified in the archaeological record, are therefore most likely buried and can only be identified in archaeological geophysical survey through the use of a magnetometer.

Objectives: The primary objective of this study is to identify the source of a representative sample of buried magnetic anomalies to develop a field-tested set of standards by which to evaluate magnetic data obtained during archaeological magnetometer survey on the Gulf of Mexico OCS. This includes identifying the composition and size of the source material, its depth below the seafloor, and its location relative to the identified target location of the magnetic anomaly during the survey.

The secondary objectives are to identify whether any of the identified buried magnetic anomalies represent historic shipwrecks or associated materials that were known to have sunk in the vicinity of the areas surveyed, and the effects of the sedimentary regime in which the archaeological materials are buried on their associated magnetic signatures.

Methods: One lease block will be chosen for investigation, which conforms to the following criteria: the quality of the existing available magnetometer data at 50-meter line spacing, the density of buried magnetic anomalies within the block, the identification as a probable location for the presence of historic shipwrecks, and the accessibility of target locations to diver-based investigation. Chosen blocks should contain minimal industry infrastructure (surface well boreholes and pipelines), few side-scan sonar targets, many magnetic anomalies with several in clusters, and the potential presence of both historic and modern shipwrecks.

Two mobilizations will be required for this study. The chosen block will first be re-surveyed using the recommended 30 meter lane spacing at six meter altitude for archaeological magnetometer survey. Thirty-meter lane spacing has been identified in peer-reviewed literature (including MMS report 89-0024) as the minimum resolution required for the identification of buried archaeological resources. Box-in towed gradiometer survey, using industry-standard survey methodology, over survey-line anomaly clusters will be used to identify the center of the anomaly and resolve its overall size, depth, and spatial characteristics. The data will then be processed, contoured, and individual anomalies with appropriate avoidance zones identified based on the rendered information. The product of this survey will be compared to the magnetic anomaly data and mapped products obtained with the original 50-meter line spacing survey. This will

include an analysis of reported versus verified magnetic anomaly data with discussion and quantification of discrepancy between the two survey and magnetic anomaly identification techniques.

During the second mobilization, diver investigations of magnetic anomalies identified as potential archaeological resources in the 30-meter survey will use standard ground-truthing techniques to determine the dimensions, material, and depth of burial of the magnetic anomaly source and if it is an archaeological resource, modern debris, or geological in origin. A differential global positioning system will be used to relocate magnetic targets and marker buoys dropped at the precise location of the target to be tested.

The results of the field-testing will be integrated into an analysis of the ability of current archaeological magnetometer survey requirements to successfully identify the presence and magnetic characteristics of buried archaeological resources. Additionally, archaeologists will gain a better understanding of the sedimentary regime in which buried archaeological resources are incorporated in the Gulf of Mexico OCS and how this regime affects the magnetic signature of the resource. If the methodology is proven successful in the chosen block, this study may be expanded to adjacent and other high traffic, high loss blocks in order to refine survey and ground-truthing methodology and increase accuracy in the identification of buried archaeological resources.

Revised Date: March 19, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Characterization of Size at Age and Growth Dynamics for Loggerhead Sea Turtles in the Gulf of Mexico

BOEM Information Need(s) to be Addressed: The proposed study will generate baseline, long-term size-at-age and growth data for threatened loggerhead sea turtles in the GOM to facilitate evaluation of potential effects of activities associated with leasing and energy development on the species in this region.

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

Description:

Background: Effective management of threatened and endangered sea turtle populations requires knowledge not only of mean values for life history characteristics, such as growth rates, life stage durations, and age at maturation, but also how these traits vary over space and time and what factors underlie this variability. The importance of such baseline data in assessing changes in population size and composition (i.e., population dynamics) for sea turtles has repeatedly been highlighted, most recently during attempts to assess the potential impacts of the 2010 DWH oil spill in the GOM, as well as to understand wide fluctuations and geographic differences in loggerhead nesting trends in the southeast U.S.

Despite the clear need for age and growth data, collecting it is challenging, as sea turtles lack external age-related characteristics and overall slow growth and highly migratory behavior impede monitoring through direct recapture of individuals. However, the technique of skeletochronology, or analysis of skeletal growth marks (GM's) in a manner similar to tree rings, has the potential to provide age and growth data, provided that the approach is appropriately validated. For loggerhead sea turtles in the Atlantic, analysis of samples from known-age, tagged, and bone-marked individuals has shown that GM's are deposited in humerus bones on an annual basis, allowing age estimation through GM counts corrected for any loss of early GM's (i.e., resorption) due to bone remodeling at the core. In addition, a proportional relationship between humerus and body size (straightline carapace length, or SCL) has been demonstrated, validating the approach of converting all GM measurements within each humerus to SCL estimates. This, in turn, makes it possible to look backward in time for each turtle to characterize size SCL-at-age throughout at least of portion of life (depending upon the extent of resorption), as well as to estimate annual growth rates by calculating the differences between pairs of SCL estimates generated from successive annual GM's. Furthermore, it is possible to combine skeletochronology with analysis of carbon, nitrogen, and sulfur stable isotopes in bone tissue that provide information about foraging history and habitat use, to assess long-term patterns in foraging behavior on annual time scales and assess its influence on growth patterns. Although recent analyses have applied these techniques to investigate growth rates, juvenile stage durations, and age at maturation for loggerhead

sea turtles in the northwestern Atlantic, to date it has not been possible to generate comparable data for loggerheads in the Gulf of Mexico.

Objectives:

- To generate approximately 800 size- and age-specific annual growth rates for loggerheads in the GOM over a time frame spanning ~1990 to 2009 (projected from results of similar Atlantic loggerhead analyses)
- To estimate (with mean and variation) loggerhead juvenile stage durations and age at maturation in the GOM
- To characterize the influence of potential covariates such as location, trophic level, SCL, age, sex, and calendar year on somatic growth patterns for loggerheads in the GOM
- To assess regional differences in loggerhead age and growth between the GOM and the northwestern Atlantic
- To establish reference baseline size-at-age and growth data for loggerheads in the GOM to facilitate evaluation of potential effects of anthropogenic activities

Methods: Through collaboration with the National Sea Turtle Stranding and Salvage Network, the NMFS National Sea Turtle Aging Laboratory has accumulated 111 front flippers from loggerheads stranded in the GOM from 1998 to 2010. These turtles ranged from 9.8 to 100.4 cm straightline carapace length or SCL (mean SCL = 65.7 cm, SD \pm 28.1 cm) and included 29 females, 13 males, and 69 turtles of unknown sex. Whole humeri will be extracted and processed for skeletochronological analysis. Briefly, a low-speed saw will be used to take 2 cross-sections of the humerus at the point with least amount of resorption, one for skeletochronology and the other for stable isotope analysis. The skeletochronology section will be decalcified and 25 μ m thick 'thin' sections will be collected using a microtome, stained using hematoxylin to highlight skeletal growth marks, and mounted on microscope slides. As stained sections fade fairly quickly, sequential, partial images of each humerus cross-section at 4x magnification will be obtained using a microscope in conjunction with a digital video camera and image capture software. The partial images (from 2 to 100 per turtle, depending on humerus size) will be manually stitched together in Adobe Photoshop to produce calibrated digital images of entire humerus cross-sections, which will be archived and used for further analysis. The number and location of GM's in each digital skeletochronology image will be assessed by two independent readers until consensus is reached. Digital skeletochronology images overlaid onto unprocessed stable isotope sections (n = 30) will be used to guide growth increment-specific collection of bone samples (10 per section = 300 growth increments) using a Micromill sampling prep device, which will then be analyzed for carbon, nitrogen, and oxygen stable isotopes using mass spectrometry. To better assess the fine-scale isotopic variation within the individual growth increments, continuous isotopic sampling along transects spanning multiple growth increments will be conducted using laser ablation inductively-coupled mass spectrometry (ICP-MS) (n = 30; same humerus cross-sections sampled using the

Micromill). Resulting data will be compared to published values for different regions and potential prey items from the GOM.

For each skeletochronology image, the diameter of the resorption core, each GM, and total humerus section will be measured using Microsuite Basic image analysis software. Correction factors will be developed and applied to account for any resorption of early GM's due to bone remodeling. The relationship between humerus diameter and SCL will be modeled to allow calculation of multiple SCL-at-age estimates and annual growth rates through conversion of all measurable GM diameters in each humerus to SCL estimates. SCL-at-age will be modeled by fitting a non-parametric smoothing spline and variability will be assessed through confidence intervals generated using Bayesian posterior probabilities. Generalized Additive Models and Generalized Additive Mixed Models will be applied to assess the influence of location, trophic status, SCL, age, sex, and calendar year on somatic growth rates.

