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Environmental Studies Program

Studies Development Plan  
FY 2013-2015





**BOEM Environmental Studies Program**

**Fiscal Years 2013-2015**

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## ABBREVIATIONS AND ACRONYMS

ADCP	Acoustic Doppler Current Profiler
ANIMIDA	Arctic Nearshore Monitoring in Development Area
ArcSEES	Arctic Science, Engineering and Education for Sustainability
AUV	autonomous underwater vehicle
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BSEE	Bureau of Safety and Environmental Enforcement
cANIMIDA	Continuation of Arctic Nearshore Monitoring in Development Area
CDOM	colored dissolved organic matter
CEQ	Council for Environmental Quality
DOI	Department of the Interior
EMF	electromagnetic fields
ESA	Endangered Species Act
ESP	Environmental Studies Program
ESPIS	Environmental Studies Program Information System
ESP-PAT	Environmental Studies Program - Performance Assessment Tool
FY	Fiscal year
GIS	Geographic Information System
GOM	Gulf of Mexico
HPPG	High Priority Performance Goal
IARPC	Interagency Research and Policy Committee
IPCC	Intergovernmental Panel on Climate Change
IWG-OE	Interagency Working Group-Ocean Education
IWG-OP	Interagency Working Group on Ocean Partnerships
LME	Large Marine Ecosystems
MARINe	Multi-Agency Rocky Intertidal Network
MMC	U.S. Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MSFCMA	Magnusson-Stevenson Fisheries Conservation Management Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act

NMEA	National Marine Educators Association
NMFS	National Marine Fisheries Service
NMNH	National Museum of Natural History
NOAA	National Oceanic and Atmospheric Administration
NOP	National Ocean Policy
NOPP	National Oceanographic Partnership Program
NOSB	National Ocean Sciences Bowl
NSF	National Science Foundation
NSL	National Studies List
OBIS-USA	Ocean Biogeographic Information System - USA
OCS	Outer Continental Shelf
OEP	Office of Environmental Programs
OMB	Office of Management and Budget
ONR	Office of Naval Research
OSCLA	Outer Continental Shelf Lands Act
OSRA	Oil Spill Risk Analysis
OSRP	Oil Spill Response Plans
OSTP	Office of Science and Technology
PAR	photosynthetically active radiation
PART	Performance Assessment and Rating Tool
PDF	Portable Document Format
SC	Scientific Committee
SDP	Studies Development Plan
SOST	Subcommittee on Ocean Science and Technology
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 Reorganization

By order of the Secretary of the Department of the Interior (DOI) date May 19, 2010 (U.S. DOI, 2010), the former Minerals Management Service (MMS) was divided into three pieces. The revenue collection arm of MMS became the independent Office of Natural Resources Revenue on October 1, 2010. The Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) spent a year as the combined agency, Bureau of Ocean Energy Management and Enforcement (BOEMRE) before becoming independent from each other on October 1, 2011.

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 supported by three Regional Offices in 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 handles the actual Oil and Gas Lease Sales, along with Sand and Gravel negotiated agreements and official maps and geographic information system (GIS) data.

BOEM is responsible for offshore Renewable Energy Programs. The Renewable Energy Program 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, and conventional and renewable energy leasing and development activities.

The Environmental Studies Program (ESP) is also within the OEP. Through the ESP, BOEM's scientists conduct and oversee environmental studies to inform policy decisions relating to the management of energy and marine mineral resources on the OCS. It is this function for which this Studies Development Plan (SDP) is a foundational document. The SDP provides the majority of the information from which the National Studies List (NSL) for the upcoming Fiscal Year (FY) is drawn. It may be used to develop and defend budget requests as well.

BOEM has close ties with and supports the environmental science needs of BSEE, our sister bureau. BSEE is responsible for developing standards and guidelines for offshore operators'

Oil Spill Response Plans (OSRP) through internal and external reviews of industry OSRPs to ensure compliance with regulatory requirements and coordination of oil spill drill activities. BSEE also plays a critical role in the review and creation of policy, guidance, direction and oversight of activities related to the agency's oil spill response. BSEE provides sustained regulatory oversight that is focused on compliance by operators with all applicable environmental regulations, as well as making sure that operators keep the promises they make at the time they obtain their leases, submit their plans and apply for their 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](#), 2012)

### 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 2011, the approximately 36 million acres on active OCS leases ([BOEM](#), 2012e) generally accounted for about 8 percent of America's domestic natural gas production and about 25 percent of America's domestic oil production ([BOEM](#), 2012a). Together, BOEM and BSEE apply oversight and regulatory frameworks to ensure that exploration, installation, operations, and decommissioning proceed in an environmentally responsible manner, and proceed safely.

The offshore areas of the United States are estimated to contain significant quantities of resources in yet-to-be-discovered fields. BOEM estimates of technically recoverable oil and gas resources in undiscovered fields on the OCS (2011, mean estimates) are 88 billion barrels of oil and 398 trillion cubic feet of gas (BOEM, 2011a)

### 1.1.3 Development and Production Planning

The OCS Lands Act requires the DOI to prepare a 5-year program that specifies the size, timing and location of areas to be assessed for Federal offshore natural gas and oil 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 with less frequent sales held in the Eastern Gulf of Mexico. 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 Gulf of Mexico, Pacific, and Alaska OCS. ([BOEM](#), 2011b)

As established oil- and gas-producing areas mature, America's energy industry is pushing into new frontiers (both in the Gulf of Mexico 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 deep water high pressure reservoirs became evident during the Deepwater Horizon event in April 2010, creating substantial new baseline and monitoring requirements.

BOEM's planning process links its activities to the Department of the Interior's Strategic Plan (U.S. DOI, 2011c) 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. The 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 Gulf of Mexico (GOM), with development and promising leasing activity in Alaska's Beaufort and Chukchi Seas, as well as some production in southern California. 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 to address critical OCS information needs.

Additionally, the passage of the Energy Policy Act of 2005 gave BOEM new 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 oceanography 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.

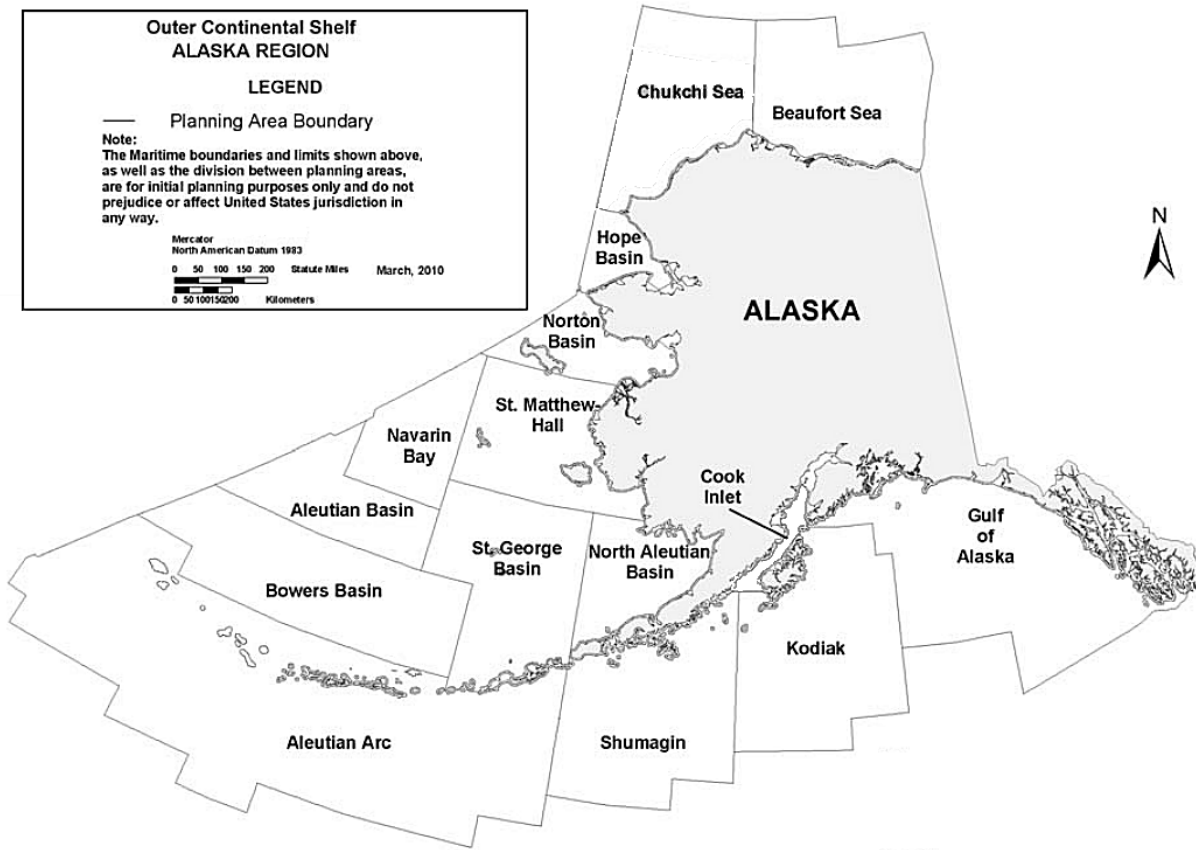
## 1.2 Map of the Planning Area

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 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, OCS-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. During the FY 2004 budget cycle, the ESP underwent a program review by the Office of Management and Budget (OMB). Through the use of the OMB's Program Assessment Rating Tool (PART), the ESP received one of the highest scores in government. We are proud of this achievement but there is always room for improvement. To this end, working with guidance provided by OMB, 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 2011 budget and performance plan, the Department of the Interior'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 Department of the Interior 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 February 2011, the Department issued a new policy (U.S. DOI, 2011a) meant to ensure and maintain the integrity of scientific and scholarly work used for decision making in the Department. The Policy replaces BOEM's earlier 2009 policy and includes the designation of a Departmental Science Integrity Officer and represents the first time scientific integrity guidelines have been adopted Department-wide by a Federal agency. 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.

#### 1.3.4 General Peer Review Planning

Section V of OMB's Final Information Quality Bulletin for Peer Review (Executive Office of the President, 2004) requires that agencies "begin 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.

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, 2012c). 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](#), 2012) to create a tool to search geospatially for reports and data from completed environmental studies. 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, 2012c). 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. 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 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.

BOEM is currently modernizing the software programs that are used to make the risk estimations. 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. With the recent addition of the responsibility to monitor air quality in Alaska, this area of research is expanding.

#### 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. 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). 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.

#### 1.3.9 Partnership

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. 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, which is currently supported by the Consortium for Ocean Leadership. The working group 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 this group 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.

#### 1.3.10 Ecosystem-based Management and Ocean Planning

We continue our efforts to integrate ecosystem-based management into the studies planning process. BOEM has a good track record in this arena. Looking back, early ESP planning in the Gulf of Mexico Region, for example, was by and large ecosystem based. The coastal habitats were studied via U.S. Fish and Wildlife Service's 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. Later studies' efforts included marine ecosystem modeling work 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 work.

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 ocean policy. It also creates the National Ocean Council, a two-tiered institutional framework to implement the National Ocean Policy.

Ocean planning is one of the nine NOP priority objectives. It is an ecosystem based spatial planning process for analyzing current and anticipated ocean uses, and identifying areas most suitable for various types or classes of activities. Plans will be prepared 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 (LMEs). This includes regions with active BOEM presence such as the Gulf of Mexico, West Coast, Alaska and the Mid-Atlantic. 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.

### 1.3.11 Marine Minerals Program

Erosion of the Nation's beaches, dunes, barrier islands, and wetlands is a serious problem that affects the quality and sustainability of coastal ecosystems and economies. As relative sea level rise and seasonal storminess increase under the forcing of climate variability, the extent and magnitude of erosion are also increasing along the U.S. coastline. Beach nourishment and ecosystem restoration continue to be preferred methods to curb loss, protect infrastructure, and stall barrier island and wetland ecosystem collapse. The availability of compatible sand from proximal upland or environmentally-suitable borrow areas in state waters continues to decline; in parallel, the demand for sand resources from the OCS is growing.

BOEM has jurisdiction over all marine mineral resources on the OCS. Public Law 103- 426, enacted October 31, 1994 (U.S. Congress, 1994), gave BOEM the authority to convey the rights to OCS sand, gravel, or shell resources for shore protection, beach or wetlands restoration projects, or for use in construction projects funded in whole or part or authorized by the Federal government. To date, BOEM has conveyed rights to about 58 million cubic yards of sand for 31 coastal restoration projects across five states resulting in the restoration of over 180 miles of coastline. ([BOEM](#), 2012d) Yet, as the demand for OCS sand has increased, sand management issues and potential environmental conflicts have also become more complex.

BOEM carries out studies in support of the Marine Minerals Program to address three main requirements:

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

Since 1993, over 40 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 oceanographic studies, which examine the potential for alteration of local wave fields from dredging sand at specific sites; and
3. impact studies, which evaluate the systemic effects of dredging on focused aspects of the physical, chemical, biological, and human environment and develop appropriate mitigation to alleviate or prevent adverse impacts.

Benthic topographical features composed of shoals, ridges and troughs are home to many federally managed fish species and may harbor submerged archaeological resources. These features also are targeted most frequently for sand extraction. Recent marine minerals studies have focused on characterizing the benthic and mobile communities inhabiting borrow areas, understanding how changing the shape of the features affects local and down stream currents and waves and sediment transport, and ascertaining the cumulative impacts of repeated dredging events.

#### 1.3.12 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. Most 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 early in 2013 proposes to examine quieting technologies and other alternatives for reducing noise generated during offshore activities.

#### 1.3.13 Education and Youth Initiatives

The ESP supports ocean education in a number of ways. The ESP is an active participant in the Interagency Working Group-Ocean Education (IWG-OE). Building a strong marine workforce is one of the issues addressed by the IWG-OE. The ESP, along with other federal

partners, funded a study through NOPP to understand and predict changes in the ocean science, technology, and operations workforce. ESP studies using cooperative agreements with universities often involve financial support to graduate students. Some of the studies result in master theses or PhD dissertations, as well as reports to BOEM. To encourage high school students studying ocean sciences, the ESP provides financial support through NOPP to the National Ocean Sciences Bowl (NOSB), a high school academic competition on the ocean sciences. Division of Environmental Sciences staff members also provide questions to the competition, serve on panels to evaluate questions they have not written, and volunteer at the regional and national competitions. One of the goals of the NOSB is to encourage students to major in the ocean sciences in college or university and pursue careers in the ocean sciences.

ESP provides financial support to the National Marine Educators Association (NMEA) and attends their annual conference. The BOEM exhibit at the annual NMEA conference focuses on the ESP. Some ESP study results are turned into posters targeted at middle to high school students. An associated teacher's packet is also prepared. These materials are distributed on the BOEM website and at various teacher conferences and meetings. The website and the ESP-based education materials are currently undergoing updates to reflect the new BOEM name and organization.

The ESP promotes the program internally through sharing study results with other parts of the organization. Newly released ESP study results are posted in ESPIS. Externally, the ESP promotes the program in a number of ways including participation on interagency working groups on a variety of topics of interest to the program and providing financial support to selected conferences, workshops, and meetings on topics relevant to the program and where ESP science can be highlighted.

#### **1.4 Identification of Information Needs**

While ESP work is conducted first to fill BOEM's own information needs, much of our efforts are of significant value to others. In particular, the invertebrate specimens collected through our research projects comprise a considerable component of the holdings at the Smithsonian's National Museum of Natural History in Washington, D.C. As the Bureau expands the geographic range of collections along the Pacific and Alaska coasts, our support for the specimen archiving program must be boosted to ensure the accurate and timely assimilation of samples.

BOEM and the ESP have a vested interest in building a strong workforce and an ocean literate public. We depend upon the recruitment and retention of qualified young scientific professionals. Our education and outreach efforts along with conference and workshop sponsorship introduce young scientists to the Bureau and the potential employment opportunities available to qualified candidates.

In the highly visible area of anthropogenic sound, BOEM and its partners will continue to engage governmental and non-governmental stakeholders in a workshop environment to assess the current state of progress and identify future actions to undertake. The forum

enables BOEM to collect information critical to developing our analyses and informing our decision-making processes. Additionally, BOEM continues to support other conferences investigating sound in the aquatic environment.

With the potential for development along Alaska's north coast, BOEM is engaging with international partners to build integrated and interdisciplinary information regarding the natural and human environment and their interactions in the Beaufort and Chukchi Seas. BOEM is interested particularly in the complex feedbacks that control the Arctic system and how that affects human activities.

Ocean circulation models in Cook Inlet have demonstrated skill in estimating currents. Simulations of the currents in Cook Inlet will be conducted. The results will be compared against field observations and used in oil spill risk analyses. Verification of model results is critical to ensuring the best information is used in analyses and decision-making.

Sand applied to beaches for renourishment needs to meet certain grain size, color and sorting criteria to be suitable for use, leaving many potential sources incompatible with the requirements. As requests to use offshore sand resources for beach nourishment increase, BOEM must consider as many sources as possible to minimize the environmental impact of dredging. Fieldwork will be undertaken to assess how grain size and sorting characteristics change during the dredging process. This may render previously incompatible sources viable for beach renourishment projects if the post-dredging characteristics fall within the acceptable range.

Part of BOEM's responsibility is to estimate longer-term and indirect impacts as well as short-term and direct impacts to resources. While the latter impacts resulting from sand dredging activities have been investigated, the former have not. BOEM will study longer-term impacts related to altered bottom morphology and sediment transport with the goal of validating exclusion zone mitigations particularly as applied to archaeological resources and benthic habitats.

In keeping with the importance of the effects of sound on aquatic life, BOEM will investigate how high frequency sounds propagate in the water column. These types of sounds typically are used in geophysical siting surveys, especially in shallow water where air guns are not as effective. A better understanding of the propagation characteristics and improved models will allow BOEM to develop better mitigation measures and improve impact analyses.

### **1.5 New Starts for FY 2013 and Ongoing Studies Table**

This section enumerates the new starts for FY 2012 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, 2012c). 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, 2012b).