Revised Date: January 8, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Comprehensive Nearshore and Offshore Avian Surveys in the Gulf of Mexico

BOEM Information Need(s) to be Addressed: Presently, limited information is available regarding the species composition, distribution, and abundance of birds using the waters in the GOM. In the GOM, very limited information is available for making informed management decisions relative to the numerous avian species using the near- and offshore environments, even though the history and level of activities far exceeds any other Region in the U.S. The bulk of the information available is primarily from surveys conducted in the early-mid 1980's. Much has changed to the environment in the intervening 30+ years. An assessment of potential direct and indirect impacts to avian resources from offshore oil and gas activities in the GOM remains one of the biggest knowledge gaps. Data obtained from this study will fill a major information gap. This study would provide valuable information for use in NEPA analyses, exploration plans (EP's), development operations coordination documents (DOCD), oil spill risk assessment, and ESA consultations, and would greatly assist the agency in meeting obligations under the Memorandum of Understanding (MOU) with the FWS (USDOI, 2009).

Approx. Cost: (in thousands) \$6,500 **Period of Performance:** FY 2015-2018

Description:

Background: Offshore, there is rather limited information relative to potential impacts to avian resources in the GOM. Baseline information on seabirds is limited (Duncan and Havard, 1980). A clear picture of impacts can be obtained as a vital part of BOEM's mission as steward of the GOM environment. Seabirds represent reasonable indicators of ecosystem health (Furness and Camphuysen, 1997). In addition, they respond to ecosystem changes, so monitoring their populations may provide an indicator of spatio-temporal changes to the ocean ecosystem (Mallory et al., 2010). Collection of basin-wide ecological avian data for input to a coupled biogeochemical ecosystem model will likely show cause (process) and effect (pattern) for variables driving both bird and ecosystem ecological parameters. Such modeling will provide both a baseline and a start at predicting deviations from baseline in the future due to OCS oil and gas related impacts. Implementation of a biogeochemical ecosystem model would be more efficacious than previous seabird modeling in the GOM (such as that in Davis et al., 2000) because it would be Gulf-wide and more rigorous. The seabird component of the Davis et al. (2000) study was restricted to the Eastern Planning Area.

Inshore, early survey efforts in the 1980s and 1990s provided information about locations of coastal marsh and waterbird colonies and species counts or population estimates (e.g., Portnoy 1978, 1981; Clapp et al. 1982, 1983). Much of the nearshore habitats have changed dramatically since these earlier studies likely as a function of

both natural and anthropogenic driving variables (Gosselink et al., 1998) such that the working baseline has changed. Much of the effort was restricted to only the breeding season (summer). Additionally, there was little effort to correct for methodological issues, particularly detectability. Also, much improvement has been made in the areas of avian survey methodologies, analytical procedures, and population estimation procedures and modeling, especially due to advances in simulation software (Williams et al., 2002; Royle and Dorazio, 2008).

Detailed information on the potentially affected avian resources will be required for appropriate analysis of impacts and the application of any mitigation or stipulations necessary to alleviate impacts. BOEM has responsibilities for protection and conservation of avian resources under NEPA, Migratory Bird Treaty Act, and the Memorandum of Understanding between the MMS (now BOEM) and the Fish and Wildlife Service (USDOJ, 2009) signed on June 9, 2009 pursuant to Executive Order 13186, Responsibility of Federal Agencies to Protect Migratory Birds. Presently, there are no mitigations or stipulations in place to minimize, reduce, or eliminate potential effects from offshore oil and gas activities on avian resources in the GOM.

Objectives: Using Atlantic Marine Assessment Program for Protected Species (AMAPPS) (AT-10-x11) as a successful planning model, the proposed study will: (1) map broad spatial scale geographic information on ecological parameters of birds (including species distribution and abundance and their variability) in the nearshore and offshore environments; (2) map finer spatial scale geographic information on avian ecological parameters in the nearshore environment that may be particularly relevant to the FWS and Louisiana Department of Wildlife and Fisheries in addition to BOEM, and (3) use the mapped data to inform a basin-wide forecasting geographic biogeochemical ecosystem model useful for offshore oil and gas siting decisions and for prediction of avian mortality risk associated with potential oil spills (Wilhelm et al., 2007). The model should include “support groups” (Fulton et al., 2004) which would be a food web with appropriate trophic coverage and resolution. The food web modeled would be based on published bird diet information for the important species. Additional modeling could relate ecological parameters of birds to potential anthropogenic driving variables (Begg et al., 1997).

Methods: Nearshore and offshore vessel-based surveys will be employed. In addition, FWS or contract aircraft will be utilized for surveys in the nearshore environment out to 5-10 miles offshore, particularly in known areas of heavy use by staging and wintering waterfowl, shorebirds, and waterbirds. Seabird observers will be deployed on NOAA survey vessels specifically for this purpose, as well as on other NOAA fishery cruises as Platforms of Opportunity to obtain data on offshore distribution and abundance of seabirds in the GOM (see Tasker et al., 1984; Spear et al., 2004; Hyrenbach et al., 2007). The cost estimate given in this profile assumes no outside funding support such as that occurring for Platforms of Opportunity and assumes both inshore and offshore surveying. For seabird surveys conducted from NOAA vessels, surveys should extend well into deep water where industry drilling effort is emphasized. Specific details regarding methods including timing, location, and type of surveys will be determined at

a later date, but should roughly follow that of AMAPPS. This project will potentially involve the NOAA-NMFS SEFSC, FWS, USGS, and several state agencies.

Revised Date: March 15, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Development of Seasonal Marine Mammal Density Models for the Northern Gulf of Mexico

BOEM Information Need(s) to be Addressed: BOEM is required to assess potential impacts to protected species, specifically under the Marine Mammal Protection Act (MMPA), ESA, and NEPA. In particular, each of these acts requires assessment of the number of lethal and/or non-lethal interactions with protected and endangered marine mammals associated with seismic exploration activities. The general approach used in such assessments is to overlay spatial maps of noise or activity levels with estimates of the density of marine mammals in targeted times and areas. However, the level of information available for such assessments in the GOM is limited, and the current abundance estimates for most species are imprecise. This project outlines a strategy to collect visual and passive acoustic line transect survey data and develop seasonal spatially-explicit density maps of marine mammals in oceanic waters of the Northern GOM during a three-year period. These surveys would complement other proposed studies (e.g., Passive Acoustic Monitoring programs) to improve the precision and accuracy of resulting density maps. The resulting products will improve the accuracy of take estimates required under various acts.

Approx. Cost: (in thousands) \$1,450 **Period of Performance:** FY 2015-2018

Description:

Background: There are 21 species of cetaceans occupying the deep waters of the GOM where they experience a variety of anthropogenic disturbances including commercial fishing, vessel traffic, military activities, and impacts from energy exploration and development. The MMPA, ESA, and NEPA each require assessments of the level of impacts of federally authorized activities on protected marine mammals. Assessment of these impacts typically requires an estimate of the number of each species of marine mammal that occurs within a specified area where an activity is going to occur. For example, in the case of a proposed set of seismic surveys, it is necessary to estimate the number of marine mammals that may occur within the range of a specified sound-level around the survey and therefore may be incidentally harassed or “taken.” In addition to direct mitigation of impacts, understanding the habitat use, seasonal variation in spatial patterns, and overall trends in marine mammal populations improves the capability to assess the impacts of cumulative effects and conserve these species while still allowing responsible use of the environment. Currently, there are relatively limited data available with which to develop precise and accurate abundance estimates and habitat models for marine mammals in the northern GOM. The most recent large scale vessel survey for estimating abundance was conducted in the summer of 2009. The resulting abundance estimates are both negatively biased and generally imprecise with large confidence intervals. Historical data is also generally lacking with only very limited numbers of surveys occurring outside of summer months. This limitation of data prevents the

development of reliable estimates of animal density and therefore reliable estimates of the number of interactions resulting from human activities.

Objectives: This project will collect data on the abundance and spatial distribution of marine mammals in oceanic waters of the GOM during large vessel surveys in the winter (Jan-Mar) and summer (Jun-Aug) months. We propose to conduct four surveys (Winter 2014, Summer 2014, Winter 2015, and Summer 2015), each of approximately 60 days in length aboard a large oceanographic research vessel. These survey data will be incorporated into spatially explicit models of animal density to develop seasonal mapping products that provide accurate and precise abundance estimates at scales of 10 km² throughout the Gulf. These analytical products will be integrated with historical maps currently under development under NOAA's Cetacean and Sound Mapping Program (CETMAP, <http://cetsound.noaa.gov/index.html>).

Methods: In partnership with NOAA, data will be collected during large vessel line transect surveys covering oceanic waters (200m isobaths to U.S. EEZ) of the northern GOM between Florida and Texas. Visual sightings data will be collected during the surveys using a double-observer method to estimate the probability of detection on the trackline and thereby develop precise and accurate abundance estimates (Laake et al., 2004). In addition, a hydrophone array will be towed during the survey and at night to collect passive acoustic data to compliment visual survey data. Additional data including surface water characteristics, hydrographic profiles, and active acoustic backscatter will be collected continuously throughout the surveys to characterize marine mammal habitats and inform the resulting density models. The resulting survey data will be incorporated into spatially explicit density models using statistical tools such as Generalized Additive Modeling and/or Bayesian Hierarchical Models to develop species-environment relationships and produce maps of predicted seasonal density of marine mammals within the surveyed area (e.g., Redfern et al., 2006). Resulting data products will be made available to environmental planners through NOAA's CETMAP project site.