**Table 1.** BOEM Headquarters Region New Starts for FY 2012 and Ongoing Studies

NSL #	Study Title	Region	Start FY	Partners
<b>New Starts</b>				
<b>Air Quality</b>				
NT-12-03	Improving Oil-Spill Risk Analysis in the Gulf of Mexico: A Multi-Model Approach	NT		
<b>Fates &amp; Effects</b>				
NT-11-07	Workshop on Alternative Technologies to Airguns for Use During Seismic Surveying of Offshore Energy Resources	NT		
NT-12-04	Outer Continental Shelf Air Quality Modeling Update	NT		
NT-12-x12	Characterization of Underwater Sound Produced by a Trailing Suction Hopper Dredge During Dredging, Pump-Out, and Placement Operations	NT		ACOE
<b>Habitat &amp; Ecology</b>				
NT-12-06	Working Group and Research Planning to Identify the Habitat Value and Function of Shoal/Ridge/Trough Complexes on the Outer Continental Shelf	NT		
<b>Information Management</b>				
NT-12-01	Enhancement of the Environmental Studies Program Information System	NT		
NT-12-02	Support for Providing Environmental Studies Program Data within the Multipurpose Marine Cadastre	NT		
NT-12-05	Support for the American Society of Limnology and Oceanography Young Professionals Development Workshop	NT		
<b>* Note: The procurement of any study is contingent upon availability of funding.</b>				



NSL #	Study Title	Region	Start FY	Partners
<b>Ongoing Studies</b>				
<b>Fates &amp; Effects</b>				
NT-10-10	Improving Emission Estimates and Understanding of Pollutant Dispersal for Impact Analysis of Beach Nourishment and Coastal Restoration Projects	NT	2010	
NT-10-x31	Best Practices for Physical Process and Impact Assessment in Support of Beach Nourishment and Coastal Restoration Activities	NT	2010	
NT-10-x32	Sub-Seabed Geologic Carbon Dioxide Sequestration Best Management Practices	NT	2010	
NT-11-01	Evaluation of the Relative Environmental Sensitivity and Marine Productivity of the Outer Continental Shelf (OCS)	NT	2011	
NT-11-x22	Responding to Oil Spills in Arctic Environments	NT	2011	NAS
<b>Habitat &amp; Ecology</b>				
NT-08-04	Effects of Pile Driving Sounds on Auditory and Non-auditory Tissues of Fish	NT	2008	
NT-09-01	Archiving of Outer Continental Shelf Invertebrates by the Smithsonian Institution	NT	2009	NMNH
NT-09-03	Surveying for Marine Birds in the Northwest Atlantic	ATL	2009	FWS, NOAA
NT-09-x10	Hearing in Sea Otters ( <i>Enhydra lutris</i> ): Measurement of Auditory Detection Thresholds for Tonal and Industry Sounds	NT	2009	
NT-11-x24	Compendium of Avian Information: Part 2	ATL	2011	USGS
<b>Information Management</b>				
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	NT	2011	

NSL #	Study Title	Region	Start FY	Partners
	Industry			
NT-10-x22	Support for Ocean Studies Board Activities	NT	2010	NAS
NT-11-02	ESP Education and Outreach Initiative	NT	2011	
NT-11-05	Support to the National Marine Educators Association Annual Conference	NT	2011	
NT-11-11	Review of Biological and Biophysical Impacts from Dredging and Use of Offshore Sand	NT	2011	
NT-11-12	Continued Support for the Development and Maintenance of a Marine Biological Data Archive	NT	2011	USGS
NT-12-x13	Support for the Interagency Sound-Field Mapping and Cetacean Density and Distribution Mapping Working Groups Symposium	NT	2012	NOAA
<b>Marine Mammals &amp; Protected Species</b>				
NT-10-03	Support for NOPP Project on Improving Cetacean Electronic Data Loggers	NT	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	NT	2011	
NT-10-x33	Underwater Hearing Sensitivity in the Leatherback Sea Turtle ( <i>Dermochelys coriacea</i> ): Assessing the Potential Effect of Anthropogenic Noise	NT	2010	
NT-11-08	Development of Software and Hardware to Acoustically Detect, Classify, and Locate Marine Mammals	NT	2011	ONR
<b>Physical Oceanography</b>				
NT-08-02	Adaptation of Arctic Circulation Model	AK	2010	
NT-09-x15	Improving Wind Wave Predictions: Global to Regional Scales	NT	2009	Navy

<b>NSL #</b>	<b>Study Title</b>	<b>Region</b>	<b>Start FY</b>	<b>Partners</b>
NT-09-x19	University-National Oceanographic Laboratory System (UNOLS) Support	NT	2009	NSF
NT-11-04	Update to the BOEMRE Oil Spill Risk Analysis (OSRA) Model: Applying Lagrangian Stochastic Model to Track Oil Spills	NT	2011	
NT-11-06	Shelf-Slope Sediment Exchange in the Northern Gulf of Mexico: Application of Numerical Models for Extreme Events	NT	2011	
<b>Social &amp; Economic Sciences</b>				
NT-08-x12	AE: OCS Renewable Energy and Space-Use Conflicts and Related Mitigation	ATL & PC	2009	
NT-11-09	Synthesis, Legislative Review, and Case Law History Applicable to Cultural Heritage in the Marine Environment	NT	2011	NOAA
NT-11-13	Commercial Fishing Hang Data as a Proxy for Locating Shipwreck Sites off the Mid-Atlantic Coast	ATL	2011	
<b>Planning Area Codes</b>				
AK = Alaska                      ATL = Atlantic                      GOM = Gulf of Mexico				
NAT = Nationwide                      PAC = Pacific				
<b>Partner Codes</b>				
ACOE = U.S. Army Corps of Engineers                      FWS = U.S. Fish and Wildlife Service				
NAS = National Academy of Sciences                      Navy = U.S. Department of the Navy				
NMNH = Smithsonian Institution's National Museum of Natural History				
NOAA = National Oceanic and Atmospheric Administration				
NSF = National Science Foundation                      ONR = Office of Naval Research				
USGS = U.S. Geological Survey				



## SECTION 2.0 PROPOSED STUDY PROFILES

### 2.1 Introduction

Headquarters proposes twelve new studies for FY 2013.

### 2.2 FY 2013 Table

**Table 2.** BOEM Headquarters Studies Proposed for the FY 2013 NSL.

Page #	Discipline	Title	Rank #
23	IM	Expanded Nation-Wide Scope for Archiving of Outer Continental Shelf Invertebrates by the Smithsonian National Museum of Natural History	1
25	IM	Support for the National Ocean Sciences Bowl (NOPP)	2
27	IM	Second Meeting of Marine Mammals and Sound Stakeholder Working Group	3
31	FE/PO/SE	An Integrated Scientific Approach to Arctic Sustainability	4
33	PO	Cook Inlet Circulation Model Calculations	5
35	HE/PO	Modeling of the Ecosystem Dynamics in the Alaskan Arctic Ocean	6
39	HE/PO	Ecosystem Dynamics and Monitoring of the Alaskan Arctic Ocean	7
43	SE	A Cultural Resource Survey of the Beaufort and Chukchi Seas	8
45	FE	Sediment Character Modification During Dredging, Pump-out, and Placement Operations	9
47	FE	Effectiveness of Exclusion Zones Designed to Protect Archeological and Benthic Resources from Indirect Dredging Impacts	10
49	PO	Propagation Characteristics of High Frequency Sounds Used for High Resolution Geophysical Surveys	11
51	IM	Support for the Third International Conference on the Effects of Noise on Aquatic Life	12
AQ = Air Quality      FE = Fates & Effects      HE = Habitat & Ecology IM = Information Management      MM = Marine Mammals and Protected Species PO = Physical Oceanography      SE = Social and Economic Sciences			



## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015

**Region:** National

**Planning Area(s):** All

**Title:** Expanded Nation-Wide Scope for Archiving of Outer Continental Shelf Invertebrates by the Smithsonian 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. Additional support is necessary to shorten required time for archiving of existing backlog as well as increasing input of specimens from BOEM studies nationwide.

**Cost Range:** (in thousands) \$144-\$216

**Period of Performance:** FY 2013-2014

### **Description:**

**Background:** BOEM conducts many biological projects in support of decision-making related to the development of offshore energy (including renewable) and mineral resources. These projects frequently result in large collections of invertebrate specimens. Taxonomy is a critical component to the ecological interpretation of biological data. Early in the history of BOEM's ESP, it was recognized that extensive biological samples collected during BOEM environmental studies were invaluable both to the relevant studies, but also to science in general. 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. 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. These collections represent one of the most extensive collections of marine organisms from U.S. continental shelves and slopes, in terms of geographic coverage and number of groups represented. 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.

The existing backlog of BOEM collections is substantial, but as BOEM studies continue to expand in national extent, including the Pacific Northwest and Arctic, additional support is warranted for funding of the archiving program at the NMNH to prevent expanding backlogs and delays in the establishment of baseline species descriptions. New program areas will include archival of vouchers from the *Multi-Agency Rocky Intertidal Network* (MARINE) and the ongoing Pacific study, *Survey of Benthic Communities near Potential Renewable Energy*

*Sites Offshore the Pacific Northwest* and collections from the Boulder Patch in the Beaufort Sea, Alaska. This supplemental funding will be concurrent through the existing archiving contract through May 31, 2014.

Objectives: The objectives of the study are to:

- Provide quality assurance for biological data generated through BOEM's ESP and the credibility of offshore energy and mineral resources decision-making.
- Preserve Federally-funded biological samples 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 identification. The collections are then maintained according to the strict guidelines of the NMNH and are made available to other researchers. Legacy samples from the Gulf of Mexico dating back to the mid to late 1800s will be considered for incorporation. Semi-annual reports 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. To date, over 400 species new to science have been identified in BOEM collections.

**Revised Date:** January 30, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Headquarters

**Planning Area(s):** All

**Title:** Support for the National Ocean Sciences Bowl (NOPP)

**BOEM Information Need(s) to be Addressed:** BOEM needs a strong workforce and an ocean literate public to meet our mission of stewardship of the nation’s offshore energy and marine minerals resources. BOEM also needs to be able to recruit and retain well qualified marine scientists and engineers to fill our expanding and changing workforce needs in the coming years.

**Cost Range:** (in thousands) \$10-\$14

**Period of Performance:** FY 2013-2017

### **Description:**

Background: The National Ocean Sciences Bowl (NOSB), established in 1998 in honor of the Year of the Ocean, is a national, academic competition for high schools on topics related to the ocean. The competition includes 25 regional competition locations with 300 schools and over 2,000 students. The NOSB mission is to enrich science teaching and learning across the United States through a high-profile competition that increases high school students’ knowledge of the ocean and enhances public understanding and stewardship of the ocean.

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. In addition, BOEM is staffing the new Renewable Energy program and is expanding staff in other divisions and in the Regions. 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. We must find ways to encourage students in their academic training and provide young professionals with opportunities to succeed in careers and select BOEM as their employer of choice.

The NOSB provides BOEM 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. NOSB also reaches out to students and communities to increase participation by minorities, women, and disadvantages students.

BOEM, through the National Oceanographic Partnership Program (NOPP), has supported the NOSB since FY 2001.

Objectives: The objective is to ensure BOEM has well-qualified marine scientists and engineers to meet its expanding and changing workforce needs.

Methods: BOEM will contribute to the NOPP effort to support the NOSB.

**Revised Date:** January 26, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Headquarters

**Planning Area(s):** All

**Title:** Second Meeting of Marine Mammals and Sound Stakeholder Working Group

**BOEM Information Need(s) to be Addressed:** The effects of anthropogenic noise remains an issue riddled with a significant amount of scientific uncertainty and a high degree of public controversy. At the same time, in this volatile and litigious environment, environmental statutes (i.e., Endangered Species Act, Marine Mammal Protection Act, Outer Continental Shelf Lands Act) all mandate that BOEM move forward in making decisions on authorizing sound-producing activities in a timely but environmentally sound manner. With these regulatory pressures, existing scientific uncertainty and known public controversy, it becomes imperative to more actively engage key stakeholders in discussions on available scientific information and policy choices to not only help reduce the degree of public controversy but, more importantly, allow for more informed and robust Federal decision making. This workshop will provide such a stakeholder forum and help BOEM develop more thorough and sound analyses for use in compliance efforts related to its regulatory mandates. This workshop would also be co-sponsored by the U.S. Navy, National Marine Fisheries Service (NMFS), and U.S. Marine Mammal Commission (MMC).

**Cost Range:** (in thousands) \$40-\$60

**Period of Performance:** FY 2013

### **Description:**

Background: In July 2010, the U.S. government (BOEM, Navy and NMFS) sponsored an interactive Marine Mammals and Sound Workshop with governmental and non-governmental stakeholders to solicit input on key issues related to:

1. Marine mammals and anthropogenic noise effects analysis and
2. Monitoring and mitigation measures development.

The meeting was directed and sponsored by the U.S. Committee on Ocean Policy Joint Subcommittee on Ocean Science and Technology (now SOST). Participants represented the marine mammal research community, including federal government, academic institutions, independent science corporations and organizations, non-governmental organizations, and industry, who had an existing understanding of anthropogenic sound and marine mammals and were active in research, policy development and other fields to address this issue. The agenda allowed for interactive discussions (rather than an emphasis on presentations) with most of the time spent in small discussion groups followed by plenary sessions. Discussions were conducted in four topical areas, including:

1. Biologically significant effects of sound exposure (baseline data and assessment);
2. Understanding and reducing sound generation and propagation;
3. Acoustic behavioral harassment criteria and methodologies for cumulative effects analysis and mitigation; and

4. Improving monitoring technology and methodologies.

Priority action areas identified by workshop participants included:

1. Development of standardized marine mammal database and portal open to all marine mammal researchers;
2. Fill existing gaps in baseline biological information on marine mammals in order to more robustly ascertain biologically significant and cumulative effects; and
3. Create a standing group of stakeholders to periodically meet, review most recent information and provide policy recommendations.

Objectives: This study will conduct a second workshop under the support of the SOST of the Marine Mammals and Sound Stakeholder Working Group to address the following questions:

1. What further actions (based on progress to date) are needed to implement priority actions identified during the 2010 meeting of this group (see actions #1-3 in the background section) and within the 2009 Interagency Research Roadmap on Anthropogenic Sound and Marine Mammals (also a SOST product)?
2. What additional action items need to be addressed based on an assessment of new information since the 2010 meeting?
3. What are the stakeholder recommendations for how any new information gathered since the 2010 meeting (new scientific data as well as outcomes from addressing priority action items since 2010) affect Federal policy making on anthropogenic noise impacts to marine mammals?

Importantly, this study will provide a continued forum to engage key stakeholders in a more deliberative, adaptive and participatory process that ultimately allows BOEM (and its cooperating Federal partners—U.S. Navy, NMFS, MMC) to access more comprehensive information on stakeholder policy preferences for use in its decision making processes.

Methods: Stakeholders include the participants from the 2010 workshop who collectively represent the marine mammal research community (i.e., federal government, academic institutions, independent science corporations and organizations, non-governmental organizations, and industry) and who also have an existing understanding of anthropogenic sound and marine mammals and are active in research, policy development and other fields to address this issue. In meeting the study objectives, the following methods will be used:

1. Formation of Advisory Committee (selected from 2010 stakeholders) and BOEM, Navy and NMFS staff to formulate the agenda.
2. Plan all workshop logistics.
3. Conduct a workshop, including registration, facilitation and on-site representation.
4. Conduct post workshop activities, such as a final meeting technical report.

The proposed budget will cover the costs to acquire a venue and conduct the workshop; form a scientific advisory committee for workshop and agenda development; organize equipment rental; and prepare the workshop proceedings.

**Revised Date:** April 3, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** National

**Planning Area(s):** Beaufort and Chukchi Seas

**Title:** An Integrated Scientific Approach to Arctic Sustainability

**BOEM Information Need(s) to be Addressed:** BOEM needs integrated and multi-disciplinary environmental information, including the socio-economic sciences, to be able to soundly feed its regulatory and permitting processes. The sustainability of all, the physical environment, living resources and local communities, is directly linked to BOEM's assessments.

**Cost Range:** (in thousands) \$400-\$600      **Period of Performance:** FY 2013-2018  
Plus joint funding from the NSF

Background: This study is an international partnership among BOEM, the National Science Foundation (NSF), the US Geological Survey, the Fish & Wildlife Service, the Environmental Protection Agency, and a consortium of French agencies through NSF's ArcSEES program (Arctic Science, Engineering and Education for Sustainability). The NSF released its program solicitation in April 2012. Proposals will be reviewed by all partners, BOEM included. In turn, the ArcSEES is a multi-year, interdisciplinary program which seeks both fundamental research that improves our ability to evaluate the sustainability of the Arctic human-environmental system as well as integrated efforts which will provide community-relevant sustainability pathways and engineering solutions. For the competition, interdisciplinary research will be focused in four thematic areas:

1. The natural and living environment,
2. The built environment,
3. Natural resource development, and
4. Governance.

In particular, BOEM is interested in better understanding the complex feedbacks that control the overall evolution of the Arctic system for timescales ranging from a few days to several years.

Objectives: BOEM's scientific objectives in the Arctic are to advance our current knowledge on:

- Human interactions, responses and adaptations to a changing Arctic environment,
- Ecosystem's vulnerabilities and resilience so the environmental impact of the oil and gas industry can be minimized through pertinent regulations and leasing decisions,

- The local circulation as this has applications for oil spill risk analysis and oil spill contingency planning.

These objectives should be approached in the overall context of Arctic sustainability.

Methods: Interdisciplinary approaches that combine the use of both, observational and model-generated data, will be given higher priority by BOEM.

**Revised Date:** March 29, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Headquarters (Alaska)

**Planning Area(s):** Cook Inlet (Alaska)

**Title:** Cook Inlet Circulation Model Calculations

**BOEM Information Need(s) to be Addressed:** The results of the 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 currents. These simulated currents will be compared to other field projects that have been conducted in the Cook Inlet, as well as the use in the OSRA calculations.

**Cost Range:** (in thousands) \$400-\$600

**Period of Performance:** FY 2013-2014

### **Description:**

Background: The circulation of the Cook Inlet has been studied through previous model simulations, with funding by the National Oceanic and Atmospheric Administration (NOAA), BOEM, U.S. Army Corps of Engineers (USACE), and others. 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 models were subjected to many sensitivity calculations and skill was assessed by teams of oceanographers. The conclusion of these studies was that the models have significant skill in simulating the ocean surface currents. Many field programs have also been conducted in this area.

Objectives: The objective is to obtain simulations of the circulation of the Cook Inlet for use in the Oil Spill Risk Analysis. The simulations must have significant skill in reproducing the near-surface currents, compared to drifting buoy data, fixed current meters, acoustic Doppler current profilers (ADCP's), and other data sets. The results of the model will provide environmental variability input into the Oil Spill Risk Analysis calculations.

Methods: The method is to use an existing, high-resolution, numerical ocean model to hindcast the current fields in the Cook Inlet, using data assimilation method, whenever practical. The numerical ocean model will include a scheme that calculates the wetting and drying of ocean cells. The sensitivity of the circulation to sea ice mechanics will be determined. The hindcast period will be determined by data availability, but not 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 12, 2012



## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015

**Region:** National

**Planning Area(s):** Beaufort and Chukchi Seas

**Title:** Modeling of the Ecosystem Dynamics in the Alaskan Arctic Ocean

**BOEM Information Need(s) to be Addressed:** BOEM needs comprehensive and multi-disciplinary information on the spatial and temporal distribution of fundamental physical, biological and chemical variables as well as on their associated interactions and regulating processes. This information will be used to describe the local ecosystem's sensitivities and vulnerabilities as a function of space and time which will aid decision-makers in minimizing the impact of some anthropogenic activities in the OCS. Formally, the resulting information will be used in NEPA analyses, environmental impact assessments, and potentially in oil spill risk analysis. Additionally, these observations and potential identification of biophysical interactions will aid in improving the accuracy of future numerical ocean simulations. The information will address BOEM information needs and also make important contributions to better understand Earth Systems interactions, climate change and regional ecosystems (which is not only important to BOEM but also to the NOAA for example). This study's findings will also lead to improved design and planning of future Alaskan Arctic observational programs and to a better understanding of biogeochemical processes in Arctic climate variability which in turn could be impacted by BOEM regulated OCS activities.

**Cost Range:** (in thousands) \$400-\$600  
Plus joint funding

**Period of Performance:** FY 2013-2018

### **Description:**

**Background:** This study was presented to the Scientific Committee (SC) in May 2011 as "*Impact of Oceanic Biophysical Feedbacks on the State of the Alaskan Arctic OCS*". It received good reviews from both the Physical Oceanography and the Interdisciplinary subcommittees. The SC's only critique was that this potential study was lacking an observational component which is addressed in a companion profile.

*Ecosystems perspective:* High resolution modeling of physical, chemical and biological variables, will aid in providing a "before" description while also providing important information not only to determine its overall biomass and overall productivity but also to better understand the ecosystem dynamics, its sensitivities and resiliencies, and ultimately, its vulnerabilities to changes in environmental conditions. Climate change issues aside, these aspects are also important to improve the predictive skill in the month-to-month timescale. The Arctic Ocean is a highly non-linear system which thus requires an integrated, comprehensive inter-disciplinary approach. Ocean, atmosphere, biogeochemistry and ice evolve together in time, constantly interacting and thus making the concepts of impact and response of dubious validity.

*Oil Spill Risk Analysis Perspective:* This study will not only provide key information on the 4-D structure of ocean currents for managing a potential oil spill in the Beaufort and Chukchi Seas, but it will also provide vital information for anticipating the dispersion and environmental impact of an oil spill taking place upstream in the Chukchi Sea.

*Climate Change Perspective:* Examples that illustrate the potential relevance of biogeochemical-physical interactions and feedbacks are the observed interplay among ice coverage, downwelling radiation, air and sea temperatures, and chlorophyll in Arctic waters (Arrigo et al., 2008). For example, Lengaigne et al., (2009) has also shown that this could have an impact on ocean currents as biological heating will alter the local stratification in areas and times of high chlorophyll concentration. This is relevant given the observed increase in Arctic chlorophyll concentration over the last decade. These types of complex feedbacks offer one possible explanation as to why Arctic sea ice volume is decreasing faster than predicted. This is starting to become recognized by scientists worldwide. The Intergovernmental Panel on Climate Change (IPCC) has neglected biogeochemical-physical feedbacks from previous forecasts and estimations. However, in the light of several research findings published over the last decade, the IPCC has recently decided to couple ecosystem models to their previous coupled models in their next round of runs. Recent groundbreaking studies have shown the importance of bio-physical feedbacks in different oceanic environments (Manizza et al., 2008; Zhang et al., 2009; Popova et al., 2010). This has drawn the attention of scientists and funding agencies since these processes can significantly affect biology and physics (e.g., the rate of change in Arctic sea-ice volume, the variability of highly productive fisheries, and the amplitude of El Niño events among other impacts). The geographical range of these recent studies encompasses nearly all domains, from the tropics (Jochum et al., 2010) to the Arctic Ocean (Lengaigne et al., 2009).

Acquiring this information addresses (a) the USGS report recommendations: 3.01, 3.02, 3.03, 3.07 and 4.01, (b) the recommendations of the OCS Studies MMS 2010-018 (Beaufort Sea Physical Oceanography) (Weingartner, et al., 2010) and MMS 2010-032 (ANIMIDA and cANIMIDA) (Neff, 2010), (c) the directions sought by the U.S. National Ocean Policy, (d) the recommendations of the White House's Council for Environmental Quality (CEQ) of 2010, and (e) one of the seven themes identified by the Interagency Research and Policy Committee (IARPC) as a priority for U.S. Arctic research. Monitoring the marine and coastal environment adjacent to OCS operations is also a mandate for the Environmental Studies Program by the OCS Lands Act.

Objectives: The objectives of this study are to:

- Identify areas of high biological productivity,
- Identify sensitivities and resiliencies to changes in environmental conditions both, geographically and in the ecosystem components.
- Provide a qualitative and quantitative description of the biogeochemical-physical interactions and feedbacks. Specifically:

- Using historical and new observations, determine sensitivities and resiliencies to environmental change.
- Provide an estimate of the climatological errors that can be expected (for different variables) from simulations like this one.
- Provide a quantitative and qualitative description of the impacts of the inter-system feedbacks on the overall oceanic state of the Alaskan Arctic OCS, e.g., by prescribing the atmospheric forcing, a constant chlorophyll concentration.
- Determine the sensitivity of the different food chain links to environmental (natural and anthropogenic) change.
- Quantify the different physical and biogeochemical contributions to the total depth-dependent heat budget.
- Provide BOEM with a) climatologies (2006 -2012) and b) trends (1990-2012) of physical, chemical, and biological variables in the Chukchi and Beaufort seas. Compare to observations in the overlapping time window.

Methods: Using a state-of-the-art high resolution coupled model (ocean, atmosphere, sea ice, biogeochemistry), produce a hindcast simulation covering the 1990 to 2012 timeframe. A suite of coupled models, ocean-atmosphere-sea ice-ecosystem (and possibly land), shall be used to reach the objectives stated above. The extensive sensitivity/calibration study stage will be followed by hindcast experiments. All available observational data (biological and physical) shall be used to calibrate, validate and evaluate the coupled model results during the sensitivity and hindcast stages and to obtain initial conditions for the ensemble forecast runs. The observational approach of Strutton & Chavez (2004) at least should be considered for inferring the impact of biophysical feedbacks. We have held conversations with the Office of Naval Research (ONR) and NOAA and are working on a potential NOPP study.

**Revised Date:** April 2, 2012



## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015

**Region:** National

**Planning Area(s):** Beaufort Sea

**Title:** Ecosystem Dynamics and Monitoring of the Alaskan Arctic Ocean

**BOEM Information Need(s) to be Addressed:** BOEM needs comprehensive and multi-disciplinary information on the spatio-temporal distribution of fundamental physical, biological and chemical variables as well as on their associated interactions and regulating processes. This information will be used to describe the local ecosystem's sensitivities and vulnerabilities as a function of space and time which will aid decision-makers in minimizing the impact of the oil and gas industry on the OCS. Formally, the resulting information will be used in NEPA analyses, environmental impact assessments (i.e., before vs. after scenarios), in validating models, as well as in oil spill risk analysis. Additionally, these observations and potential identification of biophysical interactions will aid in improving the accuracy of future numerical ocean simulations.

This continuous monitoring will provide BOEM with a multi-disciplinary baseline-proxy in the inner and outer shelves and on the slope areas. The information will address BOEM information needs and also make important contributions to better understand Earth Systems interactions, climate change and regional ecosystems (which is not only important to BOEM but also to NOAA and USGS, for example). This study's findings will also lead to improved design and planning of future Alaskan Arctic observational programs and to a better understanding of biogeochemical processes in Arctic climate variability which in turn could be impacted by BOEM-regulated OCS activities.

**Cost Range:** (in thousands) \$4,000-\$6,000      **Period of Performance:** FY 2013-2018  
Plus Joint Funding

### **Description:**

**Background:** This study was presented before the Scientific Committee (SC) in May 2011 as "*Impact of Oceanic Biophysical Feedbacks on the State of the Alaskan Arctic OCS*". It received good reviews from both the Physical Oceanography and the Interdisciplinary subcommittees. The SC's only critique was that this potential study was lacking an observational component which is addressed in this revised profile. The hope is that observational programs like this one could be expanded to other regions of the OCS.

*Ecosystems perspective:* Production of oil in the Gulf of Mexico started in the 1940's, way before the implementation of many regulatory mandates and/or intensive and mission-oriented environmental studies. It was not then possible to construct a *before vs. after* picture to assess the environmental impact of the oil & gas industry in the Gulf. However, there is that opportunity off the northern coast of Alaska. High resolution monitoring of physical,

chemical and biological variables, will aid in providing a “before” description while also providing important information not only to determine its overall biomass and overall productivity but also to better understand the ecosystem dynamics, its sensitivities and resiliencies, and ultimately, its vulnerabilities to changes in environmental conditions. Climate change issues aside, these aspects are also important to improve the predictive skill in the month-to-month timescale. The Arctic Ocean is a highly non-linear system which thus requires an integrated, comprehensive inter-disciplinary approach. Ocean, atmosphere, biogeochemistry and ice evolve together in time, constantly interacting and thus making the concepts of impact and response of dubious validity.

*Oil Spill Risk Analysis Perspective:* The Beaufort Sea was selected for this study, which could later be expanded to the Chukchi Sea, because of its smaller shelf, and weaker currents than the Chukchi Sea. This study will not only provide key information on the 4-D structure of ocean currents for managing a potential oil spill in the Beaufort Sea, but it will also provide vital information for anticipating the dispersion and environmental impact of an oil spill taking place upstream in the adjacent Chukchi Sea.

*Climate Change Perspective:* Examples that illustrate the potential relevance of biogeochemical-physical interactions and feedbacks are the observed interplay among ice coverage, downwelling radiation, air and sea temperatures, and chlorophyll in Arctic waters (Arrigo et al., 2008). For example, Lengaigne et al., (2009) has also shown that this could have an impact on ocean currents as biological heating will alter the local stratification in areas and times of high chlorophyll concentration. This is relevant given the observed increase in Arctic chlorophyll concentration over the last decade. These types of complex feedbacks offer one possible explanation as to why Arctic sea ice volume is decreasing faster than predicted. This is starting to become recognized by scientists worldwide. The IPCC has neglected biogeochemical-physical feedbacks from previous forecasts and estimations. However, in the light of several research findings published over the last decade, the IPCC has recently decided to couple ecosystem models to their previous coupled models in their next round of runs. Recent groundbreaking studies have shown the importance of bio-physical feedbacks in different oceanic environments (Manizza et al., 2008; Zhang et al., 2009; Popova et al., 2010). This has drawn the attention of scientists and funding agencies since these processes can significantly affect biology and physics, e.g., the rate of change in Arctic sea-ice volume, the variability of highly productive fisheries, and the amplitude of El Niño events among other impacts. The geographical range of these recent studies encompasses nearly all domains, from the tropics (Jochum et al., 2010) to the Arctic Ocean (Lengaigne et al., 2009).

Acquiring this information addresses (a) the USGS report recommendations: 3.01, 3.02, 3.03, 3.07 & 4.01, (b) the recommendations of the OCS Studies MMS 2010-018 (Beaufort Sea Physical Oceanography) (Weingartner, et al., 2010) and MMS 2010-032 (ANIMIDA and cANIMIDA) (Neff, 2010), (c) the directions sought by the US National Ocean Policy, (d) the recommendations of the White House’s Council for Environmental Quality (CEQ) of 2010, and (e) one of the seven themes identified by the Interagency Research and Policy Committee (IARPC) as a priority for US Arctic research. Monitoring the marine and coastal environment



adjacent to OCS operations is also a mandate for the Environmental Studies Program by the OCS Lands Act.

Objectives: The objectives of the study are to:

- Identify areas of high biological productivity,
- Identify sensitivities and resiliencies to changes in environmental conditions both, geographically and in the ecosystem components.
- Provide a qualitative and quantitative description of the biogeochemical-physical interactions and feedbacks. Specifically:
  - Describe the spatio-temporal scales of variability of physical, biological and chemical variables as well as any potential interactions (if any) among them (e.g., biological heating) over a period of 3 years.
  - Provide a comprehensive identification of the local ecosystem's sensitivities and vulnerabilities to changes in environmental conditions including under-ice synergies.
  - Describe and quantify biogeochemical and biophysical feedbacks comparing ice-free to under-ice scenarios.
  - Describe ecosystem changes under the ice for different ice thicknesses and for different penetration depths (due to chlorophyll or other organic matter presence) of downwelling radiation.
  - Describe and explain in terms of a conceptual model the time evolution among downwelling radiation, temperature versus depth, chlorophyll concentration, nutrients (particularly  $\text{NO}_3$ ), PH, oxygen and fish abundance.
  - Describe the time evolution of  $\text{CH}_4$ , temperature and pressure near the bottom and in the across shelf direction.
  - Describe and quantify any disruptions to the food web from changes in PH.
  - Determine the sensitivity of shelf currents (speed, direction, patterns) to variability in organic matter and sea ice coverage.
  - Establish and describe changes observed in all variables during upwelling events in the Beaufort Sea, onshore and offshore (typically in autumn).
  - Detect the identity of vocalizing whales and their location.

- Map-out areas of high plankton concentration (baleen whale prey).
- Provide a description of habitat utilization of migrating bowhead and grey whales in terms of environmental information (e.g., nutrient concentration, temperature, currents, etc).

Methods: Using state-of-the-art glider technology perform repeated top-to-bottom transects on the shelf of the Beaufort Sea from 2013 to 2015 (each year from early May to early December). Under-ice measurements are of particular interest in order to unveil trophic relationships and monitor their changes in time (over a single year and from year to year) and space. Atmospheric information should be obtained from available observational and model data. Specifically, observe the following variables:

1. *Physical:* measure the 4D fields of temperature, salinity, pressure, downwelling irradiance (photosynthetically active radiation - PAR), the 3D velocity field, depth, and ice coverage,
2. *Biological:* measure the 4D fields of chlorophyll, colored dissolved organic matter (CDOM) fluorescence, backscatter, algal bloom presence, marine mammal sounds, and fish abundance, and
3. *Chemical:* measure the 4D fields of hydrocarbons, pH, O<sub>2</sub>, nutrients (nitrates, nitrites, phosphate, NH<sub>4</sub> and iron), CO<sub>2</sub> and CH<sub>4</sub>.

Gliders are an observing oceanographic unmanned instrument. They have an autonomy of several months (6 to 9) and can cover very large distances while measuring and transmitting in near-real time several physical, chemical and biological observations. A single glider survey costs a small fraction of what it would take to gather that same information from a research vessel.

Interagency collaboration: To move forward this study will need collaboration across federal agencies. BOEM already has held meetings with NOAA, ONR, NSF, Navy and the USCG in order to advance this study. The recipients, in turn, will need to actively and efficiently collaborate with existing programs funded by BOEM (e.g. Chukchi and Beaufort Seas Meteorology Study from Mesoscale and Climatology Aspects), ONR (e.g. Marginal Ice Zone studies) and NSF (e.g., ArcSEES).

**Revised Date:** April 2, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015

**Region:** Headquarters

**Planning Area(s):** Beaufort and Chukchi Seas

**Title:** A Cultural Resource Survey of the Beaufort and Chukchi Seas

**BOEM Information Need(s) to be Addressed:** The Bureau of Ocean Energy Management (BOEM) is required under Sections 106 and 110 of the National Historic Preservation Act (NHPA) and Executive Order 11593 (Executive Office of the President, 1971) to mitigate the effects of its actions on cultural resource materials, which includes identifying any present archaeological cultural resources and all eligible sites to the National Register of Historic Places. BOEM is also required under Executive Orders 13175 (Executive Office of the President, 2000) and 13007 (Executive Office of the President, 1996) and also Secretarial Order 3317 (U.S. DOI, 2011b) to consult with appropriate Native American tribes to further understand which regions may have specific cultural significance and to avoid those areas that remain sacred to tribal members. An expansion of energy-related industries is anticipated off the northern coast of Alaska, and an international partnership is currently being planned among BOEM, the National Science Foundation (NSF), and other agencies through NSF's Arctic Science, Engineering, and Education for Sustainability (ArcSEES) program. While this program will perform fundamental research in order to evaluate the sustainability of the Arctic human-environmental system, as well as integrate efforts that will provide community-relevant sustainability pathways and engineering solutions, there is also a need to systematically retrieve a baseline of offshore archaeological data from this region, which is currently not available.

**Cost Range** (in thousands): \$1,400-\$2,100      **Period of Performance:** FY 2013-2018

Background: During the last glacial period, the surface under the present-day Bering Strait was exposed, forming a land bridge known as Beringia, which allowed Paleo-Indians migrating from eastern Asia to settle along what is now northern Alaska. Previous sub-aerial landscapes that are now submerged along the Beaufort and Chukchi Seas may therefore contain among the oldest known Paleo-Indian cultural remains and features, which may provide information on prehistoric habitation and settlement patterns in this region. Maritime activity has been historically prevalent along the Beaufort and Chukchi Sea regions of northern Alaska, as vessels in this area were primarily involved with commerce and hunting practices, such as whaling. During the 19th and early 20th centuries, specifically, whaling fleets from America and other nations concentrated their efforts near Alaska's Arctic waters. The harsh extremes found in the Arctic made whale hunting particularly hazardous, and on two occasions, 1871 and 1876, entire fleets were trapped by the ice, crushed, and sunk. By the early 1900s, the Alaskan whaling industry was in decline due to the over-exploitation of marine mammal populations, the emerging discoveries of oil on land, and more economical substitutes for baleen. Due to a lack of a cultural resource database, though, the types and distribution of archaeological materials in this region are relatively unknown.

Objectives: The objective of this study is to obtain baseline archaeological information along the Chukchi and Beaufort Seas off northern Alaska in order for BOEM to comply with its cultural resource protection responsibilities. This will be completed by addressing the following research questions:

1. What types of prehistoric and historic cultural resources are present in this region?
2. How do any detected cultural remains compare with the historical record or indigenous oral traditions, and how may these sites be incorporated into a submerged cultural landscape?
3. Which discovered archaeological sites are eligible for nomination to the National Register of Historic Places?
4. What are the most appropriate data recovery and geospatial plotting methods to analyze the occurrence and distribution of archaeological sites?
5. How has the unique marine environment in this region affected the preservation or degradation of cultural remains over time?

Methods: Due to the required types of information that need to be collected and analyzed, the project will progress in the following phases:

1. **Historical Research and Tribal Consultation:** Primary and secondary sources will be researched to gain better insight into the types of maritime activities that have historically been conducted in this region, and Federally-recognized Native American tribes will be consulted to better understand the location and types of Paleo-cultural sites that may be encountered offshore.
2. **Survey Area Planning:** Offshore survey locations will be based on synthesis of the historical record, tribal knowledge, and geophysical data.
3. **Remote Sensing Survey:** Field surveys will preferably be conducted with an autonomous underwater vehicle (AUV) equipped with both side-scan and multi-beam sonars and a sub-bottom profiler. High priority targets will then be visually ground-truthed for identification purposes.
4. **Results and Final Report:** All results will be analyzed and reported in terms to describe the offshore cultural landscape off northern Alaska.

**Revised Date:** April 12, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** National

**Planning Area(s):** All

**Title:** Sediment Character Modification During Dredging, Pump-out, and Placement Operations

**BOEM Information Need(s) to be Addressed:** Since project proponents must match grain size, color, and sorting of borrow area and native beach sediments in initial project planning, wide areas of the OCS may be unnecessarily excluded as viable borrow areas if the source and native materials do not match within accepted criteria. However, these policies and associated requirements fail to recognize that during the dredging and placement process it is possible that a substantial proportion of the already small fine-grained sediment fraction in borrow area sediments is sorted, so that a coarsening of the grain size distribution occurs. This process is suspected, but has not been systematically investigated. This information could be very important because alternative OCS borrow areas could potentially be dredged where lesser environmental impacts would result.

**Cost Range:** (in thousands) \$300-\$500

**Period of Performance:** FY 2013-2014

### **Description:**

Background: Many coastal states have stringent requirements about 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. What constitutes beach compatible sand will vary from state to state, but generally speaking, a typical beach grain size distribution generally ranges from fine to medium sand. Some states require that the fill material not contain more than 5%-10% silt or clay and/or that the grain size distribution must be within 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) in order to find "beach compatible" sediment in sufficient quantity. If alternative borrow areas characterized by sand with relatively higher fractions of silt and clay or finer material potentially could be dredged, 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 managed fish species.

Currently, sand sources that may 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 match within accepted criteria. However, this decision may be overly precautionary and premature if all that fundamentally matters is the sediment characteristics at the beach at some

interval post construction. Between dredging, pump-out and placement operations, sediment is entrained, dewatered, and re-slurried several times. The sediment handling process generally includes initial disturbance and entrainment by a draghead and cutterhead; 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 likely 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 (W.F. Baird & Associates, 2004).

It is 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.

Objectives: The objective of this study is to determine the degree, timing, and variability in sediment sorting and character changes that occur during dredging, pump-out and placement operations.

Methods: Field methods to determine potential sediment sorting and character changes in context of seasonal, inter-annual, and event driven variability may 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. Laboratory analysis of sediment grain size, color, sorting, and settling velocity will be required. Robust sampling strategies and statistical analyses will be required to distinguish any changes in sediment properties. Existing research efforts, including required construction monitoring, will be identified and leveraged. BOEM will need to explore partnerships with the U.S. Army Corps of Engineers' Engineer Research and Development Center and other vested stakeholders to leverage funds and maximize collaboration.

**Revised Date:** March 29, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Headquarters

**Planning Area:** All

**Title:** Effectiveness of Exclusion Zones Designed to Protect Archaeological and Benthic Resources from Indirect Dredging Impacts

**BOEM Information Needs to be Addressed:** This study will document the effectiveness of archaeological and benthic habitat exclusion zones established to avoid indirect impacts from dredging activities. Dredging modifies bathymetry, which in turn may also affect hydrodynamics and sediment transport over complex space and time scales. Because physical processes and bottom morphology are dynamically linked, sensitive resources on or embedded in the adjacent seafloor may be exposed, buried, or otherwise impacted during long-term equilibration and recovery of borrow areas. Although exclusion zones are effective mitigation during and immediately following construction operations, the potential for long-term effects is poorly understood.