Revised Date: January 14, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Effects of the OCS Industry on Tourism in the Gulf of Mexico: Extensions of Previous Research

BOEM Information Need(s) to be Addressed: BOEM is in need of a clearer understanding of the impacts of the OCS program on tourism in the GOM. This is particularly true in light of the DWH oil spill, which had particular impacts on tourism activity. This study will address targeted issues that previous studies have highlighted are in need of further research. The findings of this study will be relevant for a variety of future NEPA documents, particularly sections relating to recreational resources and economic issues.

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

Description:

Background: The potential effects of the OCS leasing program on recreation and tourism are major public concerns and are issues of particular importance to BOEM socioeconomic impact analysis. Since these industries are service-oriented and labor intensive, they generate many employment opportunities and financial opportunities for small business owners. Tourism has the added benefit of injecting money into local economies through visitor spending on locally produced services. Since the recreation/tourism industry and the offshore petroleum industry operate in the same coastal and near-coastal environments, their uses of these areas can conflict. Routine OCS actions raise concerns regarding issues such as industrial traffic, industrial releases, noise, marine debris, and aesthetics. The DWH oil spill has heightened concerns regarding the impacts of oil spills on tourism activity and has shown that a large spill can impact recreation and tourism through mechanisms other than those related to its impacts to the physical environment.

This research project would build upon the work of the study, *An Examination of the Relationship between Tourism and OCS Oil and Gas Activities in the Gulf of Mexico* (GM-11-06). That study analyzed the impacts of the DWH oil spill on tourism in the Gulf of Mexico; that study also characterized the structure of the tourism industry in the Gulf of Mexico prior to the DWH oil spill. That study used four primary methodological approaches: 1) An analysis of Gulf Coast Claims Facility damage claims data; 2) A literature review of local newspapers and local government websites; 3) a field work effort; and 4) an analysis of county-level tourism employment and wage data (this entailed creating a definition of the tourism industry that aggregated multiple North American Industrial Classification System [NAICS] industries).

Objectives: The overall goal of this study is to pursue targeted research needs identified during the conduct of the base study (GM-11-06). For example, the base study identified the need for an analysis of the determinants of the impacts on tourism in Gulf

of Mexico counties. The base study also identified improvements that could be made to the database with which BOEM will create its measures of tourism and recreation in future years.

Methods:

This study would pursue targeted research needs identified during the conduct of *An Examination of the Relationship between Tourism and OCS Oil and Gas Activities in the Gulf of Mexico* (GM-11-06). Anticipated extensions of GM-11-06 include:

1. GM-11-06 entailed conducting a preliminary statistical analysis of the impacts of the DWH event on tourism activity. However, this study would entail a more rigorous statistical analysis of tourism in data in light of the DWH event. This would entail creating more precise statistical variables, as well as performing a wider variety of statistical tests. For example, this would entail creating more precise measures of the impacts to tourism, the extent of physical oil damage to various areas, and the scale of the influx of relief workers to various areas. This project would also entail presenting the results of the study in a formal report so as to allow for distribution of the statistical results.
2. GM-11-06 entailed creating a database that inputs data from outside sources and computes 3 measures of tourism/recreation. There are a few extensions of this database that this follow-up project would pursue. First, BOEM will soon finalize the economic units it will use in its socioeconomic impact analysis. This follow-up study would entail adjusting the database such that it would compute measures of tourism/recreation for counties in BOEM's revised economic impact areas (the current database computes the measures for the coastal counties in Economic Impact Areas but not for most of the inland counties). In addition, the database created in GM-11-06 creates annual measures of tourism/recreation. However, this follow-up study would entail creating a database that would produce higher frequency measures of tourism/recreation (i.e. monthly or quarterly).

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

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) \$250 **Period of Performance:** FY 2015-2019

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. 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.

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.

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.

Revised Date: January 16, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

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: 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 an updated map of the mudslide prone area, 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) \$1,400 **Period of Performance:** FY 2015-2020

Description:

Background: Mudslide damage to oil and gas infrastructure in the Gulf of Mexico 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 1970’s (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 predictive models.

Objectives:

- To develop updated baseline geomorphic and geologic data for the mudslide prone area to quantify seafloor change and identify the most highly dynamic zones;
- To monitor mudslide activity and drivers to quantify motion and mode(s) of failure; and
- To develop and test predictive tools that can be used to quantify and 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 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Review of New and Emerging Remote Sensing Technologies

BOEM Information Need(s) to be Addressed: BOEM suggests to operators through Notices to Lessees and requires through regulation how remote sensing surveys should be conducted in order to effectively avoid negative impacts to benthic and sub-seafloor resources as well as avoidance of hazards on the seafloor. However, the rapid influx of new survey technology requires that the agency assess the potential capabilities of new equipment such as synthetic aperture sonar and parametric sub-bottom profiler, as well as use of other technologies BOEM perhaps has not yet considered for inclusion for this study.

Approximate Cost: (in thousands) \$30 **Period of Performance:** FY 2015-2017

Description:

Background: BOEM's Office of Environment reviews survey data to help determine potential impacts from permitted activities to sensitive biological and cultural resources. Both the NEPA and the NHPA require agencies to consider the impacts of Federal actions, like permitting activities for oil and gas development, on these sensitive ecological and non-renewable cultural resources. Furthermore, other departments, like the Shallow Hazards group within the Resource Evaluation office of BOEM, shall also make use of this guide. The primary tools for determining what is present on the seafloor are side-scan sonar, magnetometer, and sub-bottom profiler. These technologies have been in use since the late 1960s. Technologies like synthetic aperture sonar and parametric sub-bottom profiler have the potential to completely change the technological landscape in terms of survey capabilities in the GOMR. BOEM must be prepared to address the use and have comprehensive and accurate information on the capabilities of these new tools before they are widely implemented to meet BOEM requirements for marine survey.

Objectives: The purpose of the study is to produce both a technical and non-technical reference guide to new survey technologies that could come into use in the GOMR. The guide will provide sample data and examples of the capabilities of each technology paired with a cost-benefit analysis of the adoption of these tools by surveyors. The report will provide BOEM an annotated bibliography and literature review. The report will include a general history of the development of each technology and its intended use. The conclusions of this report will be to suggest best practice survey guidelines for the use of this technology in the GOMR environmental regime. Based on the results and findings, a follow-up study may be produced to conduct field-testing of these technologies to determine how they might best serve to protect sensitive resources by improving their identification.

Methods: Survey experts will provide a literature review and an analysis. They will compile sets of technical information on the use and capabilities of these new technologies and interpret this information specifically for BOEM's use. They will contact and consult with the survey companies to determine potential capabilities and how they have been used historically.

Revised Date: March 5, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Simulating Planktonic Prey and Higher-Trophic Habitat Variability in the Gulf of Mexico

BOEM Information Need(s) to be Addressed: BOEM needs information on the spatio-temporal variability of planktonic distributions and related higher-trophic habitat to address the potential gulf-wide impacts of the offshore oil and gas industry on these communities in the GOM. This modeling will: (1) provide a better understanding of past spatio-temporal variability in organic matter fluxes (e.g., primary and secondary production) and higher-trophic habitat gulf-wide and in a nested region-of-interest (such as Mississippi and De Soto Canyons), and (2) will develop predictive capabilities for assessing future cumulative impacts on marine biota. This predictive need is identified in the Outer Continental Shelf Lands Act (OCSLA) for understanding impacts that may result from oil and gas activities on the OCS. Model simulations will inform NEPA analyses related to current variability in habitat and prey and predicted impacts from possible perturbations, such as oil spills.

Approx. Cost: (in thousands) \$1,000 **Period of Performance:** FY 2015-2019

Description:

Background: Over the last 50 years, circulation and ecosystem concepts and observational and modeling programs have evolved in the GOM (U.S. and Mexican waters) with a steady movement toward synergy. More than two decades ago, Walsh et al. (1989) published seminal research on nitrogen exchange at the continental margin using a two-layered baroclinic circulation model and a 21-layered biochemical model for the GOM. Advances have since been made with regional ecosystem models that couple 3D physical fields with biogeochemical processes (e.g., nutrient-phytoplankton-zooplankton-detritus, NPZD), such as in application to bottom-water hypoxia on the Texas-Louisiana shelf and harmful algal blooms on the Florida shelf. However, further research is required to develop an improved basin-wide NPZD model for the Gulf of Mexico, with relevance to the large footprint of the oil and gas industry in the Gulf and its potential impacts on key-prey and/or far-ranging biological species of interest, including plankton, cetaceans, and seabirds. Key processes which impact distributions of these species can be captured by coupled models, including areas of upwelling, convergence, eddy activity, and riverine inputs.

Model development and application will be informed by the large dataset of physical, chemical, and biological measurements previously collected in the Gulf. These include the Southeast Area Monitoring and Assessment Program (SEAMAP), GulfCet I and II Programs (e.g., Davis et al., 2000), Sperm Whale Acoustic Prey Study (GM-09-05) in Mississippi Canyon, and marine mammal stock assessments.