**Cost Range:** (in thousands) \$500-\$750

**Period of Performance:** FY 2013-2017

### **Description:**

**Background:** A host of environmental laws, such as the National Environmental Policy Act, National Historic Preservation Act, the Magnuson-Stevens Fisheries Conservation and Management Act, and the Endangered Species Act, require that BOEM consider the effects of dredging on cultural and/or environmental resources. Resources of particular concern include shipwrecks, prehistoric sites, and sensitive biological habitats (e.g., hard bottom and reef communities). BOEM has previously funded a study to analyze the effects of dredging on known or suspected cultural resources and provide guidance for the creation of exclusion zones to avoid direct impacts during dredging (Michel et al., 2004). BOEM has not specifically investigated the effectiveness of exclusion zones for protecting sensitive benthic habitats, but exclusion zones around such resources are common practice (CSA, 2009). Long-term scour and sediment dynamics have not been taken into consideration in the BOEM-funded research done to date. Research suggests that exclusion zones need to account for the direct impacts of the activity, uncertainty in the location of the resource being protected, as well as the influence of longer term physical processes that may interact with and negatively impact adjacent sensitive resources (Dix et al., 2007; Quinn and Boland, 2010). The same is true for benthic habitat resources (Berquist et al. 2010; Jordan et al., 2010; Wren et al., 2010). Although direct impacts are believed to be effectively avoided by establishing conservative exclusion zones, BOEM needs to validate the same for indirect impacts.

**Objectives:** The objective of the study is to better understand if, when, and how changed physical processes resulting from dredging on the OCS affect adjacent sensitive resources over extended space and time scales. The concept of designing exclusion zones to account for potential, longer-term impacts related to altered bottom morphology and sediment transport will be validated.

Methods: Existing research efforts will be identified and cost-leveraged, and BOEM will explore other possible funding partnerships. The study will identify an appropriate borrow area(s) for an *in situ* before-after controlled impact study where there are known sensitive archaeological resources and/or benthic habitats. Previously attempts to find such a location, where both resources co-exist, proved difficult. If a suitable study area cannot be found, a flume/wave tank experiment study may be a reasonable substitute.

Field and/or lab methods may include bottom boundary layer observations, repeat high-resolution geophysical (or other appropriate) surveys, underwater camera and video observations, and sediment tracer studies.

**Revised Date:** April 12, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Headquarters

**Planning Area(s):** All

**Title:** Propagation Characteristics of High Frequency Sounds Used for High Resolution Geophysical Surveys

**BOEMRE Information Need(s) to be Addressed:** High resolution geophysical surveys use high frequency sound sources that emit noise within the water column at an intensity, frequency, and duration which may disturb marine life (e.g., marine mammals, sea turtles, and fish). Limited observations are currently available on the underwater noise propagation of the high frequency sounds generated from sources other than air guns (e.g., boomers, sparkers, chirpers, side-scan sonar, and single, swath, and multi-beam bathymetry). Improved understanding of their propagation characteristics is crucial to assess the potential behavioral response of marine species and determine appropriate mitigation, as required under the National Environmental Policy Act (NEPA), the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), and the Magnusson-Stevens Fisheries Conservation Management Act (MSFCMA).

**Cost Range:** (in thousands) \$1,000-\$1,200

**Period of Performance:** FY 2013-2015

### **Description:**

**Background:** Geophysical data is critical for industry and BOEM to make informed leasing decisions. High frequency sound sources are commonly used during infrastructure siting, geological or environmental characterization, and shallow hazard or archaeological clearance survey. The sound sources currently in use generally include boomers, sparkers, chirpers, side-scan sonar, and single, swath, and multi-beam bathymetry. The source levels generally range from 210 to 240 dB re 1  $\mu$ Pa @1 m, and the sources operate in the 500 Hz to several hundred KHz range (Lurton and DeRuiter, 2011). Because of characteristic high frequencies, beam directionality, and short pulse length, only in very close range to the source is the potential for physical injury a concern (BOEM, 2012f). Little information exists on the far-field propagation characteristics (e.g., transmission loss) from these non-air gun sound sources despite their wide use by industry. The propagation characteristics are especially poorly understood in shallow to intermediate water settings (e.g., 10 to <70 m), where transmission is critically affected by complex bathymetric interaction, variable sediment composition, shallow water processes (i.e., breaking waves), and mesoscale oceanographic properties. At the same time, the sources may produce noise within the water column at an intensity and frequency which may adversely affect marine mammal behavior over various species' hearing integration time. Improved understanding of the propagation characteristics from these sources is crucial to more accurately assess potential impacts to marine species and determine appropriate mitigation, as required under NEPA, MMPA, ESA and MSFCMA. Information garnered from this project would apply across all BOEM program areas (oil/gas, renewable, marine mammals) and in all BOEM Planning Areas.

Objectives: The objectives of this study are to:

1. Characterize through observation the propagation characteristics of commonly used high frequency, high resolution non-air gun sound sources (e.g., boomers, sparkers, chirpers, side-scan sonar, single, swath, and multi-beam bathymetry); and
2. Enhance and validate an existing sound propagation model to improve accuracy of transmission loss predictions for shallow/intermediate waters (e.g., 10 to <70 m) for use in determining the area of ensonification from these sound sources in future environmental assessments.

Methods: The study methods may consist of the following components:

- Review existing information about source levels, frequencies, beam directionality, and pulse length of sonar systems used in high resolution geophysical surveys to determine the appropriate range of sources to observe and model.
- Identify the appropriate study area(s), capitalizing on existing research efforts. Design and complete the necessary field work to: (1) characterize the 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 tune an existing sound propagation model(s) for use in shallow water (e.g., 10 - <70 m), accounting for the potential influence of complex bathymetry, variable bottom types and underlying geology, shallow water processes, and mesoscale oceanographic properties. Multiple or ensemble modeling may be appropriate where results differ significantly between models or ecoregion.
- Develop and implement an approach to test the sensitivity of and/or skill of the model using field data for the purposes of validation.
- Form a peer-review scientific group to advise on and review field work design, model selection and development, and data validation/analysis.

**Revised Date:** January 20, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015

**Region:** Headquarters

**Planning Area(s):** All

**Title:** Support for the Third International Conference on the Effects of Noise on Aquatic Life

**BOEM Information Need(s) to be Addressed:** The expansion of BOEM activities into new geographic areas, such as the Atlantic coast and the Pacific Northwest, combined with a rising concern for the impacts of anthropogenic sound on the natural environment nationwide increases the need for information regarding the noise produced by BOEM regulated activities. This conference provides excellent access to the latest scientific information on the effects of noise on aquatic life. Results may identify specific research needs for BOEM or suggest potential mitigations particularly relevant to upcoming renewable energy projects.

**Cost Range:** (in thousands) \$40-\$60

**Period of Performance:** FY 2013

### **Description:**

**Background:** There has been an increasing interest and concern among scientists, regulators, and industry about the effects of noise on marine life. While emphasis has been on effects on marine mammals, recent concerns have arisen about effects of the same sounds on fish, and there is a smaller but growing concern about effects on invertebrates as well. The issues revolving around effects of sounds on aquatic life are extensive and complex. They range from differences in the sources of sounds potentially affecting aquatic life, the diversity of species affects, the potential different effects on animals with different anatomy and physiology, and effects on animals living in different habitats. The complexity arises, in part, from current difficulties in extrapolating between sounds with different characteristics and between species with different body structures. To alleviate the lack of contact between scientists working on different aspects of effects of sounds, two international conferences on the effects of noise on aquatic life were conducted. They facilitated interaction between the scientists investigating these questions and the regulators and industrial users of sound who need the answers and created an ideal venue for the networking and brainstorming that advance the state of science. The goal of the conferences was to examine the current understanding of the effects of noise on marine organisms, especially mammals, fish, and invertebrates. They defined major research questions to be answered and brought together scientists, regulators and industry representatives to place the work into its full context. The first conference resulted in a dedicated issue of the peer-reviewed journal *Bioacoustics* (Hawkins, et al., 2008), wherein the collected papers from the conference are presented. The scholarly contributions to the second conference have been published in a book edited by Popper and Hawkins (2012).

Feedback from participants and supporters of the previous conferences demonstrated a strong need to continue in subsequent conferences the dialog and collaborations generated from them. Indeed, to date, these conferences are the best opportunity to bring together all the key

individuals to share information, particularly on measuring and understanding the effects of sound on marine organisms. As with the previous meetings, the main emphasis of the third conference will be on defining the current state of knowledge and reviewing progress made since the second, in particular on the topic of metrics. The other program details have not yet been developed, but they are likely to include new research on turtles and a number of new approaches on sound propagation modeling.

Objective: The objective of this study is to co-fund a conference that will provide a venue for the collection and sharing of research related to the effects of noise on aquatic life. The event will provide an opportunity for networking among all attendees and possible research collaborations.

Methods: With BOEM co-funding, a conference will be conducted using a standard general conference format with multiple sessions for presentations and a poster session. The “lightning sessions” of the second conference may be repeated in the third. Also, as with the previous conferences, an advisory board likely will be convened to guide the development of program topics and selection of presenters.

**Revised Date:** April 04, 2012

## **SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2015**

### **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 such as the Deepwater Horizon oil spill 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.

### **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. Dr. Alan Thornhill is a full member of the Interagency Arctic Research and Policy Committee (IARPC) which is led by the White House's Office of Science and Technology (OSTP). BOEM's ESP recently (April 18, 2012) partnered with the National Science Foundation, the Environmental Protection Agency, the Fish and Wildlife Service, the U.S. Geological Survey, 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.

### **3.4 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.

### **3.5 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 2013-2015  
Studies Development Plan  
Alaska OCS Region**

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

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## ACRONYMS

ADF&G	Alaska Department of Fish and Game
AEWC	Alaska Eskimo Whaling Commission
ANIMIDA	Arctic Nearshore Impact Monitoring in Development Area
AOOS	Alaska Ocean Observing System
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
CMQA	Community Modeling and Analysis System
CCSM	Community Climate System Model
CESU	Cooperative Ecosystem Studies Unit
CHAOZ	Chukchi Acoustics, Oceanography and Zooplankton study
CMI	Coastal Marine Institute
COMIDA	Chukchi Offshore Monitoring in Drilling Area
DFO	Canadian Department of Fisheries and Oceans
DPP	Development and Production Plan
EA	Environmental Assessment
ECS	Eastern Chukchi Sea
EIS	Environmental Impact Statement
EP	Exploration Plan
ESA	Endangered Species Act
ESP	Environmental Studies Program
FY	Fiscal Year
GIS	Geographic Information Systems
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
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
NOPP	National Oceanographic Partnership Program
NOS	National Ocean Service
NPPSD	North Pacific Pelagic Seabird Database
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
OMB	Office of Management and Budget
OSRA	Oil-Spill-Risk Analysis
OSU	Oregon State University
OWM	Oil Weathering Model
PMEL	Pacific Marine Environmental Laboratory
SDI	Satellite Drilling Island
SEIS	Supplemental Environmental Impact Statement
SOAR	Synthesis of Arctic Research
TAR	Technology Assessment and Research
UAA	University of Alaska Anchorage
UAF	University of Alaska Fairbanks
UAS	Unmanned Aircraft System
uERD	ultra Extended Reach Drilling
URI	University of Rhode Island
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UT	University of Texas
UW	University of Washington

VLOS	Very Large Oil Spill
WHOI	Woods Hole Oceanographic Institution
WRF	Weather Research and Forecasting model

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## **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 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 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. The basic mission of BOEM is to manage the safe and environmentally responsible development of energy and mineral resources on the OCS. 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 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 and/or review Environmental Impact Statements (EISs), Environmental Assessments (EAs), Exploration Permits (EPs), and Development and Production Plans (DPPs). 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 the MMS/BOEM have funded nationally more than \$935 million for environmental studies through fiscal year (FY) 2011. More than \$350 million of that amount has funded studies in Alaska across 15 planning areas in the Arctic, Bering Sea and Gulf of Alaska sub-regions (see Figure 1) to produce more than 500 different

study reports, as well as more than 300 peer-reviewed publications since 1990. The ESP manages ongoing study projects in Alaska (currently about 60) in disciplines such as physical oceanography, fate and effects of pollutants, protected and endangered species, wildlife biology, and the social sciences. Completed study reports are posted on our website at <http://alaska.boemre.gov/ref/AKPUBS.HTM>.

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-release 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 (ITMs) and Information Update Meetings (IUMs) 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.

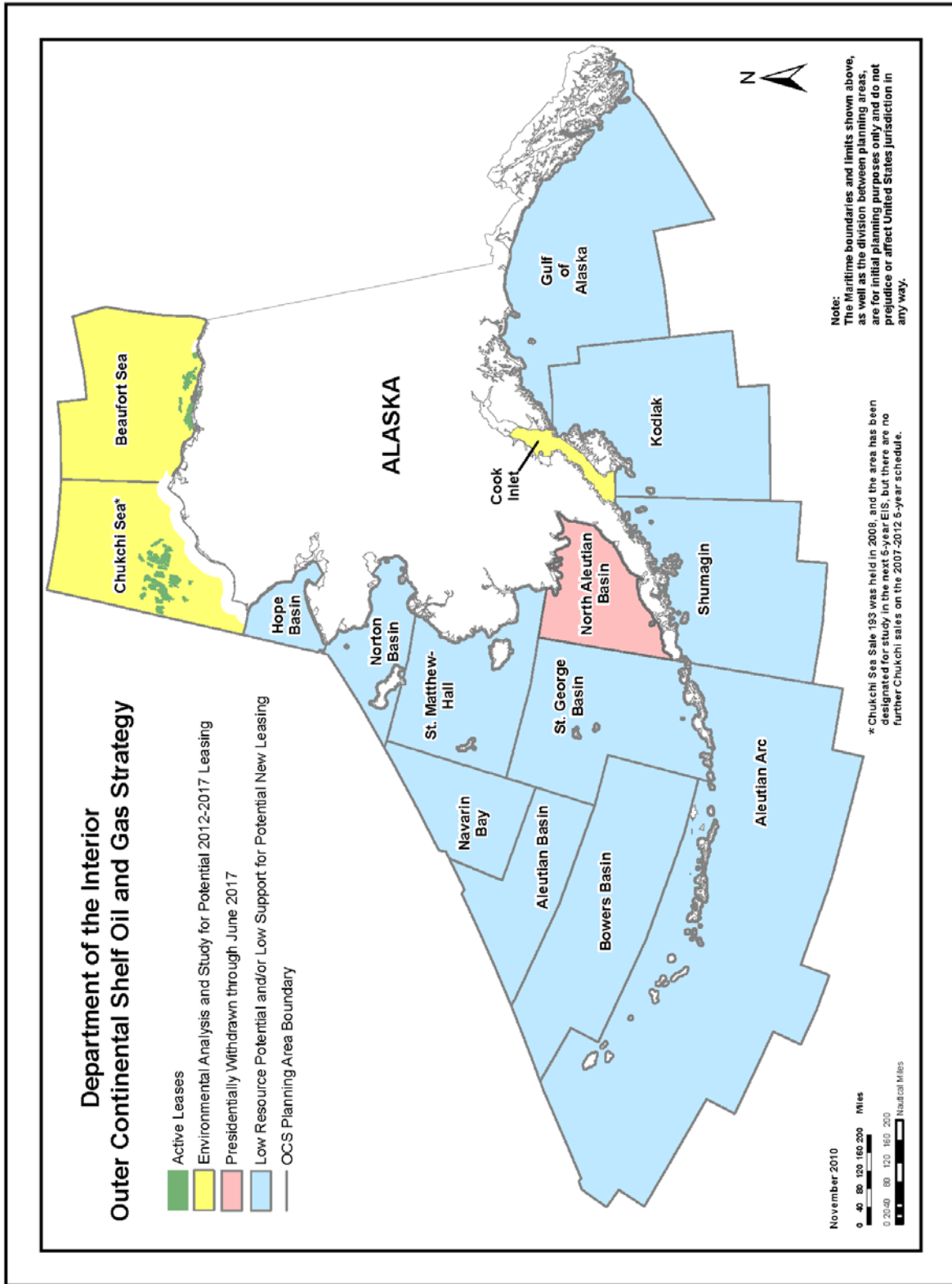
### 1.1.2 Scientific Studies are Conducted in Partnership

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

**Figure 1** Alaska OCS Region Planning Areas



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); Bureau of Land Management (BLM) and the North Slope Science Initiative (NSSI); National Aeronautics and Space Administration (NASA); National Science Foundation (NSF); Arctic Research Commission; and the Polar Research Board.

The ESP also 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 \$16 million of agency funds into \$32 million worth of relevant marine-based research. During that time, the CMI program has also provided roughly 120 years of graduate student support and completed over 60 studies. The ESP is currently working on an extension of the cooperative agreement through 2017. Under the current 5-year agreement with the CMI, the Alaska OCS Region has committed \$750,000 per year with a dollar-for-dollar match arrangement. More information can be found at <http://www.sfos.uaf.edu/cmi>.

The Alaska Region ESP also conducts cooperative research with universities through the Cooperative Ecosystem Studies Units (CESUs). The CESUs are working partnerships among leading academic institutions, federal, state, and non-governmental organizations. A national network of seventeen CESUs has been established, with each unit focusing 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. The BOEM currently participates in six CESUs that encompass the state of Alaska, the Pacific Northwest, California, 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.

Studies also address recommendations from programmatic reviews. For example, the National Ocean Council established by Executive Order 13547 has adopted a list of nine National Priority Objectives as recommended by the Interagency Ocean Policy Task Force. Objectives that are particularly relevant to the ESP include: adopting a system of ecosystem-based management for the ocean and coasts; implementing comprehensive, integrated, ecosystem-based coastal and marine spatial planning and management; and addressing environmental stewardship needs in the Arctic Ocean and adjacent coastal areas in the face of climate-induced and other environmental changes. Also, the report *An Evaluation of the Science Needs to Inform Decisions on Outer Continental Shelf Energy Development in the Chukchi and Beaufort Seas, Alaska* from USGS (2011) summarizes key existing scientific information, identifies information needs and provides initial guidance of what new or continued research could improve decision-making.

Another key source of input derives from discussion and advice generated through the OCS Scientific Advisory Committee, an external peer review body that meets on an annual basis. Other involvement of external scientists occurs through forums such as participation on project-management review boards, which greatly facilitates ESP collaboration and coordination. Significantly, the ESP also systematically seeks out and includes the knowledge of coastal community residents in planning (see Section 1.3).

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 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 2011 USGS Recommendations

In March 2010, U.S. Department of the Interior Secretary Salazar asked the U.S. Geological Survey (USGS) to conduct an independent evaluation of the science needs that would inform consideration of “the right places and the right ways” in which to develop oil and gas resources in Federal arctic waters, with particular focus on the Chukchi and Beaufort seas. The Secretary asked USGS to: summarize key existing scientific information; develop a rapid process to identify where knowledge gaps exist; and provide initial guidance of what new or continued research could improve decision-making.

The full report, released on June 23, 2011, under the title *An Evaluation of the Science Needs to Inform Decisions on Outer Continental Shelf Energy Development in the Chukchi and Beaufort Seas, Alaska*, is posted online at <http://pubs.usgs.gov/circ/1370/>. More than 50 findings and an equal number of recommendations are contained in the 279 page report. The report identifies several major categories where additional scientific research, analysis, and synthesis could reduce uncertainties, which include:

- Developing a better understanding of the effects of climate change on physical, biological and social conditions as well as resource management strategies in the Arctic;
- Developing foundational geospatial data of the Arctic Outer Continental Shelf;
- Synthesizing existing scientific information on a wide range of topics on the Arctic;
- Building upon advances in spill-risk evaluation and response knowledge by developing better information on key inputs to spill models (such as oceanographic, weather, and ecological data);
- Improving dialogue and using collaborative, comprehensive science planning, both domestically and internationally.