Objectives: The overarching goal of this 4-year study is to simulate how planktonic distributions and higher-trophic habitat vary at more detailed spatio-temporal scales than can be obtained through ship-based sampling alone. This improved understanding of prey and habitat variability will contribute to predictive capabilities related to potential cumulative impacts of the oil and gas industry on the ecosystem.

Methods: The objectives of this study will be met through development, validation, and implementation of a coupled bio-physical model on a basin-wide scale for the GOM. A well-vetted, data-assimilating ocean circulation model for the Gulf will be used to provide physical forcing fields through coupling to a biological model. The biochemical modeling component will include the lower trophic levels of bacteria, phytoplankton, and zooplankton grazers, as well as appropriate linkages with nutrients 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 then be run over a multi-year time frame to explore both seasonal and interannual variability in ecosystem processes (e.g., nutrient fluxes, patterns of productivity, and organic matter sedimentation). 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.

The second part of this study is exploratory in nature and will be used to simulate variability in habitat likely used by higher-trophic levels. Nested models will be used to provide greater detail (i.e., higher resolution) in 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. Based on existing datasets, relationships between select cetacean and pelagic seabird species and habitat variables (e.g., planktonic biomass, temperature, water depth, etc.) will be explored and developed. These relationships will then be applied to coupled-model output to provide a time series of potentially suitable habitat for each species. Spatial and temporal variability in modeled habitat will be analyzed.

This modeling will be an initial attempt at developing a Gulf-wide model, which will provide an understanding of long-term variability in the ecosystem. In the future, cumulative impacts of the oil and gas industry could be simulated by performing model experiments (such as injections of hydrocarbons) and/or by assessing deviations from the natural variability described by the model. Finally, this study will develop prioritized recommendations for future observational work which will improve accuracy of future versions of the bio-physical model and relationships with higher trophic levels. These recommendations will be based in part on the model sensitivity analyses performed as part of this study.

Revised Date: March 21, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Spatial and Temporal Historical Time-series Analysis of Benthic Infaunal Data in the Northern Gulf of Mexico OCS

BOEM Information Need(s) to be Addressed: As stewards of the marine and coastal environment and manager of energy-related activities on OCS Federal lands, the DOI's mission is to ensure that OCS resources are made available for development while protecting the environment. Environmental protection stems from the NEPA process which was designed to assist public officials in decision making based on an understanding of the environmental consequences and take actions that protect, restore, and enhance the environment. In the NEPA process, DOI provides factual, reliable, and clear analytical statements to inform decision makers and the public about the environmental effects of proposed OCS activities and the alternatives. Results of the proposed study will provide a collective dataset of benthic habitats and associated infauna, sediment properties, and chemical contaminants in all planning areas of the Gulf to further support future environmental impact assessments for activities associated with energy development.

The proposed work will also support the activities described in the MOU between DOI/BOEM and NOAA to coordinate and collaborate on OCS energy development and environmental stewardship. This work will facilitate development of a partnership between the two agencies and results of this work will provide relevant scientific information to fulfill the stewardship and conservation of living and marine resources and ecosystems responsibilities that fall under the agencies' respective authorities. For DOC/NOAA, this work will further support future NRDA injury assessment and restoration scaling efforts in the Gulf.

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

Description:

Background: Benthic macro- and meio- infauna are a sedentary community that serve as biological indicators of environmental health. Benthic infaunal communities and other sediment properties and chemical contaminants have historically been sampled in the GOM at approximately decadal intervals in separate studies. Comprehensive analysis of existing, historical benthic data could provide insight to the temporal and spatial environmental health of benthic habitats in the Gulf. With the occurrence of the largest oil spill in the history of this nation in the Gulf in May 2010, it is prudent to compile and analyze available benthic infauna, sediment, and chemical contaminant data comprehensively to assess current and potential future environmental effects on benthic infaunal communities in space and time in all planning areas of the Gulf.

Objectives: The present study proposes to compile and conduct temporal and spatial time series analysis of existing benthic macro- and meio- fauna, sediment properties, and chemical contaminant data in the Gulf of Mexico OCS:

1. To gain a better understanding of data variability over time and space,
2. To elucidate ecozones similar in community composition and structure, and
3. To provide baseline data to determine environmental impacts from anthropogenic activities.

This work will be limited in scope to areas in the Gulf where historical benthic data exists, e.g., GOOMEX (Northern Gulf of Mexico Continental Slope Habitat and Benthic Ecology Study), DGoMB (Gulf of Mexico Offshore Operation Monitoring Experiment), DWH, etc.

Methods: Benthic infauna, sediment properties, and chemical contaminant data has been collected historically by BOEM and NOAA NRDA in the GOM. These data will be compiled in a georeferenced, relational database and integrated with NOAA's Environmental Response Management Application (ERMA). The data will be used to support a variety of temporal and spatial statistical analyses using univariate and multivariate statistical techniques. Indicators of environmental health stem from attributes such as taxonomic diversity, density, relative species abundances, percentages of sensitive vs. tolerant species, and biomass. These attributes will be used in the analyses to support ecozone delineation and interpretation.

Revised Date: January 8, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Subsistence Production, Exchange, and Use in Coastal Gulf of Mexico: Description and Assessment

BOEM Information Need(s) to be Addressed: The DWH oil spill raised the issue impacts to subsistence resources used by Gulf Coast households and, highlighted, as well, the almost complete lack of information concerning Gulf Coast subsistence uses. The coexistence of the petroleum and fishing industries in the coastal and offshore Gulf is an unusual and oft-cited characteristic of both enterprises. Many communities and households have ties to both, and subsistence has significant links to the fishing industry. This study will support BOEM baseline, impact and cumulative analyses in environmental impact assessments (EIS's) and Coastal Zone Management Act (CZMA) consistency determinations by identifying factors that affect subsistence and by analyzing the consequences of past oil spills. The CZMA requires a proposed action to be consistent with state CZM plans. Executive Order 12898 on environmental justice requires BOEM to consider whether a proposed action may negatively and disproportionately impact a low income or minority population.

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

Description:

Background: The Gulf of Mexico Region is unusual. While, for over 60 years, it is the most highly developed and industrialized offshore oil province in the world, it also hosts two other types of extensive and intensive uses of its coastal and maritime environments: recreation, tourism, and amenity settlement on the one hand and commercial fishing and subsistence on the other. These very different uses have coexisted, grown and evolved over decades—sometimes in conflict but more often not—and past BOEM environmental assessments have reflected these characteristics of their coexistence. At least temporarily, the DWH oil spill shattered this normalcy and, in doing so, raised new issues about these uses of the Gulf coastal and marine environments and about the relationships among them. One outstanding issue was the geography of spill impacts; driven by media, public perception, and industry and government responses (e.g., fish closures, cleanup activities), impacts to recreation/tourism and to fisheries spread well beyond the oiled beaches.

The impact to subsistence was one unanticipated but substantial consequence of the spill's impact geography. Everyone knows that Gulf Coast households consume large quantities of shrimp, fish, oysters and other wild foods. Everyone knows that much of this is purchased but much of it is produced, distributed and consumed locally in ways other than by buying and selling. Yet, while substantial, prior to the DWH oil spill this Gulf Coast subsistence was virtually undocumented and invisible to managers, academics and analysts alike. Prior to the DWH oil spill, even the concept of subsistence lay undeveloped, a term associated with impoverishment (as in so-in-so

eked out his subsistence fishing and hunting nutria) or with traditional lifestyles (as in some Native Americans still practice subsistence). Whatever nonmarket-based uses of wild foods pertained on the Gulf, they were not fundamentally about poverty or ethnicity. As in decades past, many Gulf Coast subsistence activities—such as shrimping—often occur in a context of market production. Strong market ties are characteristic of subsistence systems in southwestern Alaska and were once common to most such systems.

Although not marketed, subsistence goods still have economic value and losses are an economic cost. Following the DWH spill, fisheries closures and concerns about seafood safety reduced the consumption and transfer of subsistence seafood but a lack of documentation undercut the ability to compensate subsistence users. The claims process seems also to have encouraged an a priori adoption of a needs- or ethnicity-based subsistence model

Following the DWH oil spill, BOEM initiated a very limited exploratory study of Gulf Coast subsistence. This effort highlighted the complexities of defining the boundaries between subsistence production and commercial and recreational forms, and between subsistence distribution and other forms of exchange. It also identified a wide range of activities associated with subsistence, including gardening.

Objectives: The objectives are:

1. To explore the wide range of subsistence activities related to production, exchange and use of wild resources, including such activities as sharing, gift exchange, barter, and small-scale informal sales from the harvest.
2. To identify key dynamics in the overlapping activities of subsistence, commercial and recreational harvesting, household consumption, gift exchange, barter, and small-scale informal sales from the harvest.
3. To describe the social, cultural and economic role of subsistence production in households, family and community in the Coastal Gulf.

Methods: What follows are observations, not directives. Given the limited availability of information and research, BOEM does not proscribe a particular focus or methodology. A mix and, possibly, a progression of research strategies, methodologies, and/or techniques are appropriate. Given the current state of knowledge, description itself is of great value and its reliability, topical coverage, and detail are of great concern. Understanding will flow from description—answers to such questions as what constitutes subsistence, how is it shaped by commercial activities (and vice versa), etc. The study design must balance the advantages of breadth of description against the analytical needs for depth. A significant field presence will likely be necessary; an extensive literature review is likely not (given subsistence literature's emphasis on ethnic- and law-based systems, e.g. Alaskan, and low income systems, e.g., Appalachian, dual economies), although useful material may be gleaned from regional histories and descriptions, travel books, etc.

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Western

Title: Texas Coastal Land Loss from 1992 to 2010

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 EIS's. 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. While much is known about land loss in Louisiana and other Gulf states, relatively little has been done to quantify these rates in the Texas coastal zone in recent years. This study would help to provide this much needed information.

Approximate Cost: (in thousands) \$360 **Period of Performance:** FY 2015-2016

Description:

Background: With a nearly 4,000 mile coastline, barrier islands, bays and estuaries, and coastal wetlands are important and valuable natural resources to the State of Texas. These resources provide habitat to an immense number of species of plants and animals. Coastal areas are at a high risk of loss due to stressors including urbanization, climate change, sea-level rise, subsidence, and impacts from hurricanes. The impacts of beach or barrier island erosion and wetland loss due to these major stressors are widespread, including loss of habitat for birds and other fauna, economic impacts associated with land loss, and the loss of storm protection. To understand how best to manage and plan for future land loss, conservation planners need a clear understanding of past and current land loss rates. As coastal restoration efforts associated with the Resources and Ecosystems Sustainability Tourism Opportunities and Revived Economy (RESTORE) Act begin to take place, it is imperative that conservation planners broaden the understanding of land loss throughout the Gulf Coast.

Objectives: The objective of this two-year study is to evaluate land loss in the Texas coastal zone since 1992. Beginning in 1992, land/water will be mapped on a three year interval (i.e., 1992, 1995, 1997, 2000, 2003, 2006, 2009, and 2010). Land/water area estimates between these dates will be analyzed to develop land loss (i.e., conversion of land (e.g., beach or barrier island erosion, wetland loss) to open water) rates for major watersheds. By selecting dates before and after Hurricane Rita (2005) and Hurricane Ike (2008) we will be able to assess impacts from both hurricanes. The land loss rates and maps depicting land loss associated with this study will be used by BOEM in their NEPA documents to describe the affected environment for beaches and wetlands, and to assess cumulative impacts in coastal Texas. It would also help inform conservation planners on areas to place restoration projects in order to sustain current coastal resources into the future.

Methods: Cloud-free Landsat Thematic Mapper imagery will be collected for the Texas coastal zone. The modified normalized water index and other indices leveraging the near-infrared spectrum will be used to classify land/water. The classifications will be checked manually and edited using expert analyses. This study will leverage classifications underway by the USGS National Wetlands Research Center from the Texas/Louisiana state line to Corpus Christi, Texas for 2009 and 2010 and National Wetland Inventory data for 1992 for the entire Texas coast and for portions of the Texas coast for 2006 (i.e., Galveston Bay area). It is intended that this study be funded through an interagency agreement.

Revised Date: January 14, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Workshop on Developing a New, Leveraged Approach to Long-Term Monitoring in the Gulf of Mexico Using Stations

BOEM Information Need(s) to be Addressed: BOEM has sponsored an extensive amount of studies on the GOM. Baseline studies in the 1970's and 1980's evolved into focused ecosystem studies in both continental shelf depths, but also extending to the full depths of the GOM. In some instances, early exploration and descriptive studies transitioned into long-term monitoring, particularly in the case of the Flower Garden Banks coral reefs where monitoring continues that was initiated in the mid-1970's becoming annual in 1988. In accordance with the Outer Continental Shelf Lands Act (OCSLA; SEC. 20. ENVIRONMENTAL STUDIES (b)*) and BOEM's mission, BOEM should periodically revisit the results of past studies and consider new research and monitoring efforts to allow for the identification of environmental changes and potential cumulative effects of offshore oil and gas activity on the GOM. Thus, BOEM needs to determine the most efficient and effective way to use both past studies and propose future studies/monitoring with this goal in mind. The sum of past and current, as well as future studies forms a strong applied science environmental monitoring framework that guides BOEM management decisions. One approach to creating an efficient on-going monitoring program is to develop a set of stations in the GOM so that future studies revisit past sampling locations. These stations should consider past water quality, archaeology, oceanography, and biology studies as (1) often past studies collected several types of data and (2) future research cruise efforts could stretch their research dollar further if several types of samples could be knowledgably collected in a similar area. All future BOEM sponsored GOM studies sampling within proximity to these designated stations could be required to include basic sampling at these stations. BOEM must also consider if any new baseline data needs to be collected. If so, stations could be created which have not been extensively sampled before. In addition to considering stations, consideration should also be given to new tools and techniques that might be applied to past data or future research. Furthermore, changes in the baseline due to the DWH oil spill and any new results from DWH-related studies are a significant consideration.

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

Description:

Background: The oil and gas industry has been operating in the GOM since the 1940's and has expanded over about two-thirds of the continental shelf and now including more than 50 structures operating in water depths over 200 m to more than 3,000 m. The cumulative effect of this energy exploration and production activity on the environment should be assessed periodically in accordance with OCSLA and BOEM's mission to ensure safe and environmentally sound offshore energy development. In the 1970's, the ESP first began with the focus on developing statistically significant baseline

information. Following recommendations from a National Academy of Sciences review, the program evolved to focus on gathering detailed scientific information that could inform management decisions, such as the identification of vulnerable ecosystem components and development of protective measures. Many years of BOEM sponsored research is available to compare with future research in order to elucidate the long-term effects of offshore oil and gas activities on the GOM. BOEM reports from the ESP can be searched at: http://www.data.boem.gov/homepg/data_center/other/espis/espismaster.asp?appid=1 However, it should be noted that the types of data included in a report may not be obvious from the title of the report. For example, water quality data, though broadly defined, is often collected as ancillary data to biological studies though such data is not often fully explored within the context of water and sediment chemistry.

Additionally, BOEM also works with NOAA, FWS, USGS, EPA and many other agencies that also publish relevant research results that should be considered along with peer-reviewed academic literature. Recent, post-DWH event research must also be considered. Before solicitation of contracts for new monitoring studies, it is necessary to determine how to build upon this monitoring framework by determining the key components of effective new research studies that fully utilize all past research.

Though multi-disciplinary efforts have existed in the past, to our knowledge, multiple disciplines have never considered a comprehensive Gulf wide planning area monitoring program.

One approach to utilizing past studies and streamlining future monitoring efforts would be to create stations in the GOM that represent locations that have been visited by past study efforts and that represent a site that could yield suitable data to multiple disciplines.

Objectives: The purpose of this proposal is to hold a two day multi-disciplinary workshop where a diverse group of scientific experts and other stakeholders guide BOEM on the direction of future research examining the long-term effects from the oil and gas industry in federal waters of the GOM. Particular attention will be paid to establishing a set of stations of interest to multiple disciplines for long-term sampling. Objectives include:

1. Evaluate the best way to utilize available data from previous studies,
2. Determine what previous studies are most valuable for baseline or incremental data with consideration given to multiple fields of study; consideration must also be given to what data within that study is to be mined (e.g., physicochemical data collected to support biological investigations),
3. Appraise what offshore sites “stations” should be (re)examined, including consideration of new exploration,
4. Consider what new techniques or instrumentation should be used to collect new data or analyze previously collected data,

5. Evaluate what new data should be collected including consideration of needs for new baseline data in areas of existing activity or from sites where oil and gas activity has not yet taken place. The workshop should also define the most basic data needed by multiple disciplines so that all future GOMR field studies travelling within proximity to these stations would be required to collect a set of basic data from that station if that station had not been sampled within a defined period of time,
6. Recommend standard techniques for sample collection and analysis so that data may be compared, and
7. Assess the needed frequency of sampling for monitoring efforts and how the need for frequent large monitoring efforts might be minimized by using the station approach (i.e., once a new monitoring effort takes place can subsequent sampling by other studies passing by a station minimize the need for another large scale monitoring effort in the near future?).

Methods: This study will conduct a workshop with participation by academic, private sector, and government scientists and stakeholders with specialties including, but not limited to: archaeology, toxicology, biology, microbiology, genetics, chemical oceanography, (bio)geochemistry, environmental mineralogy, and sedimentology among many other possible specialties. The workshop will give the participants the opportunity to:

1. Learn about BOEM's mission and possible future research needs,
2. Distinguish the latest methods and technology that might be applied to future research or that might be used to "mine," "rescue" or reanalyze past data,
3. Identify data in past studies that would be most comparable to future work as well as noting current or future studies that attendees may be participating in that would complement BOEM's interests (this includes DWH event related research),
4. Determine what sites should be designated as stations to not only be (re)visited in an initial monitoring study, but also to be included in any future study that will be collecting data using complimentary or similar methods in a nearby area and evaluate possible sampling schemes,
5. Advise BOEM on what type of samples should be taken and types of data that should be collected for various fields including a set of basic data and the skill set required to collect such data,
6. Discuss whether the best baseline data is from old studies, within a specified distance away from oil and gas operations, from deeper samples, or from areas where there are no oil and gas activities. This discussion should include the possibility that "pristine" areas may have different properties that must be accounted for in order to compare data. Further consideration should be given to how these differences should be accounted for (e.g., normalization methods), and
7. Resolve an approach to distinguish between possible environmental effects from the offshore oil and gas industry from other anthropogenic or natural effects.