The USGS report represents the most recent effort to summarize systematically and comprehensively the large volume of existing scientific information of relevance to offshore energy development planning in Alaska. The science of offshore energy development involves and concerns a wide array of research entities, scientists, stakeholder groups, and regulatory institutions. We understand the report properly addresses this entire network of arctic operations, but since that network does prominently include the USDOJ Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE), we take particular interest in the findings.

Within BOEM, the Environmental Studies Program (ESP) funds and manages a broad array of research on potential impacts to the marine, coastal, and human environment, including studies pertaining to physical oceanography, biology and habitat, protected species, and social systems. Science always proceeds by identifying and filling knowledge gaps. The ESP systematically undertakes on an annual basis its own thorough review of science needs and proposals to inform ongoing decisions about resource management on the arctic OCS.

Numerous external groups also conduct similar reviews on a frequent basis.<sup>1</sup> These review processes always feed our own efforts to prioritize science information needs as we plan and procure new studies through our public Annual Studies Plan, with formal scientific peer review provided by our external OCS Scientific Committee.

The USGS report consistently affirms the direction of research recently undertaken by the ESP, validating our annual cycle of studies planning and procurement for arctic research over the last five years. The ESP is currently undertaking a large number of ongoing studies that address the very same information needs as those identified by the USGS report. These active studies, which total more than \$70 million, explicitly include:

- long-term monitoring studies that can be used to address the ecological and social impacts of climate change effects on Alaska and the Arctic;
- GIS-based studies of subsistence hunting patterns;
- long-range migration patterns of marine mammals and birds;
- syntheses of recent data collection across multiple projects to elucidate ecosystem relationships between oceanographic conditions, lower trophic prey species (food webs) and marine mammal distribution and behavior;
- syntheses of individual species and taxa;
- syntheses of ocean circulation and meteorological modeling.

In addition to our list of active studies and completed reports, the ESP has made attempts to fill information needs on many complex topics identified by the USGS report that did not yield conclusive results. Some prominent examples include ESP attempts to: construct a local and traditional knowledge database; construct an arctic “co-variance of human activities” database (including cumulative impacts from industrial noise); provide economic valuation of ecosystem services; provide support for marine mammal tissue archives; develop wildlife hazing techniques in the event of an oil spill; and improve scalar resolution within oceanographic models. The ESP applies adaptive strategies as we attempt to move forward with new research projects on complex topics.

#### 1.1.4 Issues To Be Addressed

The *Alaska Studies Development Plan FY 2013-2015* 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

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<sup>1</sup> Some of the more recent relevant reports include: Arctic Council Oil and Gas Effects Assessment; National Ocean Policy Strategic Action Plan for Changing Conditions in the Arctic; Interagency Arctic Research Policy Committee 5-Year Research Plan; North Slope Science Initiative Emerging Issues Papers; Arctic Ocean Synthesis (edited by UAF Institute of Marine Sciences); National Research Council report on Cumulative Effects; and recurring reports conducted under the auspices of the National Academy of Sciences.

To be responsive to ongoing leasing plans and changing offshore 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 remains especially flexible in planning and implementing needed studies.

At each step of the offshore leasing 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 developments, exploration activities and existing leases, as well as potential future lease sales, in the Beaufort Sea and Chukchi Sea Planning Areas. Current 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 development prospects?
- What long-term changes in heavy metal and hydrocarbon levels may occur near Beaufort Sea development prospects, such as Liberty, or regionally along the Beaufort Sea coast?
- 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 species that are potentially sensitive, 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?

## 1.2 Projected OCS Activities

The ESP funds studies that have strong applicability to pending pre- and post-lease decisions under the upcoming (and previous) 5-Year OCS Program(s). The most important considerations for establishing priorities within the national needs context include:

- Mission/OCS 5-Year Program relevance
- Timing in relation to decision/environmental assessment needs
- Study design/scientific methods/feasibility
- Availability of needed information from other sources

### 1.2.1 Pre-lease Considerations

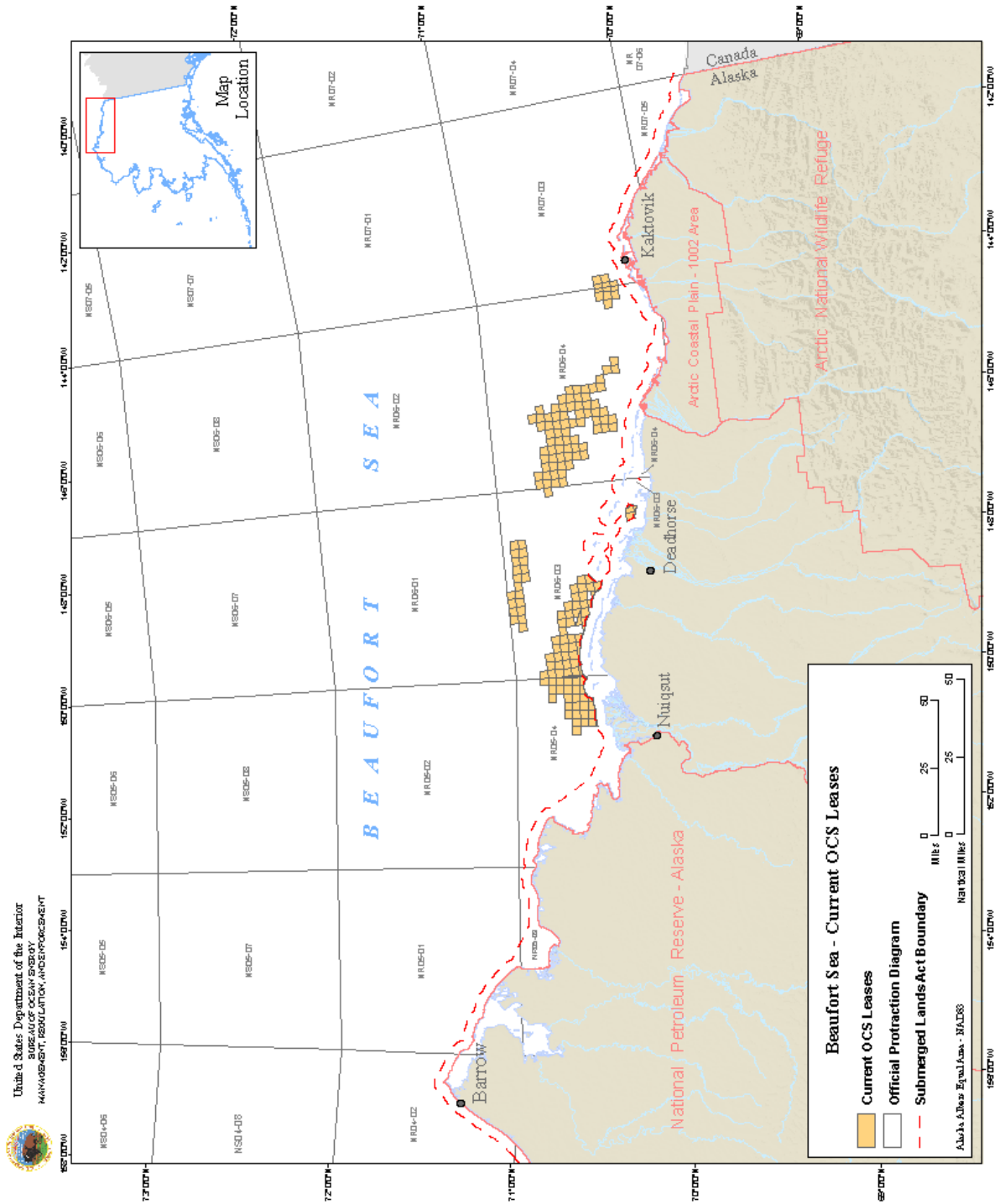
This *Alaska Studies Development Plan* reflects consideration of the many changes occurring in the Alaska OCS Region, as well as anticipated needs for the future. In a frontier region such as the Alaskan Arctic, planning lead-time is necessary to conduct adequate environmental studies. Challenges include: large and remote planning areas, diverse and extreme environmental conditions, still-evolving hydrocarbon extraction technology, and potential environmental hazards associated with offshore activities.

Preparation of an EIS is an essential part of the pre-lease process that requires environmental information. In particular, information is needed in time to prepare draft EISs for proposed lease sales. 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.

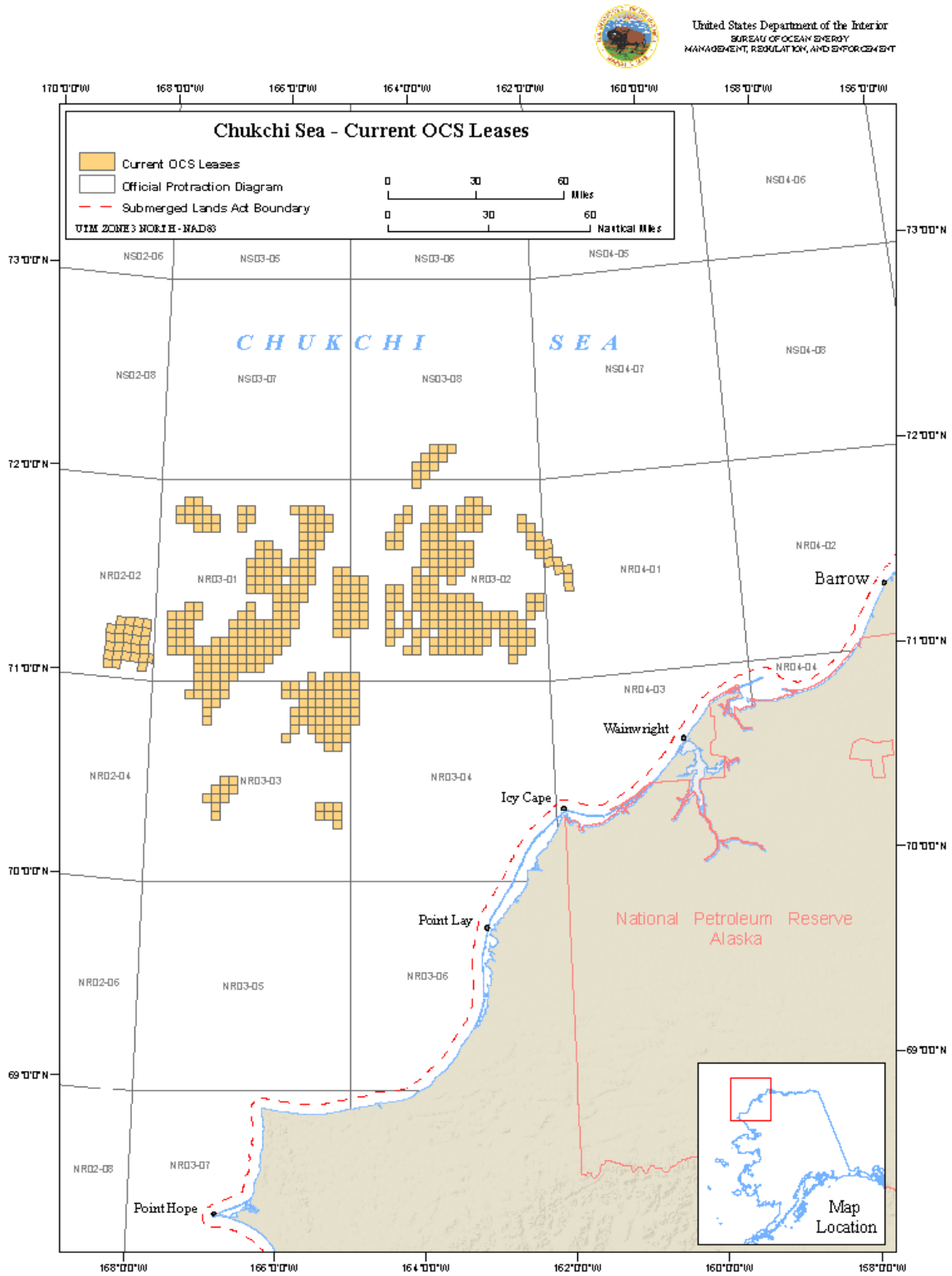
Three lease sales were held under the *Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007* (USDOJ, MMS, 2002), all of them in the Beaufort Sea Planning Area (see Figure 2). Other lease sales in that *Program* were postponed or were cancelled due to lack of industry interest. The first lease sale under *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOJ, MMS, 2007) was held in February 2008 in the Chukchi Sea Planning Area (see Figure 3). This *Final Program* also proposed lease sales in the Beaufort Sea, the Chukchi Sea, the North Aleutian Basin, and special interest sales in Cook Inlet. In March 2010, the President issued a memorandum withdrawing the North Aleutian Basin from consideration for leasing through June 2017. In addition, in December 2010, the Bureau released a *Revised Program Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOJ, BOEMRE, 2010) that cancelled the lease sales planned for the Beaufort and Chukchi seas. Cook Inlet Sales 211 and 219 were cancelled due to lack of industry interest.

The *Revised Program* cited the need for additional exploration and scientific, environmental and oil spill risk analysis before more area in the Arctic is considered for leasing. The Beaufort Sea and Chukchi Sea planning areas, as well as Cook Inlet (see Figure 4), are being evaluated for possible leasing under the upcoming *Outer Continental Shelf Oil and Gas Leasing Program 2012-2017*. Publication of the proposed *2012-2017 Program* will likely occur in mid-2012.

**Figure 2** Beaufort Sea Oil and Gas Leasing Activity

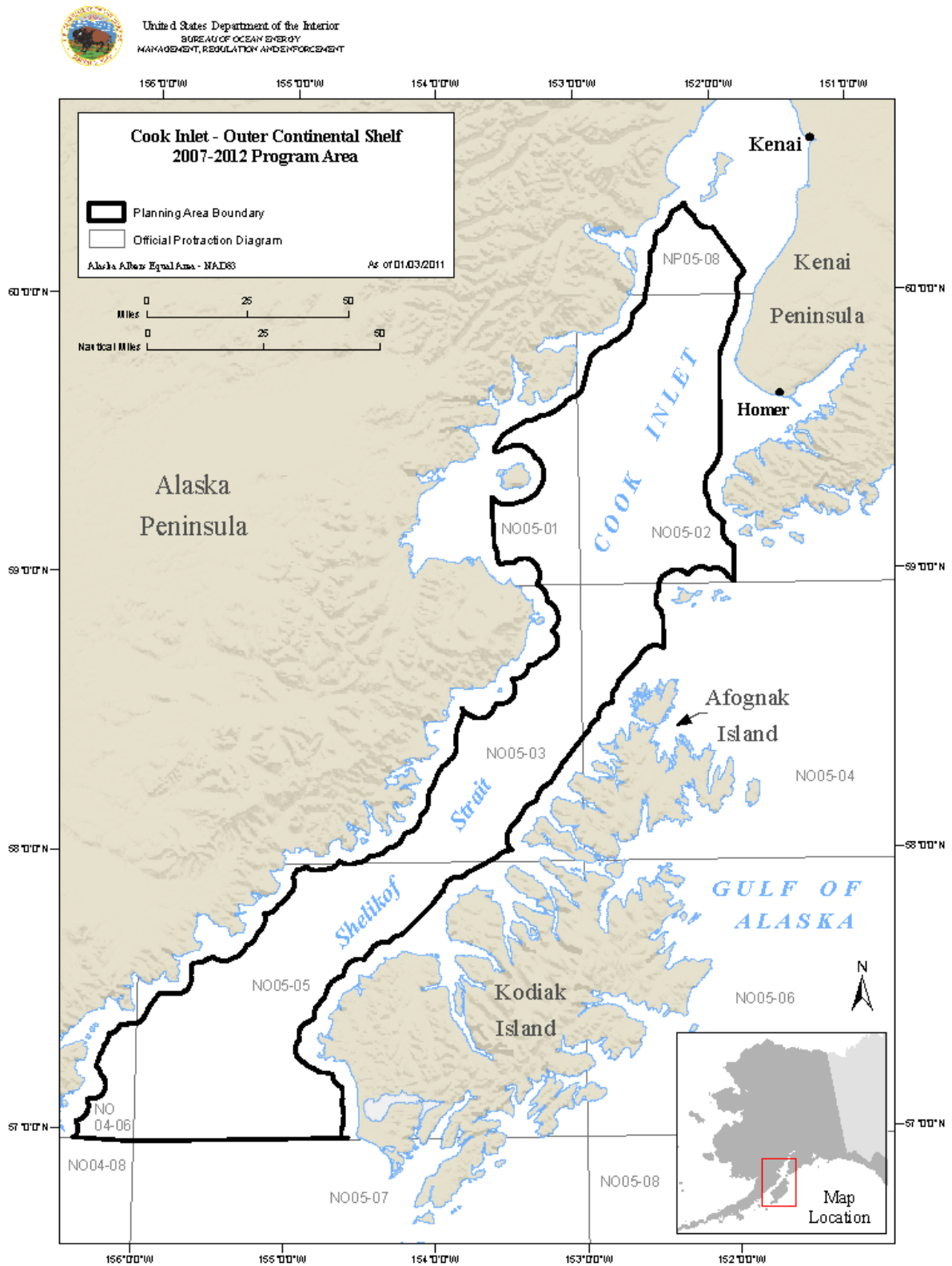


**Figure 3** Chukchi Sea Oil and Gas Leasing Activity





**Figure 4** Cook Inlet Planning Area



### 1.2.2 Post-lease Considerations

Prior to FY 1982, most studies of the Alaskan offshore were planned, conducted, and concluded before a sale was held in order to provide information for decision making and EISs. 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 developments. The ESP acquires additional information for environmental analyses related to development and production in the post-lease phase. Thus, an increasing number of studies have become more closely related to development schedules and monitoring and evaluation in addition to those broader studies related to the pre-lease phase. As with the pre-lease phase, 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
- Preparation of Exploration Plans (EPs)
- Exploration drilling
- Preparation of Development and Production Plans (DPPs)
- Development, construction and production activities
- Oil transportation, including pipelines and tankers
- Lease termination or expiration (platform decommissioning)
- Oil spill detection, containment, clean-up and damage assessment

In the Beaufort Sea Planning Area, there have been 929 tracts leased in ten OCS Lease Sales. Industry has drilled 31 exploratory wells and determined 11 to be producible. As of January, 2012, there are more than 180 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.

Legal Challenges: Litigation remains a factor for Alaska OCS activities. Currently, there are two 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 Federal recognized tribe, and an Alaska Native organization challenged the Chukchi Sea Sale 193 regarding compliance with the National Environmental Policy Act. On July 21, 2010, the U.S. District Court of Alaska remanded to the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) the Chukchi Sea Sale 193 Final EIS to satisfy its obligations under NEPA in accordance with the Court's opinion. Specifically, BOEMRE was instructed to address three concerns, as follows: (1) analyze the environmental impact of natural gas development; (2) determine whether missing information identified by BOEMRE 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.

The BOEMRE released a Draft Supplemental EIS (SEIS) in October 2010. The Draft SEIS augmented the analysis in the Sale 193 Final EIS by analyzing the environmental impact of natural gas development and evaluating incomplete, missing, or unavailable information pursuant to 40 CFR 1502.22. The Draft SEIS was made available for a 45-day public comment period. Over 150,000 comments were submitted. Many commenters requested that BOEMRE perform an analysis that takes into account the possibility of a blowout during exploration activities in view of the *Deepwater Horizon* event. In March 2011, BOEMRE announced a Very Large Oil Spill analysis (VLOS) would be included in the SEIS process. On May 27, 2011, BOEMRE released the Revised Draft SEIS, which included an analysis of a hypothetical VLOS, for a 45-day public comment period. At the conclusion of the public comment period, BOEMRE received over 360,000 comment letters and cards from Federal Agencies, state and local governments, Alaska Native tribes, interested groups, and members of the public.