The proposed budget will cover the cost for event planning and execution, facilities and needed equipment rental, and preparation of the workshop recommendations.

*OCS Lands Act. Section 20 (b) Subsequent to the leasing and developing of any area or region, the Secretary shall conduct such additional studies to establish environmental information as he deems necessary and shall monitor the human, marine, and coastal environments of such area or region in a manner designed to provide time-series and data trend information which can be used for comparison with any previously collected data for the purpose of identifying any significant changes in the quality and productivity of such environments, for establishing trends in the areas studied and monitored, and for designing experiments to identify the causes of such changes.

Revised Date: January 14, 2013

Environmental Studies Program: Studies Development Plan FY 2014–2016

Region: Gulf of Mexico

Planning Area(s): Gulfwide

Title: Workshop on Future Directions in Understanding Bio-Physical Oceanographic Interactions in Mid- to Deep Waters of the Gulf of Mexico

BOEM Information Need(s) to be Addressed: The results of this workshop will help BOEM plan future directions in bio-physical oceanographic studies in the GOM. A more thorough understanding is needed of the role that physical processes play in structuring biological communities in mid- to deep waters, in order to inform BOEM of the current state of the ecosystem and how it might be impacted by perturbations (e.g., storm events, oil spills, climatic variability, etc.). This supports BOEM's mission of sponsoring scientific research to effectively manage and protect the environment, particularly as oil and gas operations move toward deeper waters. Major information gaps identified by this workshop and the resulting research will contribute to BOEM studies planning and preparation of NEPA documents.

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

Description:

Background: Recently completed, and ongoing, BOEM studies in the GOM recommend that more integration is needed between the physical and biological oceanographic disciplines. Physical processes impact the biotic components of the oceanic ecosystem through changes in oceanographic processes (e.g., transport, turbulence, fronts, and mixing), environmental and climatic factors, nutrient availability, and physical habitat type. Over 10 years ago, in 1999, MMS (now BOEM) held a biological/physical oceanographic interaction workshop for the De Soto Canyon and the adjacent shelf (Schroeder and Wood, 2000). The workshop suggested a number of data gaps that needed investigating, including understanding of circulation patterns and linkages with primary and secondary productivity, factors impacting the distribution of nutrients and sediments, physical drivers of larval dispersal, and the impacts of extreme or occasional events such as eddy intrusions, upwelling, floods, and hurricanes on the ecosystem.

A broader perspective workshop is now needed to address processes bridging regions within the GOM, including between U.S. and Mexican waters, and to contribute to an understanding of larger-scale connectivity with other ocean basins. Given the increased importance of oil and gas activities in deeper waters, and in light of the recent DWH spill, this workshop is focused on mid- to deep waters. Topics previously addressed at the De Soto Canyon workshop are also relevant to the current workshop, including the impacts of currents and circulation patterns on productivity, larval dispersal, and sedimentation, as well as the impacts of perturbations on the ecosystem. Additionally, there is a recognized need in the ocean science community to incorporate ocean observations into ecosystem models, in order to improve understanding of processes which bridge disciplines (physical, biological, chemical, etc.). Trends in ocean ecosystem

modeling and its application to the GOM will also be considered in this workshop. The goals of this workshop are in support of BOEM's mission to sponsor scientific research to effectively manage and protect the environment.

Objectives: The objectives of this workshop are as follows:

- To review the current state-of-knowledge related to bio-physical interactions and ecological/mathematical modeling in mid- to deep waters of the GOM (>100 meters).
- To identify significant data gaps in our use of physical data/information and their implications to biology in these waters.
- To develop a plan to conduct integrated studies addressing the identified data needs.
- To identify collaborating partners for performing this research both from the U.S. and Mexico.
- To evaluate the science of ecological modeling on long-term time scales, with relevance to climatic impacts.

Methods: Support will be sought from other affected agencies (such as NOAA) to help share costs and explore common research directions. The workshop will consist of invited technical presentations, workgroup sessions, and a final plenary session. A planning group will be formed to select the Chair(s) and finalize the structure of the workshop, with participation from both U.S. and Mexican scientists. BOEM scientists will participate in and actively contribute to this workshop. Topics to be addressed include, but are not limited to, upwelling and productivity, aggregation along physical gradients, bio-physical processes in eddies and eddy pairs, mixing and bio-optics, and larval dispersal. As well, modeling and mathematical approaches to integrated studies will be explored, including evaluating the science of ecological modeling on long-term time scales, with relevance to climatic impacts. Keynote speakers will be chosen to address selected topics and to stimulate further discussion in workgroups. A final synthesis report will detail major workshop findings. This workshop will provide a roadmap for a potential set of future BOEM studies that will link physical and biological processes in the GOM.

Revised Date: January 16, 2013

SECTION 3 TOPICAL AREAS FOR FY 2016

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 2015.

3.1 Deepwater

BOEM recognizes 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, development of a Gulf-wide coupled bio-physical model is required for 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 recover. In addition, a large number of cetacean species inhabit deepwater, and we require improved understanding of how seismic exploration 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, being 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 and long-term availability as pseudo hard bottom for 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 expected to engage 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.

Operationally, we define an integrated observing (or monitoring) system as the observing and reporting of a set of variables that can be used to assess the state of the GOM ecosystem. When viewed over time, indices can be developed as measures of changing states or trends in the Gulf ecosystem or in system components. The variables to be observed and reported will include both the biotic and abiotic aspects of the ecosystem. These ecosystem parameters 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.

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 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 nearly 4,000 oil and gas platforms currently in the GOM. Over the next decade, it is expected that a large number of these structures will be removed. These structures have supplied a hard surface for organisms to flourish, creating an artificial ecosystem and affecting the distribution of species. Since the 1980's, Gulf States have requested and been granted permits to reef decommissioned oil and gas platforms through the Rigs-to-Reefs Program. Historically, the annual percent of decommissioned platforms used as artificial reef material has increased each year; an estimated 8 percent from 2000 to 2004, to over 10 percent in 2009-2010. Over the last decade, structure removals have begun to outpace new structure emplacements. Will the Gulf States continue to request the decommissioned oil and gas platforms for artificial reef material? Will the percent of decommissioned platforms used continue to 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 *EcoSpatial Information Database – U.S. Atlantic Region*, are expected to be published in 2013. 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 2013-2015 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.

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 in Texas, Louisiana, Mississippi, and Alabama or the Florida Panhandle, and these counties/parishes are aggregated into 13 Economic Impact Areas. The GOMR is reviewing a CMI study that has proposed an alternative set of aggregations to better reflect onshore industry distributions and activities. To further this effort, BOEM has also launched an additional 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. Within days of the event, BOEM established a field presence to document socioeconomic consequences as they occur and change. BOEM plans to continue this effort, at least to 2015, focusing on longer-term consequences to coastal industry and governance. The oil spill has raised the profile of questions related to multiple uses of the coastal environment. Along with updating baseline information, 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). For example, BOEM has concluded studies of crime, work scheduling, and coastal land loss, and BOEM is considering additional efforts in these areas and others. 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." After baseline focus areas are defined, a study will be needed to identify, at that local level, which SIA do or do not occur, and under what conditions.

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BOEM Environmental Studies Program

Fiscal Years 2014-2016 Studies Development Plan

Pacific OCS Region

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

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Abbreviations and Acronyms

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

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

SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

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

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

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

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

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

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

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

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

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

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

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

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

1.2 Maps of the Region

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

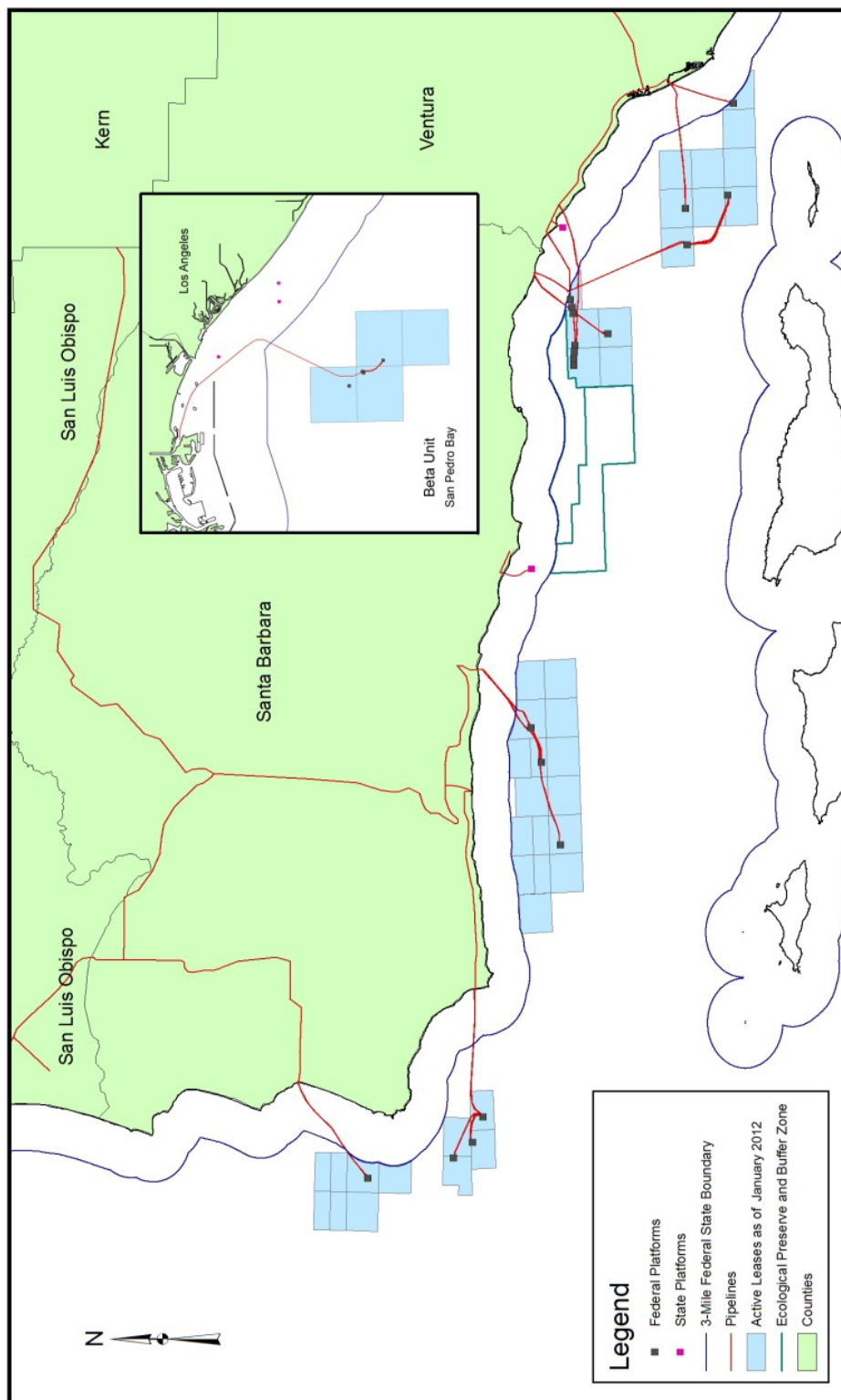


Figure 2. Wave Resource Potential for the U.S. West Coast and Hawaii (NREL, undated)

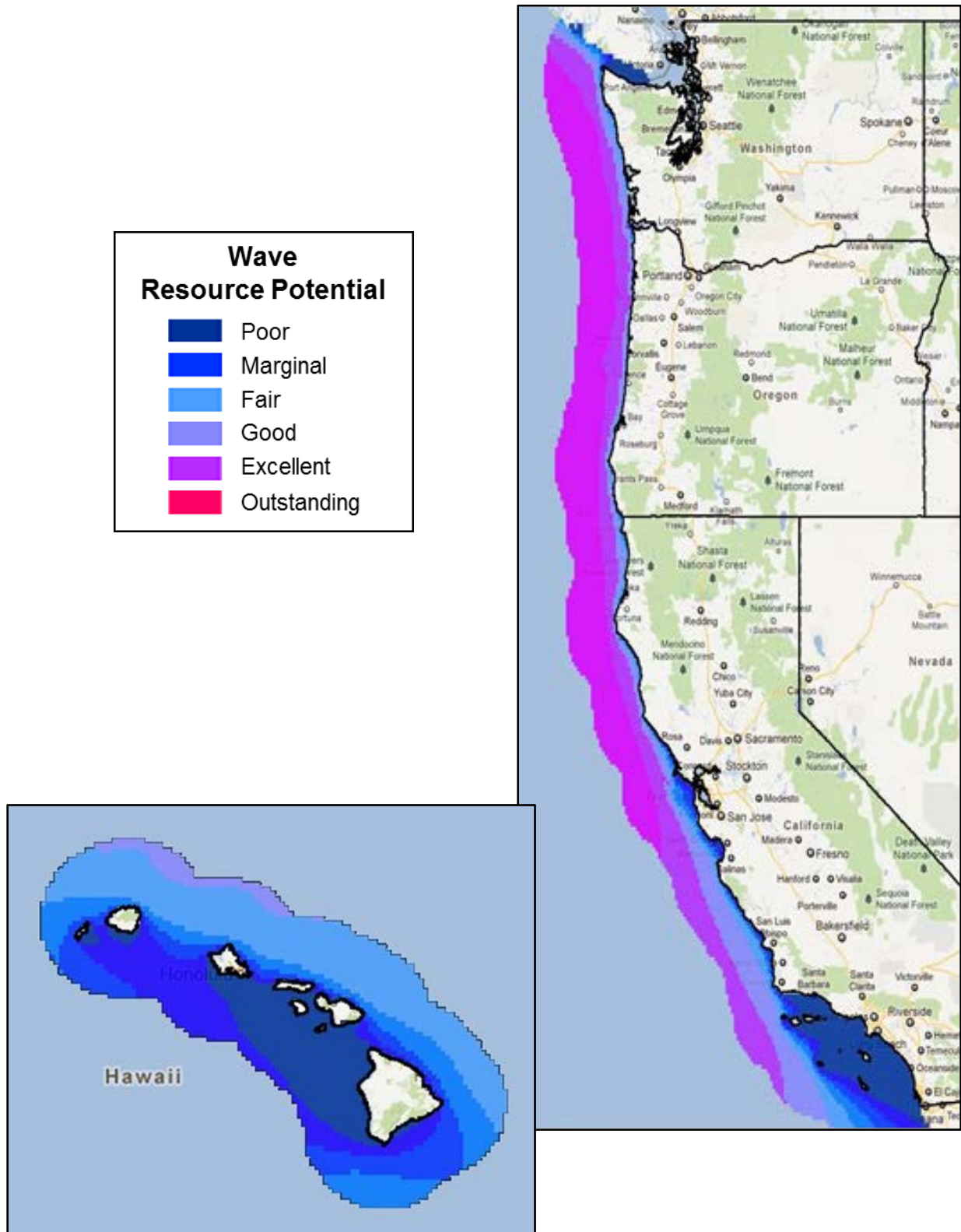
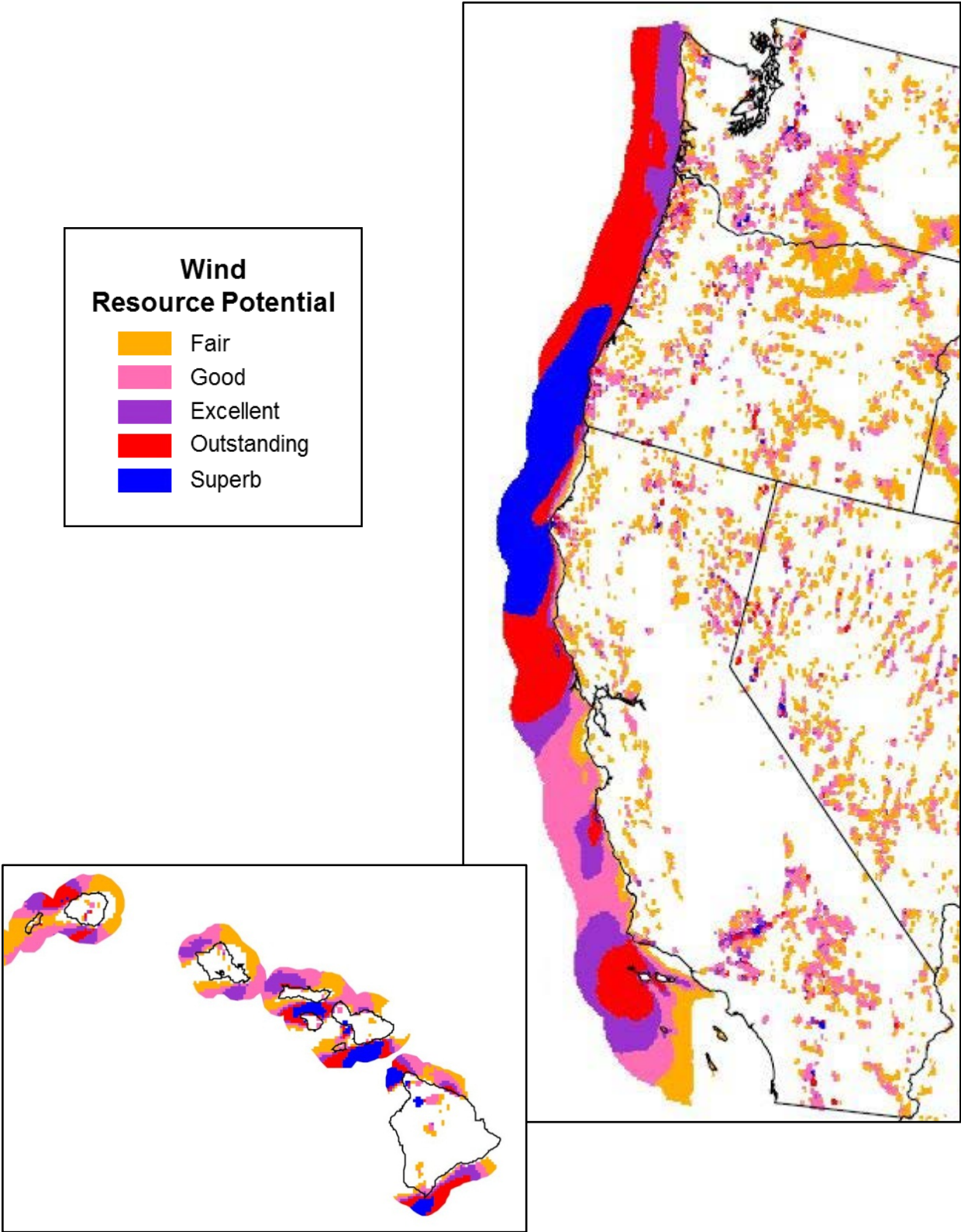