On August 19, 2011, BOEMRE released the Final SEIS for Sale 193. In the Final SEIS BOEMRE has responded to the public comments and considered information from the U.S. Geological Survey's report: *An Evaluation of the Science Needs to Inform Decisions on Outer Continental Shelf Energy Development in the Chukchi and Beaufort Seas, Alaska* (USGS, 2011). The Final SEIS comment period closed September 26, 2011, and BOEMRE received about 50,000 comments. Information relevant to these comments will be presented to the Secretary of Interior for his Sale 193 decision.

The Final SEIS satisfies the concerns addressed by the District Court in its remand order, provides a comprehensive VLOS analysis, and together with the Sale 193 FEIS provides the Secretary with sufficient information to make the decision to reaffirm, modify, or cancel Lease Sale 193. The Record of Decision from the Secretary is due to the District Court by October 3, 2011.

The BOEMRE issued a Suspension of Operations on all Sale 193 Chukchi Sea leases on September 13, 2010, as no exploration activities can be conducted until resolution of this litigation.

*Native Village of Point Hope, et al. v. Kenneth Salazar, Secretary of the Interior, and Bureau of Ocean Energy Management, Regulation and Enforcement* (9<sup>th</sup> Cir. filed Sept. 29, 2011). In September 2011, the Native Village of Point Hope; Alaska Wilderness League; Center for Biological Diversity; Defenders of Wildlife; Greenpeace, Inc.; Natural Resources Defense Council; National Audubon Society; Northern Alaska Environmental Center; Oceana; Pacific Environment; Resisting Environmental Destruction on Indigenous Lands (REDOIL); Sierra Club; and The Wilderness Society filed a petition for review with the U.S. Court of Appeals for the Ninth Circuit. The petitioners requested the court to review BOEMRE's approval with conditions of Shell Offshore, Inc., Revised Camden Bay (Beaufort Sea) Exploration Plan. The petitioners allege that BOEMRE violated the Outer Continental Shelf Lands Act and the National Environmental Policy Act.

Development:

*Liberty* – The Liberty prospect is located in the central Beaufort Sea about 6 miles east of the existing Endicott Satellite Drilling Island (SDI). British Petroleum Exploration Alaska (BPXA) will use ultra-Extended Reach Drilling (uERD) technologies to lengths of 5-8 miles, allowing the Liberty unit to be developed from an expansion of the existing Endicott Satellite Drilling Island. All drilling activity will be from surface locations on State lands using a land-based rig and surface blowout preventer. BPXA has delayed the initial wells until at least 2013. Both the USDOJ Bureau of Safety and Environmental Enforcement (BSEE) and the State must approve applications for permit to drill and are reviewing requirements for blowout preventers and relief wells for projects. BPXA estimates that the reserves for the Liberty project are 105 million barrels of oil.

Production:

*Northstar* – Northstar (see Figure 5) is a joint Federal/State of Alaska unit located in the Beaufort Sea about 6 miles northwest of Prudhoe Bay. BP Exploration Alaska, Inc. (BPXA) is the lessee and operator of Northstar. The six producing Federal wells fall under BSEE regulatory authority, the State wells fall under the State's oversight. Production started in 2001 and peaked in 2004. Total production through November 2011 is more than 152 million barrels; with the Federal portion comprising about 27 million barrels.

**Figure 5** Northstar Island, August 2000



### 1.3 Identification of Information Needs

The Alaska OCS Region assesses its mission information needs continuously, and systematically develops new study profiles on an annual basis. The ESP in Alaska distributes the *Alaska Annual Studies Plan* to more than 200 Federal, State, local, environmental, Native, industry, international and other stakeholders each September. We also distribute a letter to the same stakeholders requesting suggestions for new studies for the next cycle. We consider comments in response to that request and previous program reviews. In addition, we request suggestions for new studies from all components of the Alaska OCS Region staff and actively seek their input throughout the profile development process.

The ESP also relies heavily on information needs identified through solicitation of public comment and suggestions on how to enhance our information base at scientific and information meetings. For example, BOEM, along with numerous organizations and agencies, sponsors the Alaska Marine Science Symposium held in Anchorage, Alaska, each year. The Alaska OCS Region also has conducted eleven Information Transfer Meetings (ITMs). In addition, Alaska OCS Region has sponsored a number of workshops and conferences over the years with topics that include: using high frequency radar to map surface currents; various aspects of physical oceanography; arctic cisco in the Beaufort Sea; and social and economic impacts associated with oil and gas development. The meetings, which were attended by experts in the respective fields and other interested stakeholders, identified information needs and recommended studies to support the BOEM mission.

In preparation for possible oil and gas exploration in the Chukchi Sea (see Figure 3), the Alaska OCS Region conducted a three day *Chukchi Offshore Monitoring in Drilling Area* (COMIDA) planning workshop November 1-3, 2006, in Anchorage. The purpose of the workshop was to identify potential monitoring tasks for a COMIDA field effort to meet information needs. Invitations were sent to over 150 scientists and stakeholders, including local and regional governments, tribes, native associations, oil industry and environmental groups. Over 100 scientists and stakeholders attended. Thirteen monitoring study profiles were developed by four working groups, discussed by the workshop participants, and submitted to the agency for prioritization and inclusion in the COMIDA field effort. The workshop report was published in April 2007 (USDOJ, MMS, Alaska OCS Region, 2007) and has become a useful planning tool that continues to influence our study priorities. Many of these same priorities have been reiterated by the 2011 USGS report.

#### 1.3.1 Beaufort Sea General Information Needs

Monitoring of Interdependent Physical, Biological and Social Processes: 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 EISs, EPs and DPPs are expected to 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. Related questions that need to be addressed are the characteristics of major oceanographic and meteorological processes and how they influence the human, marine and coastal environment.

The “Arctic Nearshore Impact Monitoring in Development Area” (ANIMIDA), a program started in 1999, was developed to address these issues. This suite of studies provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites (see Figure 6). The recently concluded continuation of ANIMIDA (cANIMIDA) gathered long term biological and chemical monitoring data to provide a basis of continuity and consistency in evaluation of potential effects from upcoming site-specific development and production in the Beaufort Sea OCS. The final study reports from cANIMIDA are available on our website of completed study reports and at the cANIMIDA website: <http://www.duxbury.battelle.org/canimida/home/index.cfm>.

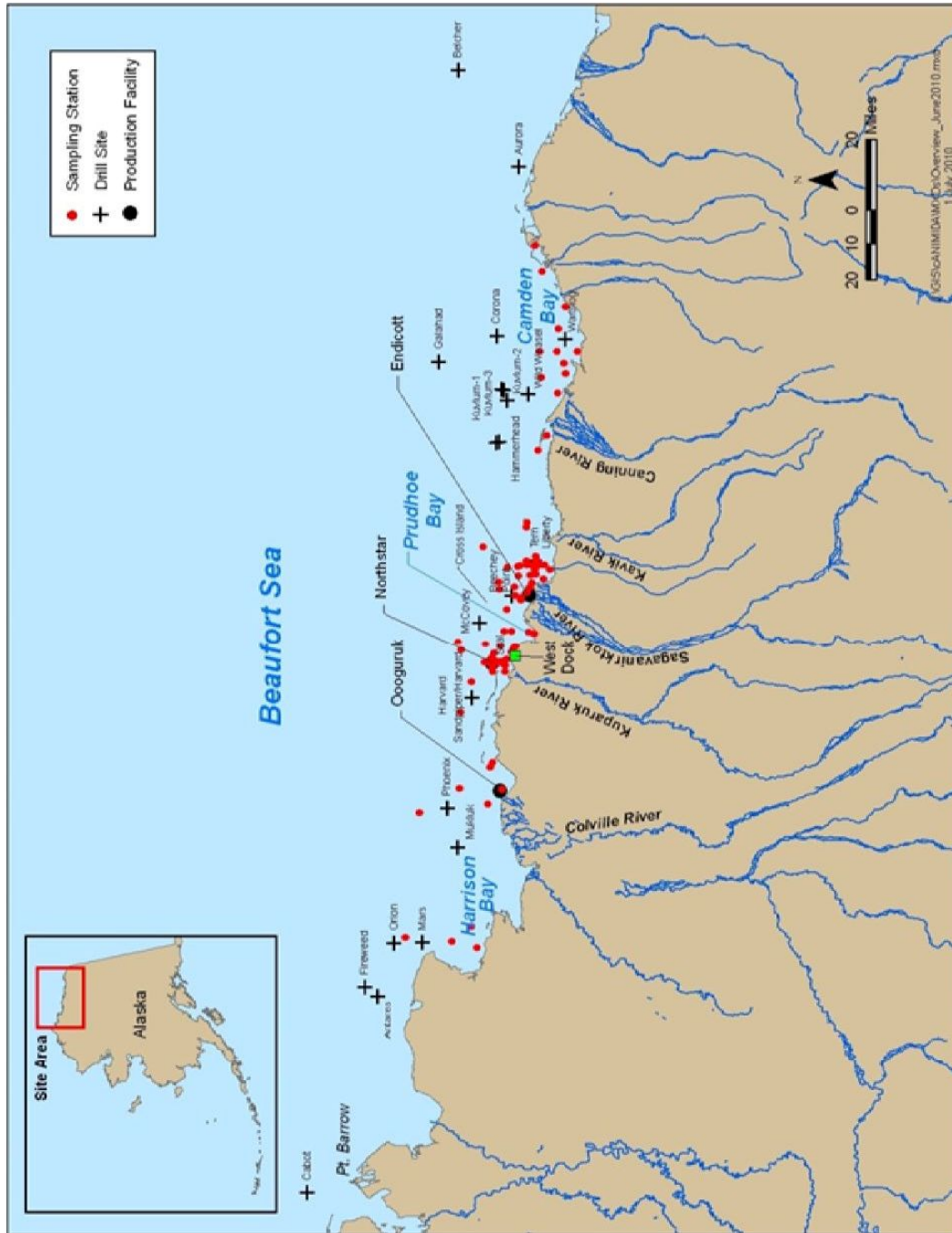
Much of this work is planned to extend beyond the cANIMIDA project. The “Continuation of Impact Assessment for Cross Island Whaling Activities” has recently been extended to add a fifth field season. The study “ANIMIDA III: Boulder Patch and other Kelp Communities in the Development Area” is planned to begin in 2012. Also, a planned companion study, “ANIMIDA III: Contaminants, Sources, and Bioaccumulation” will comprise a continuation of monitoring of sediment chemistry, turbidity and suspended sediment dispersion, and bioaccumulation of contaminants. This proposed study has been expanded in area to include Camden Bay, where drilling to delineate existing oil discoveries is planned.

A number of currently 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 1.3.4.

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 landfast ice completely blocks wind forcing of under-ice waters. Thus, water moves differently under landfast ice than adjoining open or pack ice waters. It becomes very important to know locations of and seasonal changes in the distribution of polynyas, leads, and landfast ice. The study “Enhanced Interpretation of Arctic Ice Formation, Distribution, and Density,” proposed for FY 2013, will enhance the resolution of regional-scale ice data to improve understanding of spatial and temporal variations in sea ice characteristics.

Air Quality: In December 2011, Congress returned authority over Arctic Outer Continental Shelf industrial air emissions from the Environmental Protection Agency to the Department of the Interior, through the OCS Program now under BOEM. The Outer Continental Shelf Lands Act originally required Interior to administer outer continental shelf oil and gas leasing in compliance with the U.S. Clean Air Act. In 1990, the Clean Air Act was amended to give the Environmental Protection Agency authority over air quality regulation in all areas of the OCS, except the central and western Gulf of Mexico. This transfer of authority to BOEM to regulate industrial emissions in Arctic OCS areas necessitates prioritization of Arctic OCS air quality studies.

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





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. The study “The Hanna Shoal Ecosystem Study” in the area between Barrow and the Chukchi Sea drilling area and the planned “ANIMIDA III” study in the Beaufort industrial development area will continue contaminant monitoring in biota and sediments.

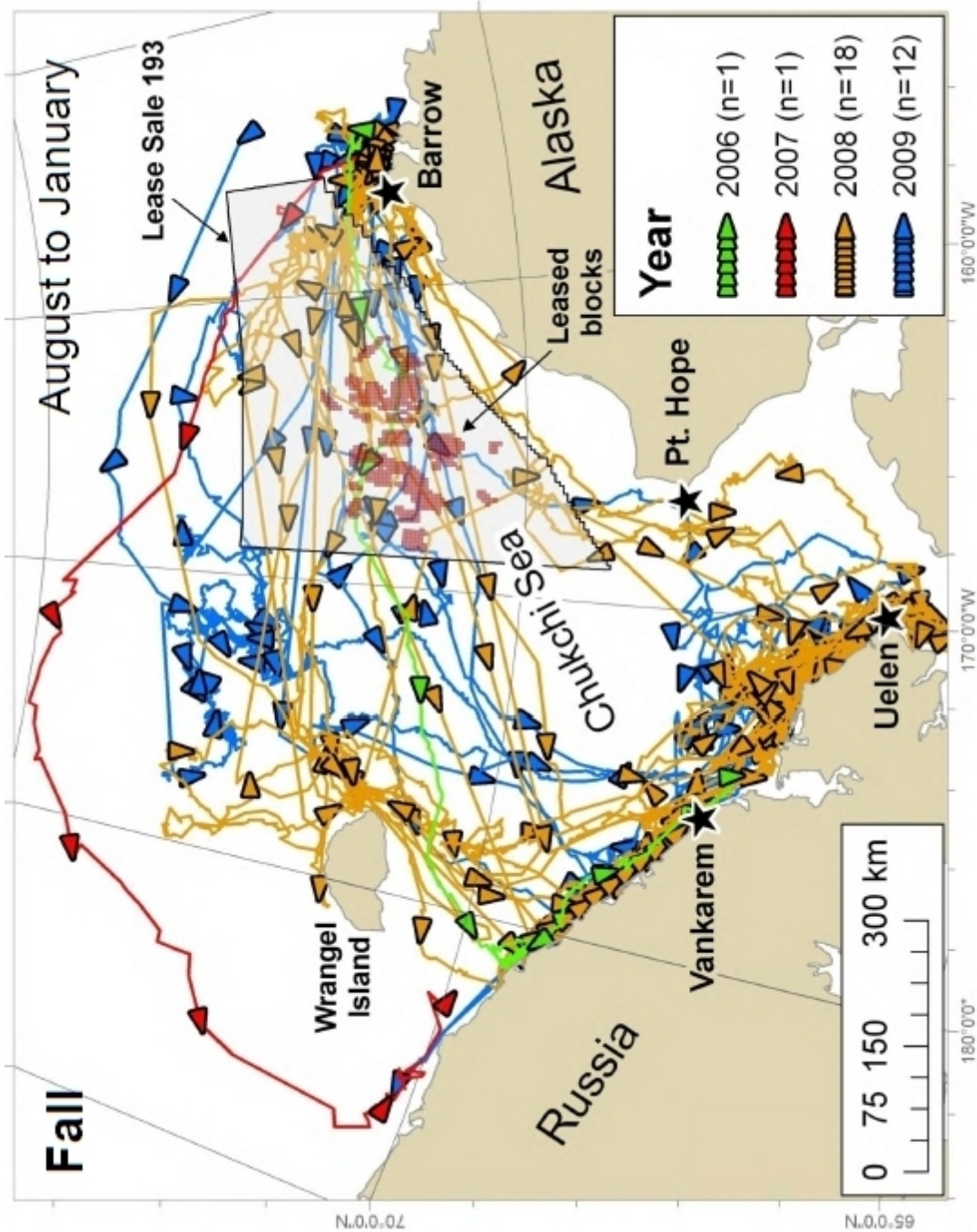
Concern has also been raised over increasing spillage from corroded pipelines on the North Slope. The study “Oil Spill Occurrence Estimators for Onshore Alaska North Slope Crude and Refined Oil Spills” will update spill data for the Alaska North Slope and estimate occurrence rates for onshore oil spills. 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 2013, 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: Iñupiat whale hunters rely heavily on bowhead whales for subsistence. The bowhead whale is central to village cultural and spiritual life. Figure 7 depicts a synthesis of tracks from 32 satellite-tagged bowhead whales during fall 2006–2009. Whale hunters have reported that migrating bowhead whales deflect from their normal migratory route well upstream of active industry vessels and may divert their migration route. A concern is that deflection around oil and gas-industry activity (including drilling activity and associated icebreaker support) makes whales skittish and more difficult to hunt. Bowhead whales also feed along the fall migration route and information about bowhead feeding and habitat use is needed. Additionally, Iñupiat whale hunters and the scientific community have raised concerns about potential cumulative impacts on bowhead whales. Noise from industrial activity is a central concern. It is important to assess the factors that may be affecting the habitat use, health, population status and migration routes of bowhead whales.

The populations of bowhead whales, polar bears, spectacled eiders, and other threatened and endangered species, as well as candidate species such as walrus and ice seals, are an ongoing concern of environmental groups, Federal agencies and others. 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.

**Figure 7** Tracks of 32 satellite-tagged bowhead whales during fall 2006–2009. (Quakenbush et al. 2010)



Native Culture: The Iñupiat report in public testimony that their culture is vulnerable to short-term, long-term and cumulative effects from OCS activities. There are concerns 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 lifestyle 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, including 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 augment the scientific knowledge base.

### 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 interdisciplinary linkages between the physical and biological sciences, and many of them also provide a role for active participation by 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 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.

#### 1.3.4 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.

*Synthesis of Arctic Research:* Between the years 2005 and 2015 MMS/BOEM will have invested more than \$50,000,000 in marine mammal and related oceanographic studies in the western Arctic. These data will 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.

*COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales:* This study partners BOEM with NOAA's Alaska Fisheries Science Center, National Marine Mammal Laboratory and the Pacific Marine Environmental Lab to document the distribution and relative abundance of whales in areas of potential industry activity and relate changes in those variables to oceanographic conditions, indices of potential prey density, and anthropogenic activities. This study is comprised of two components:

- *Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic:* This component 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 will fund the fabrication and deployment of arrays of long-term acoustic recorders that are capable of continuous year-round recording.
- *Ecosystem Observations in the Chukchi Sea:* The oceanographic component utilizes biophysical moorings, hydrographic measurements, and numerical climate models to monitor the changing ecosystem of the Chukchi Sea. The moorings measure ocean temperature, salinity, nutrients, chlorophyll (a measure of phytoplankton abundance), oxygen, photosynthetically available radiation, ice thickness, ocean circulation, and zooplankton abundance (volume).

The three-year study "Chukchi Acoustics, Oceanography and Zooplankton (CHAOZ): Hanna Shoal" proposed for FY 2013 will extend this monitoring to the area of Hanna Shoal.

### Physical Oceanography:

*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).

*Surface Current Circulation Mapping:* In collaboration with UAF, ocean current circulation fields are being mapped and analyzed along the coast of the northeastern Alaskan Chukchi Sea through the deployment of coastal High Frequency radar systems and offshore bottom mounted Acoustic Doppler Current Profilers. Such direct circulation measurements improve understanding of the ocean currents that drive oceanographic processes and influence the transport and fate of spilled oil.

*Polynyas and Landfast Ice:* In collaboration with CMI, this study extends previous research along the Beaufort/Chukchi coast to quantify through high resolution satellite imagery the spatial and temporal extent of the leads, polynyas and landfast ice, including any recent changes in their extent south of Icy Cape. The analysis also provides mean, minimum, and maximum measurements of landfast ice extent and examines the effects of climate state on ice characteristics.

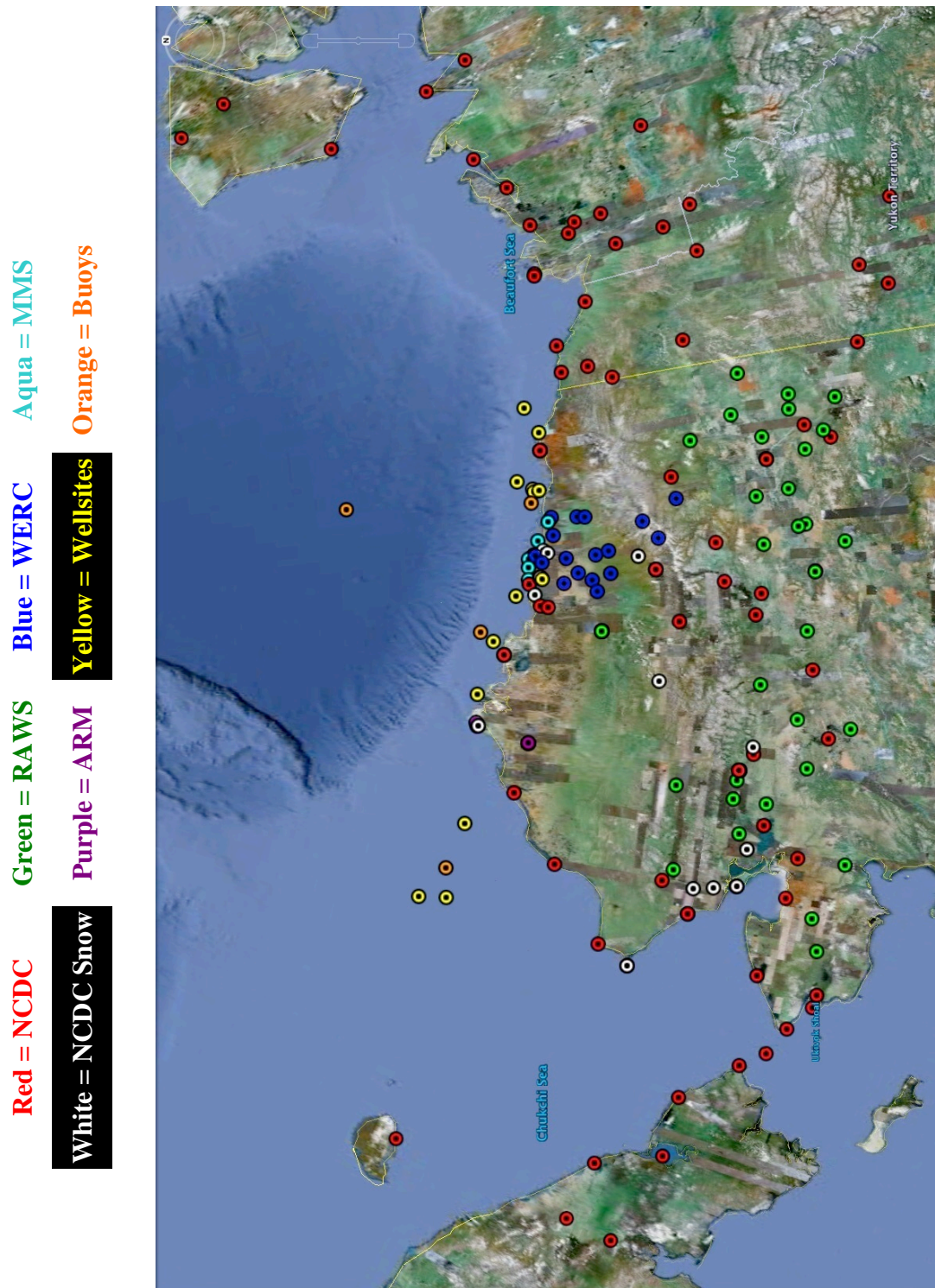
*Arctic Circulation Modeling:* This study, in collaboration with Rutgers University, will adapt a coupled ice-ocean circulation model to represent the physical processes, especially circulation, within the Chukchi and Beaufort seas. The study will conduct a multi-decadal hindcast simulation to provide surface circulation, ice and forcing fields for use in BOEM oil spill risk analyses.

### 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.

The 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.

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



*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.

*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.

*Pinniped Movements and Foraging: Bearded Seals:* Large numbers of pinnipeds migrate through and potentially occupy prospective oil and gas areas in the Chukchi Sea, including habitat near the Burger Prospect. Pinnipeds may be affected in a variety of ways during all stages of oil and gas exploration, development, and production. In collaboration with NMFS, this study develops a phased cooperative project with Native subsistence hunters to track the movements and habitat use of bearded seal in the western Chukchi Sea.

*Pinniped Movements and Foraging: Walrus:* In collaboration with the Alaska Department of Fish and Game, this study develops a phased cooperative project with Native subsistence hunters to track the movements and habitat use of walruses in the Chukchi Sea. The project trains Native hunters to deploy satellite transmitters on walruses in the vicinity of coastal villages and to conduct shore-based monitoring of tagged-walrus behaviors and general haul-out use patterns.

*Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area (Loons):* This collaboration with USGS-Biological Resources Division (BRD) provides updated information about marine bird distribution, species composition, molting, staging and timing of use of the eastern Chukchi nearshore environment in the vicinity of Peard Bay, Ledyard Bay, and Kasegaluk Lagoon.

*Migration and Habitat Use by Threatened Spectacled Eiders:* This study, in collaboration with USGS, estimates the spatial distribution, demographic composition, timing of use, and residence times of male and female spectacled eiders in the Chukchi and Beaufort Seas.

#### Habitat and Ecology:

*Beaufort Sea Marine Fish Monitoring:* In collaboration 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.



*Arctic Fish Ecology Catalogue:* Arctic fish ecological and behavioral information is only available piecemeal from a wide range of peer-reviewed and gray literature. This study, in collaboration with USGS, synthesizes ecological and behavioral information for freshwater, diadromous, and marine fish species occurring in the Beaufort and Chukchi Seas.

*Biogeochemical Assessment of the OCS Arctic Waters:* In collaboration with the Coastal Marine Institute at UAF, this cooperative study measures ecosystem productivity in the northern Bering Sea and in the Chukchi Sea and evaluates its vulnerability to climate change. The study involves three years of oceanographic sampling focused on measurements of dissolved organic and inorganic nutrients and carbon, total alkalinity, particulate organic matter, and pCO<sub>2</sub>.

*Recovery in a High Arctic Kelp Community:* In partnership with CMI, this study monitors rates of vegetative re-growth in the Boulder Patch kelp community to provide a better understanding of how sessile communities recover from disturbances.

#### Social Systems:

*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 offshore oil and gas operations. 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.

*Continuation of Impact Assessment for Cross Island Whaling Activities:* This synthesis study extends the long-term ethnographic monitoring effort for subsistence whaling activities that occur from the base camp at Cross Island. These data aid understanding of Cross Island subsistence whaling variation over time and support evaluation of the relationship of offshore oil and gas industry activities to whaling variability.

*Aggregate Effects Research and Environmental Mitigation Monitoring of Oil Operations in the Vicinity of Nuiqsut:* This synthesis study investigates and documents the history of negotiated mitigation measures for select oil related exploration and development activities near Nuiqsut. It identifies and analyzes both the formal and informal mitigation mechanisms that have emerged over time.

*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.

*Subsistence Use of Salmon Populations:* In partnership with CMI, this study will document local observations of increasing numbers of salmon in subsistence fisheries and conduct ethnographic fieldwork among Iñupiat communities about changing salmon populations/species composition. This data updates information on subsistence harvest and traditional knowledge about salmon and maps the spatial and temporal distribution of salmon species in streams.

## 1.4 New Starts for FY 2012 and Ongoing Studies

Table 1 lists new studies planned to start in FY 2012 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** Alaska OCS Region New Starts for FY 2011 and Ongoing Studies

Planning Area(s)	NSL #	Partners	Project Contact	TITLE
<b>* PLANNED NEW STARTS (FY 2012)</b>				
Chukchi	AK-11-08			Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area
Beaufort Chukchi	AK-11-11			Workshop—Interagency Protocols for Immediate On-Scene Arctic Oil Spill Impact Science
Beaufort Chukchi	AK-11-12			Maximum Credible Blowout Occurrence and Size Estimators for Alaska OCS
Beaufort	AK-11-14a			ANIMIDA III: Boulder Patch and other Kelp Communities in the Development Area
Beaufort Chukchi	AK-11-15			Alaska Environmental Database
Beaufort Chukchi	AK-12-01			Conference Management and Reports on BOEM Results
Beaufort Chukchi	AK-12-02			Satellite Tracking of Bowhead Whales: Habitat Use, Passive Acoustic and Environmental Monitoring
Beaufort Chukchi	AK-12-03a			Characterization of the Circulation on the Continental Shelf Areas of the Northeast Chukchi and Western Beaufort Seas
Chukchi	AK-12-03b			Applications for Mapping Spilled Oil in Arctic Waters
Beaufort	AK-12-04			U.S.-Canada Transboundary Fish and Lower Trophic Communities
Beaufort Chukchi	AK-12-06			Distribution and Habitat Use of Fish in the Nearshore Ecosystem of the Beaufort and Chukchi Seas
Beaufort Chukchi	AK-12-07			Use of the Chukchi Sea by Endangered Baleen and Other Whales (Westward Extension of BOWFEST)
<b>*Note: The procurement of any study is contingent upon availability of funding</b>				
<b>ONGOING STUDIES</b>				
<b>Physical Oceanography</b>				
Beaufort Chukchi	AK-06-05		Horowitz	Beaufort/Chukchi Seas Mesoscale Meteorology Modeling Study Phase II
Chukchi	AK-08-12-08	CMI	Horowitz	Satellite-Tracked Drifter Measurements in the Northeast Chukchi Sea
Chukchi	AK-09-02b	PMEL	Crowley	COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Biophysical Moorings and Climate Modeling
Chukchi	AK-09-04	CMI	Horowitz	Mapping and Characterization of Recurring Polynyas and Landfast Ice in the Chukchi Sea
Chukchi	AK-09-06	CMI	Horowitz	Surface Current Circulation High Frequency (HF) Radar Mapping in the Chukchi Sea
Beaufort Chukchi	NT-08-02		Johnson	Adaptation of Arctic Circulation Model

Planning Area(s)	NSL #	Partners	Project Contact	TITLE
<i>Fates and Effects</i>				
Chukchi	AK-08-03		Prentki	COMIDA: Chemistry and Benthos (CAB)
Beaufort Chukchi	AK-11-01		Prentki	Updates to the Fault Tree for Oil-Spill Occurrence Estimators Needed Under the Forthcoming BOEM 2012-2017, 5-Year Program
Beaufort Chukchi	AK-11-02		Prentki	Oil Spill Occurrence Estimators for Onshore Alaska North Slope Crude and Refined Oil Spills
<i>Habitat and Ecology</i>				
Chukchi	AK-93-48-67	CMI	Coon	Current & Historic Distribution & Ecology of Demersal Fishes in the Chukchi Sea Lease Area
Beaufort Chukchi	AK-07-05	BRD	Wedemeyer	Arctic Fish Ecology Catalogue
Beaufort	AK-08-12-02	CMI	Wedemeyer	Recovery in a High Arctic Kelp Community
Chukchi	AK-08-12-03	CMI	Prentki	Biogeochemical Assessment of the OCS Arctic Waters: Current Status & Vulnerability to Climate Change
Chukchi	AK-08-12-05	CMI	Wedemeyer	Trophic Links: Forage Fish, Their Prey, and Ice Seals in the Northeast Chukchi Sea
Beaufort	AK-08-12-07	CMI	Wedemeyer	Epifaunal Communities in the Central Beaufort Sea
Beaufort Chukchi	AK-08-12-09	CMI	Coon	Population Assessment of Snow Crab, <i>Chionoecetes opilio</i> , in the Chukchi and Beaufort Seas Including Oil and Gas Lease areas
Beaufort	AK-10-06	NMFS	Wedemeyer	Beaufort Sea Marine Fish Monitoring Survey in the Central Beaufort Sea
Beaufort Chukchi	AK-10-09	University of Alaska	Wedemeyer	Joint Funding Opportunities in Existing Marine Fish Studies
Beaufort Chukchi	AK-10-10	USFWS	Coon	Seabird Distribution and Abundance in the Offshore Environment
Chukchi	AK-11-03	CESU-UT	Crowley	Hanna Shoal Ecosystem Study
Beaufort	AK-11-10a	USGS	Coon	Shorebirds and Infaunal Abundance and Distribution on Delta Mudflats along the Beaufort Sea
Beaufort	AK-11-10b	CESU-UAF	Coon	Wading Shorebirds Habitats, Food Resources, Associated Infauna, Sediment Characteristics and Biomediation Potential of Resident Microbiota of Deltaic Mudflats
Beaufort Chukchi	AK-11-13a	USGS	Wedemeyer	Arctic Cod Pilot Genetics and Toxicity Study
<i>Marine Mammals and Protected Species</i>				
Beaufort Chukchi	AK-05-02	DFO	Cody	Populations and Sources of Recruitment in Polar Bears
Beaufort Chukchi	AK-06-01; AK-10-01	ADF&G, DFO	Denton	Bowhead Feeding Variability in the Western Alaska Beaufort Sea: Satellite Tracking of Bowhead Whales
Beaufort Chukchi	AK-06-01; AK-10-02	NMML	Denton	Bowhead Feeding Variability in the Western Alaska Beaufort Sea: Oceanography and Feeding
Chukchi	AK-07-04a	BRD	Coon	Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area (Loons)
Chukchi	AK-07-08	NMML	Holiday	Pinniped Movements and Foraging: Bearded Seals
Chukchi	AK-09-01	ADF&G	Coon	Pinniped Movements and Foraging: Walrus Habitat Use in the Potential Drilling Area (Chukchi)
Beaufort Chukchi	AK-09-02a	NMML	Crowley	COMIDA: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic
Beaufort Chukchi	AK-09-03	BRD	Coon	Migration and Habitat Use by Threatened Spectacled Eiders in the Eastern Chukchi Near and Offshore Environment

<b>Planning Area(s)</b>	<b>NSL #</b>	<b>Partners</b>	<b>Project Contact</b>	<b>TITLE</b>
Beaufort Chukchi	AK-09-05	BRD, USFWS	Cody	Demography and Behavior of Polar Bears Summering on Shore in Alaska
Beaufort Chukchi	AK-10-05	NMML	Denton	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	AK-11-05	PMEL	Crowley	Synthesis of Arctic Research (SOAR) Physics to Marine Mammals in the Pacific Arctic
Beaufort Chukchi	AK-11-06		Denton	Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea – Aircraft Needs
<b><i>Social Systems</i></b>				
Beaufort Chukchi	AK-05-04a	CESU-UAF, NSF	Campbell	Study of Sharing Networks to Assess the Vulnerabilities of Local Communities to O&G Development Impacts in Arctic Alaska
Beaufort	AK-08-01	NMML	Campbell	Continuation of Impact Assessment for Cross Island Whaling Activities-Beaufort Sea
Chukchi	AK-08-04		Campbell	COMIDA: Impact Monitoring for Offshore Subsistence Hunting
Bering	AK-08-06		Campbell	Subsistence Study for North Aleutian Basin
Beaufort	AK-08-09	NSSI	Campbell	Aggregate Effects Research & Environmental Mitigation Monitoring of Oil Operations in the Vicinity of Nuiqsut
Beaufort Chukchi	AK-08-10		Brian	Testing, Improvement, and New Alaska Data for MAG-PLAN
Beaufort	AK-08-12-04	CMI	Campbell	Subsistence Use and Knowledge of Beaufort Salmon Populations
Beaufort Chukchi	AK-11-09		Campbell	Social Indicators in Coastal Alaska: Arctic Communities
<b><i>Information Management</i></b>				
Beaufort Chukchi	AK-08-12-01	CMI	Crowley	BOEM-University of Alaska-State of Alaska Coastal Marine Institute Management
Beaufort Chukchi	AK-10-03	NPRB	Horowitz	Alaska Marine Science Symposium (co-sponsor)
Beaufort Chukchi	AK-10-04		Coon	Management, Logistics, and Warehouse Storage of Oceanographic Equipment
Beaufort Chukchi	AK-11-07		Coon	ShoreZone–Shoreline Mapping of the North Slope Alaska
<b><i>INTEGRATED STUDIES</i></b>				
Beaufort Chukchi	AK-05-04a	CESU-UAF, NSF	Campbell	Study of Sharing Networks to Assess the Vulnerabilities of Local Communities to O&G Development Impacts in Arctic Alaska
Beaufort Chukchi	AK-06-01; AK-10-02	NMML	Denton	Bowhead Feeding Variability in the Western Alaska Beaufort Sea: Oceanography and Feeding
Chukchi	AK-08-03		Prentki	COMIDA: Chemistry and Benthos (CAB)
Chukchi	AK-08-04		Campbell	COMIDA: Impact Monitoring for Offshore Subsistence Hunting
Beaufort	AK-08-09	NSSI	Campbell	Aggregate Effects Research & Environmental Mitigation Monitoring of Oil Operations in the Vicinity of Nuiqsut
Chukchi	AK-08-12-03	CMI	Prentki	Biogeochemical Assessment of the OCS Arctic Waters: Current Status & Vulnerability to Climate Change
Beaufort Chukchi	AK-09-02a	NMML	Crowley	COMIDA: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic

Planning Area(s)	NSL #	Partners	Project Contact	TITLE
Chukchi	AK-09-02b	PMEL	Crowley	COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Biophysical Moorings and Climate Modeling
Chukchi	AK-11-03	CESU-UT	Crowley	Hanna Shoal Ecosystem Study
Beaufort Chukchi	AK-11-05	PMEL	Crowley	Synthesis of Arctic Research (SOAR) Physics to Marine Mammals in the Pacific Arctic
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		
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 eleven new studies for FY 2013. The proposed studies focus on the Beaufort and Chukchi seas.

The Alaska 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/Environmental-Stewardship/Environmental-Studies/Alaska-Region/Index.aspx>

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://alaska.boemre.gov/ref/AKPUBS.HTM>

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## 2.2 Profiles of Studies Proposed for FY 2013 NSL

**Table 2** Alaska OCS Region Studies Proposed for the FY 2013 NSL

Page No.	Discipline	Title	Ranking
39	AQ	Arctic Air Quality Impact Assessment Modeling	1
41	MM	Chukchi Acoustic, Oceanography and Zooplankton Study: Hanna Shoal (Extension of CHAOZ)	2
43	IM	Coastal Marine Institute (extension)	3
45	IM	Cook Inlet Workshop: Information Status & Research Planning	4
47	PO	Enhanced Verification and Interpretation of Arctic Ice Formation, Distribution, and Density	5
49	IM	*Support for the 2012 United States-Canada Northern Oil and Gas Research Forum	6
51	MM	*Walrus Seasonal Distribution and Habitat Use in the Eastern Chukchi Sea	7
53	FE	Physical and Chemical Analyses of Crude and Refined Oils: Laboratory and Mesoscale Oil Weathering	8
55	SS	Subsistence Mapping of Wainwright, Point Lay, and Point Hope	9
AQ = Air Quality IM = Information Management PO = Physical Oceanography		FE = Fates & Effects SS = Social Systems HE = Habitat & Ecology	MM = Marine Mammals and Protected Species REN = Renewable Energy

\* Denotes project that remains contingent on collaboration with external groups.

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## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Alaska

**Planning Area(s):** Beaufort Sea, Chukchi Sea

**Title:** Arctic Air Quality Impact Assessment Modeling

**BOEM Information Need(s) to be Addressed:** BOEM requires information 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 permit requirements. This information would be used by BOEM and various federal and state agencies to support compliance with the Clean Air Act and environmental justice initiatives. In addition, the information would provide public agencies, permit applicants, and the public with a holistic view of the air pollution impact on the people and environment in Northern Alaska.