Figure 3. Wind Resource Potential for the U.S. West Coast and Hawaii (NREL, 2009)



1.3 Projected OCS Activities

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

1.3.1 Oil and Natural Gas

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

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

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

1.3.2 Renewable Energy

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

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

Oregon Task Force

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

Oregon Research Lease Interest

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

Oregon Commercial Lease Interest

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

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

Oregon Science Conference

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

Hawaii Task Force

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

Hawaii Research Lease Interest and Clean Energy Initiative

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

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

Hawaii Commercial Lease Interest

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

California Research Lease Interest

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

California Commercial Lease Interest

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

1.3.3 Marine Minerals Other than Oil and Gas

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

1.4 Identification of Information Needs

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

1.4.1 Information Needs in Support of Existing Oil and Gas Production

Physical Oceanography

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

1.4.2 Information Needs in Support of Renewable Energy Leasing

Habitat and Ecology

Oregon is at the forefront among West Coast states in planning for offshore renewable energy. *In situ* tests of commercial-scale wave energy converters (WEC) have occurred in recent years, and the installation of the first WEC testing system was installed in the summer of 2012. The first installation and testing of grid-connected devices are planned to take place in 2013. Through recent retrospective studies, meetings, and gap analyses, several critical data needs for seabirds were highlighted. These data needs include quantitative information on year-round, diurnal/nocturnal, and weather-related patterns in movements, behaviors, residence time, and migration corridors for seabirds. The only feasible way to fill these data gaps is through individual tracking studies.

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

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

Fates and Effects

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

Marine Mammals and Protected Species

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

Interdisciplinary Habitat and Ecology / Social and Economic Sciences

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

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

Fates and Effects

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

Habitat and Ecology

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

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

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

Information Management

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

Interdisciplinary Habitat & Ecology / Social & Economic Sciences

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

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

1.5 New Starts for FY 2013 and Ongoing Studies

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

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

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

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

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

SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

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

Reference information about the Pacific Region ESP can found at:

Pacific Studies homepage:

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

Current Pacific Studies:

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

Recently Completed Pacific Studies:

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

2.2 Profiles of Studies Proposed for the Fiscal Year 2014 NSL

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

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

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

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

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California

Title: Expansion of West Coast Oceanographic Modeling Capability

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

Approx. Cost: (in thousands) \$240

Period of Performance: FY 2014-2016

Description:

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

Objectives:

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

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

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

Revised Date: January 15, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): All

Title: Potential Impacts of Submarine Power Cables on Crab Harvest

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

Approx. Cost: (in thousands) \$600

Period of Performance: FY 2014-2017

Description:

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

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

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

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

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

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

Pilot project for cancer crabs:

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

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

Dungeness crab:

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

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

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

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

Approx. Cost: (in thousands) \$600

Period of Performance: FY 2014-2016

Description:

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

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

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

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

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

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

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

Revised Date: March 22, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

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

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

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

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

Description:

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

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

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

Methods: Four tasks will be performed.

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

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

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

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

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

Title: West Coast Information Transfer Meeting

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

Approx. Cost: (in thousands) \$150

Period of Performance: FY 2014-2016

Description:

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

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

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

Revised Date: January 15, 2013

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Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): All

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

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

Approx. Cost: (in thousands) \$250

Period of Performance: FY 2014-2015

Description:

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

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

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

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

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

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

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

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): All

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

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

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

Approx. Cost: (in thousands) \$700

Period of Performance: FY 2014-2019

Description:

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

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

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

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

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

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

Revised Date: April 1, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

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

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

Approx. Cost: (in thousands) \$225

Period of Performance: FY 2014-2015

Description:

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

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

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

Objectives: The purpose of this study is to provide:

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

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

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

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

Revised Date: March 18, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): Washington-Oregon

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

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

Approx. Cost: (in thousands) \$750

Period of Performance: FY 2014-2016

Description:

Background: Oregon hosts approximately 1.2 million breeding seabirds and even more summer and winter migrants with at-sea residence times of days to months. Common Murres are the most abundant breeding bird (50% of breeding population), followed by storm-petrels (37%), cormorants (5%), and gulls (2%). Common Murres, along with loons, grebes, and seaducks, are the most abundant overwintering species. At times of the year, shearwaters and albatrosses also are abundant. Several species, including the Short-tailed Albatross and Marbled Murrelet, are federally protected under the U.S. Endangered Species Act. Limited tracking data currently exist for larger bodied, non-resident species (albatrosses, Sooty and Pink-footed Shearwaters), and very little, if any,

for numerically dominant breeding, overwintering, and migratory species. Oregon seabirds can be used to identify ocean regions of important community-level food-web interactions and trophic transfer of energy. Furthermore, some have adapted ranging behaviors, morphologies, and flight characteristics that capitalize on energy associated with predominant wind patterns and wave energy. Oregon seabirds face increasing threats at sea, including interactions with fisheries, pollution, and climate change. Increasing interest in ocean-based alternative energy and certain activities associated with development of these energy resources pose additional risks for seabirds. Seabird interactions with wind-turbine structures, lighted facilities, elevated power lines on land, and lighted ships at sea have been documented in many regions, and we lack comprehensive knowledge of seabird distribution and behavior to inform siting decisions and minimize risk to seabirds at sea.

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

Methods: (1) Newly available micro-electronic tracking devices will be used to quantify at-sea movements and range behavior of breeding seabirds on the Oregon coast. Specifically, fine-scale, short-term (GPS) and coarse-scale, long-term (Argos, GLS) tracking devices will be deployed on breeding birds at or near important breeding colonies. Non-breeding/migratory species that use the CCS will be captured and outfitted at-sea or on breeding colonies prior to migration. (2) Spatially explicit habitat modeling to combine seabird utilization with oceanographic habitat will be used to generate mapped species probability distributions and community-level hotspot areas. (3) To evaluate three-dimensional risk, numerical models that relate flight behavior with fine-scale (2-6 km) winds and waves (c.f., *Hawaiian seabird ranging study*) will be generated and supplemented using direct observations during peak migrations through the CCS. All new regional telemetry data will be integrated with existing telemetry-based information on at-sea utilization and behavior of non-breeding, migratory species (e.g., Short-tailed and Black-footed Albatrosses, Sooty and Pink-footed Shearwaters).

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

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

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

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

Approx. Cost: (in thousands) \$275

Period of Performance: FY 2014-2016

Description:

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

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

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

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

Objectives: The purpose of this study is to provide:

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

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

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

Revised Date: March 18, 2013

2.3 Profiles of Studies Proposed for the Fiscal Year 2015 NSL

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

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

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

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Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): Hawaii

Title: Hawaii Information Transfer Meeting

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

Approx. Cost: (in thousands) \$200

Period of Performance: FY 2015-2016

Description:

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

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

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

Revised Date: January 15, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): All

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

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

Approx. Cost: (in thousands) \$475

Period of Performance: FY 2015-2018

Description:

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

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

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

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

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

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

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

Title: BOEM-MARINE

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

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

Description:

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

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

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

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

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

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

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

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

Revised Date: March 25, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): Southern California

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

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

Approx. Cost: (in thousands) \$225

Period of Performance: FY 2015-2017

Description:

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

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

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

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

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

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

Revised Date: March 29, 2013

Environmental Studies Program: Studies Development Plan FY 2014-2016

Region: Pacific

Planning Area(s): California, Washington-Oregon

Title: West Coast Physical Oceanographic Assessment

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

Approx. Cost: (in thousands) \$250

Period of Performance: FY 2015-2017

Description:

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

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

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

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

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

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

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

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

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

Revised Date: January 15, 2013

SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2016

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

3.1 Multipurpose Studies – All Areas

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

3.2 Oil and Gas Studies – Southern California

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

3.3 Renewable Energy Studies – Hawaii and Oregon

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

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

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

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

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

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