**Cost Range:** (in thousands) \$1,600-\$2,400      **Period of Performance:** FY 2013-2016

### **Description:**

Background: Arctic oil and gas exploration and extraction activities proposed for the OCS require environmental evaluations pursuant to the National Environmental Policy Act and air pollution operating permits to comply with the impact analysis required under NEPA and the Clean Air Act. An air quality model capable of conducting an air impact analysis requires various input datasets, including emission 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 Modeling and Analysis System (CMAQ) or the Comprehensive Air Quality Model, with extensions (CAMx), to assess the cumulative air quality impact of proposed offshore OCS projects and North Slope support activities.

A current BOEM project, “Chukchi/Beaufort Seas Mesoscale Meteorology Modeling Study” (MMM data), is developing a long-term dataset of meteorological model data. While useful in air quality modeling, the MMM dataset configuration is designed to support modeling of an oil spill response. The data was not evaluated and optimized for air pollutant concentrations and transport. The project proposed in this profile would leverage the current BOEM MMM data project to produce a five-year meteorological modeling dataset (years 2007-2011) that could be evaluated and optimized for performance with air quality dispersion models.

Various estimates exist for pollutant emissions from proposed and existing North Slope and OCS activities, but there is no overall analysis to show the increased pollutant concentration from all aspects of the proposed activities, including increased emissions in towns along the coast, emissions from support vehicles far from the drilling operation, and aircraft and helicopter emissions. This project would pull together all existing emissions information available from the Alaska Department of Environmental Conservation, which would be combined with estimates of additional emissions from proposed OCS activity. From this

comprehensive database, an emission inventory could be calculated and translated to three-dimensional emissions for a time period of interest (i.e., output from the Sparse Matrix Operator Kernel Emissions [SMOKE] processor).

The meteorological and emissions datasets would be applied to 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<sub>2.5</sub>) and ozone chemistry that may be occurring in this environment. This study will be coordinated with work in the Gulf of Mexico OCS Region to avoid duplication of efforts and ensure consistency with similar approaches.

#### Objectives:

- Test the hypothesis that the cumulative impacts from OCS-related activities, exclusive of permitted sources, would not be statistically significant.
- Test the hypothesis that secondary PM<sub>2.5</sub> and ozone are not significant for cumulative impact analyses.
- Evaluate modeling results to assess the cumulative impact of emissions on the OCS and on the North Slope.
- Apply the results to demonstrate compliance under the NEPA and the Clean Air Act for EISs and EAs prepared by BOEM and to develop valid exemption thresholds.

#### Methods:

1. Build upon meteorological datasets developed by the BOEM “Beaufort/Chukchi Seas Mesoscale Meteorology Modeling Study” and by industry that reflect climatological conditions of the North Slope, Beaufort Sea, and Chukchi Sea.
2. Format the compiled dataset for use in dispersion models approved for the Arctic OCS.
3. Build an input database of emission sources typically associated with oil and gas activities on the OCS. Build in scenarios of potential OCS development.
4. Prepare an emission inventory using EPA-approved calculation methods and prepare emissions data sufficient as input to a regional air quality model.
5. Conduct air quality modeling by applying the input datasets to an EPA-approved model such as CMAQ or CAMx.
6. Analyze importance of atmospheric chemistry with tools such as a literature survey, box chemistry models, plume models with chemistry, and regional air quality models.
7. Assess the results to identify the background impact and the cumulative impact of proposed OCS activities to meet the project objectives.

**Revised Date:** April 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Alaska

**Planning Area(s):** Beaufort Sea, Chukchi Sea

**Title:** Chukchi Acoustic, Oceanography and Zooplankton Study: Hanna Shoal (Extension of CHAOZ)

**BOEM Information Need(s) to be Addressed:** Information from this study will document the physical and biological dynamics in the Hanna Shoal region, including the temporal and spatial distribution of marine mammals. Findings may be used for evaluating potential deferral areas and other potential limitations on offshore leasing, exploration, and development. This study will provide useful information to support NEPA analysis and documentation for Beaufort and Chukchi Sea Lease Sales, exploration plans, development and production plans, consultations under the ESA and MMPA, and monitoring protocols for adaptive management.

**Cost Range:** (in thousands) \$2,800-\$4,200      **Period of Performance:** FY 2013-2016

### **Description:**

**Background:** The western Arctic physical climate is rapidly changing. The summer minimum sea ice extent in 2007, 2008 and 2011 covered an area which was 37% less than the areal coverage of two decades ago and 20% less than the previous minimum coverage in 2005. The reduction in sea ice coverage also opens up vast new regions of the Arctic Ocean to increased absorption of sunlight and storage of heat. The rapidity of these changes was unexpected, as the consensus of the climate research community just a few years ago was that such changes would not be seen for another 30 years. The observed northward retreat of the minimum extent of summer sea ice has the potential to expand oil and gas-related exploration and development into previously closed seasons and localities in the Alaskan Arctic.

Baleen whales (bowheads [*Balaena mysticetus*], gray whales [*Eschrichtius robustus*], fin whales [*Balaenoptera physalus*], humpbacks [*Megaptera novaeangliae*], and minke [*Balaenoptera acutorostrata*]) are subject to changes in environmental variables such as oceanographic currents, sea temperature, sea ice cover, prey availability, and anthropogenic impacts. Furthermore, extreme ice-retreat and climate warming in the western Arctic over the last decade are expected to lead to changes in species composition and distribution, evidenced already through local knowledge and opportunistic observations.

Hanna Shoal in the northeast Chukchi Sea is an area of special biological concern bordering the boundary between Chukchi and Arctic Ocean waters. The reason for this, however, is poorly understood. The shallower waters of the shoal have long been known as traps for grounding of sea ice, and a reoccurring polynya is created down current of the grounded ice. In most recent years, floating pack ice in summer persists in this area longer than elsewhere in the Chukchi, often surrounded by open water even to the north. Biological “hot spots” in the Chukchi Sea are thought to be related to coupled pelagic and benthic productivity. The importance of the Hanna Shoal region to bowhead, gray and other whales, as well as walruses and ice seals, is not well known.

The study “COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales” combines passive acoustic detection and tracking of whales, active acoustic detection of zooplankton, and biophysical measurements from long-term moorings on the Chukchi Shelf to examine relationships between primary production, zooplankton biovolume and the presence/absence of whales. Passive acoustic detection and tracking is a proven tool for assessment of large whales in Alaskan seas. Specifically, acoustic detection has proven a key addition to the census of bowhead whales (*Balaena mysticetus*) during their spring migration past Barrow, and in relation to oil and gas development activities offshore Prudhoe Bay. The proposed study will refocus this monitoring to the region of Hanna Shoal. These measurements will complement the biological, oceanographic and contaminant data collected by the “Hanna Shoal Ecosystem Study.”

**Objectives:** This study will refocus the acoustic and biophysical monitoring begun under the study “COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales” to the region of Hanna Shoal. Specific objectives include:

- Assess the spatial and temporal distribution of marine mammals near Hanna Shoal.
- Implement a tonal detector/classifier for all marine mammal species of interest to BOEM in the Arctic.
- Describe patterns of current flow, hydrography, ice thickness, light penetration, and concentrations of nutrients, chlorophyll and large crustacean zooplankton.
- Evaluate the extent to which variability in environmental conditions such as sea ice, oceanic currents, water temperature and salinity, and prey abundance influence whale distribution and relative abundance.
- Develop a quantitative description of the Chukchi Sea’s noise budget, as contributed by biotic and abiotic sound sources, and continuous, time-varying metrics of acoustic habitat loss for a suite of arctic marine mammal species.

**Methods:** This study will deploy long-term passive acoustic recorder moorings in the vicinity of Hanna Shoal to provide information on marine mammal distribution. Researchers will also opportunistically deploy sonobuoys to monitor vocalizing marine mammals while the ship is underway. Annual data will be analyzed for whale calls to estimate: seasonal occurrence by species, inter-annual differences in occurrence by species, variation in occurrence due to changes in ice extent, types and strengths of anthropogenic noise in the study area. Biophysical moorings and active acoustic moorings for zooplankton deployed on the flanks of Hanna Shoal will collect information on currents, hydrography, ice, nutrient and chlorophyll concentrations, etc. These instruments will be refurbished and redeployed annually.

The study will also use autonomous and real-time passive acoustic recording systems to monitor the Chukchi Acoustic ecosystem and quantify changes in its acoustic habitat as a function of natural and man-made noise contributors. The systems will automatically collect, detect and report via satellite species-specific sounds from a broad suite of marine mammals in the Chukchi Sea, including: beluga, bowhead, fin, humpback and killer whales; bearded, ribbon and ringed seals; walrus; and fishes. These data will populate models of the acoustic environment that are currently under development.

**Revised Date:** April 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Alaska

**Planning Area(s):** All Alaska Planning Areas

**Title:** Coastal Marine Institute (extension)

**BOEM Information Need(s) to be Addressed:** By adopting this cooperative agreement, improved leasing decisions and NEPA analyses pertinent to lease sales in the Beaufort Sea, Cook Inlet and Chukchi Sea can be made. Final reports will be available for lease sales and post-sale decisions; interim data products and inputs will be used to address information needs. Topical areas to be addressed under the Coastal Marine Institute have been identified through this Annual Study Plan, previous Alaska Region study plans, and the Framework Issues. The study also will develop information that addresses public concerns raised during outreach efforts.

**Cost Range:** (in thousands) \$4,000-\$6,000      **Period of Performance:** FY 2013-2017

### **Description:**

Background: This study provides management of a large ongoing program of scientific research into framework issues related to potential future lease sales in the Alaska OCS Region. It is a cooperative program between BOEM and the University of Alaska, with State of Alaska participation. The Coastal Marine Institute (CMI) is expected to leverage additional scientific results and logistics capability at levels comparable to the BOEM contribution of \$1,000,000 per year. The Coastal Marine Institute will update and expand our understanding of OCS environmental information and address future needs related to the offshore oil and gas program in Alaska.

Objectives: The purpose of the CMI is to support BOEM's commitment to environmental stewardship and generate scientific information for BOEM and State of Alaska decision makers that is consistent with the needs outlined by the Framework Issues. The Framework Issues are:

- Scientific studies for better understanding marine, coastal or human environments affected or potentially affected by offshore oil and gas or other mineral exploration and extraction on the OCS.
- Modeling studies of environmental, social, economic, or cultural processes related to OCS gas and oil activities in order to improve scientific predictive capabilities.
- Experimental studies for better understanding of environmental processes, or the causes and effects of OCS activities.
- Projects which design or establish mechanisms or protocols for sharing data or scientific information regarding marine or coastal resources or human activities in order to support prudent management of oil, gas and marine mineral resources.
- Synthesis studies of scientific environmental or socioeconomic background information relevant to the OCS gas and oil program.

Methods: A proposal process is initiated each year with a request for letters of intent to address one or more of the Framework Issues. The proposals are requested from university researchers and other scientific researchers in State agencies. A Technical Steering Committee, made up of scientific representatives of the cooperators, reviews letters of intent and proposals to be evaluated for possible funding. External peer reviews may be requested for new projects. Principal investigators give presentations at ITMs, scientific conferences and various public meetings.

**Revised Date:** April 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Alaska

**Planning Area(s):** Cook Inlet

**Title:** Cook Inlet Workshop: Information Status & Research Planning

**BOEM Information Need(s) to be Addressed:** The BOEM 5-year leasing program 2012-2017 may consider a lease sale in the Cook Inlet. An OCS Cook Inlet Lease Sale EIS hasn't been undertaken since 2003. This area has a number of natural resources development issues (state and federal oil/gas, coal production, hydro/kinetic energy), ESA issues (Cook Inlet Beluga Whale) as well as importance for commercial, recreational, and subsistence fishing. In addition there has been a lot of research conducted by state and federal agencies in the last decade. A workshop would provide a method to identify and gather literature, and identify current research programs, and current resource uses and stakeholder concerns. Information made more accessible by these efforts will be used in NEPA analysis and documentation for Lease Sales, Explorations Plans (EPs), and Development and Production Plans (DPPs), including cumulative impacts, as well as meeting preparations and the writing of new studies descriptions.

**Cost Range:** (in thousands) \$65-\$100

**Period of Performance:** FY 2013-2014

### **Description:**

Background: Cook Inlet holds promising energy resources by state, federal, and private industry for oil and gas, coal, and alternative energy. Additionally scientists are accumulating a wealth of information about Cook Inlet oceanography that could prove invaluable in predicting the movement of pollutants and oil spills as resource development is considered. The National Ocean Service's circulation model will be completed in 2013.

Additionally, pursuant to Section 388 of the Energy Policy Act of 2005, BOEM has discretionary authority on leasing, easements or rights-of-way on the OCS for alternative energy projects, such as wind, wave, or ocean current facilities. As Cook Inlet holds promising efforts for alternative energy resources this workshop would build on existing information conducted by NOAA/AEA. It would use the new Cook Inlet Response Tool – created by AOOS/CIRCAC, the National Ocean Service (NOS) Circulation model (complete in 2013), and new NOS multibeam data available for Kachemak Bay and Upper Cook Inlet.

Objectives: The objective of this study is to assess the current status of information about the Cook Inlet marine, coastal, and human environment and to prioritize information needs. Topics will include: oceanography and ecosystems; fish and fisheries; seabirds, shorebirds and waterfowl; marine mammals; socioeconomic and subsistence issues; or other subjects relevant for NEPA analysis.

Methods:

1. Conduct a literature search of material relevant to Cook Inlet authored over the last 15 years. Information will be compiled using available tools, such as Web of Knowledge, and results will be provided in a RefWorks database.
2. Compile a report with GIS maps that summarizes:
  - current research programs in Cook Inlet conducted by Federal and State agencies, industry, non-governmental organizations, etc.
  - current and permitted energy uses in the area, including: oil and gas, coal, wind, hydro-energy
  - other relevant information such as vessel traffic, ESA issues, etc.
3. Hold a facilitated 2-3 day workshop in Anchorage with subject matter experts, knowledgeable local stakeholders, relevant agency representatives, and BOEM staff to prioritize information needs and evaluate study concepts for future monitoring.

**Revised Date:** April 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Alaska

**Planning Area(s):** Beaufort Sea, Chukchi Sea

**Title:** Enhanced Verification and Interpretation of Arctic Ice Formation, Distribution, and Density

**BOEM Information Need(s) to be Addressed:** This study will provide improved analytic interpretation and decision-making tools about inter-annual ice characteristics for offshore lease areas in the Beaufort and Chukchi Seas during freeze-up conditions (October/November). The study will improve resolution and interpretation of available data about ice formation, including new ice as well as pack ice incursion timing, growth, distribution, density, and velocity. BOEM's NEPA analysts often require detailed spatial and temporal information about freeze-up conditions over specific locations within the OCS. Data will be provided in a format that is compatible with existing BOEM digital databases and products. Study products will be used for NEPA analysis, including region specific environmental assessments, and during regulatory review of applications for permit to drill (CFR§250.417).

**Cost Range:** (in thousands) \$1,000-\$1,500      **Period of Performance:** FY 2013-2015

### **Description:**

**Background:** BOEM has proposed a restriction on late season (freeze-up) drilling operations that would assure a greater opportunity for spill response and cleanup. As a consequence of this proposed mitigation measure, BOEM requires information on the timing of freeze-up conditions over the proposed drilling locations. BOEM utilizes spatial data from the BOEM Sea Ice Database and from the study "Mapping and Characterization of Recurring Spring Leads and Landfast Ice in the Beaufort and Chukchi Seas" (OCS Study MMS 2005-068) to provide Environmental Assessment Analysts with the information needed to determine the timing of freeze-up conditions, and when drilling activities must cease at the proposed drill site. This information is produced on an annual basis based upon information from the five previous ice seasons. For the 2012 drilling season, the information was calculated from 2007-2011. The BOEM Sea Ice Database contains weekly and sometimes biweekly National Ice Center (NIC) interpreted spatial and temporal sea ice polygons in ESRI GIS format. The sea ice polygons contain attributes of ice concentration and ice type. The database contains NIC sea ice data from the 1970's to present. The BOEM Sea Ice Database is used internally to investigate sea ice concentration and ice type both seasonally and interannually and to determine the timing of freeze-up conditions (new ice) over the proposed drill sites.

Although the data contained within BOEM Sea Ice Database is considered good, it is not peer-reviewed by outside sources, it lacks resolution at times, and the satellite imagery used to interpret the data is inaccessible to the user. This study will provide an independent assessment of the offshore ice conditions during the freeze-up period, improve the spatial and temporal resolution of these data by providing a more refined analysis of late season ice

conditions within the Chukchi and Beaufort seas. This new study will enhance the resolution of regional scale ice data through analysis of bi-weekly satellite data and improvements in ice data interpretation through ground-truthing utilizing available oceanographic instruments and potential aerial surveys. The new data analysis will provide a more refined product describing the type and extent of new ice formation beyond the landfast ice boundary and improve interpretation of the timing, characteristics, and speed of the main pack ice incursion into the active OCS lease area.

Objectives: The study will achieve the following objectives pertaining to the months of October/November during the years 2007-2013 for the areas which include the Chukchi and Beaufort Sea active OCS lease areas:

- (New Ice Formation from Shore) Interpret, analyze and document the seasonal and interannual spatial and temporal characteristics of timing, growth and persistence of new ice formation, and its relationship to atmospheric forcing and available oceanographic measurements.
- (Pack Ice Incursion) Interpret, analyze and document the seasonal and interannual spatial and temporal characteristics of timing and growth of pack ice incursion with changing atmospheric forcing conditions.
- Interpret, analyze and document the seasonal and interannual variation in freeze-up conditions within the Chukchi and Beaufort Seas active lease areas from 2007-2013.
- Enhance the analytical capabilities of the BOEM Sea Ice Database with additional data and information provided by this study.

Methods: This new study will enhance the resolution of regional scale ice data 1) through analysis of bi-weekly satellite data (high resolution Synthetic Aperture Radar) and other imagery; and 2) as a result of improvements in ice data interpretation through ground-truthing from available meteorological and oceanographic measurements of offshore conditions. High resolution Synthetic Aperture Radar (SAR), thermal, MODIS sea surface temperature, and other satellite imagery will be processed and analyzed to map late season new ice formation from shore out to the active lease areas and pack ice incursion into the active lease areas from the north for the years 2007 through 2013. Available atmospheric model data, local meteorological data, and oceanographic measurements will be collected to document the seasonal growth of new ice from shore. Atmospheric model data will be used to estimate the daily, weekly, and late season movement of pack ice into the active lease areas. Five years of late season data will be incorporated into the BOEM Sea Ice Database to quantify the late season formation, growth, movement, speed and characteristics of new ice and pack ice incursion into the Beaufort and Chukchi seas active lease areas from 2007-2013. The derived data and analysis will be delivered in appropriate database formats that will enhance the current BOEM Sea Ice Data Analysis. A final report and peer-reviewed journal article will be produced to document the results.

**Revised Date:** May 3, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Alaska

**Planning Area(s):** Beaufort and Chukchi Seas (and adjoining Canadian Beaufort Sea)

**Title:** Support for the 2012 United States-Canada Northern Oil and Gas Research Forum

**BOEM Information Need(s) to be Addressed:** This Forum provides BOEM scientists and Principal Investigators for BOEM Alaska OCS Region studies and BSEE researchers for the TAR Program a unique bi-lateral forum to share their research findings on the Arctic Alaska marine environment with U.S. and Canadian decision-makers and stakeholders, and an opportunity to network with other scientists and researchers from around Alaska, the nation, and Canada. Since it is impossible for any agency or group to conduct all of the needed research within the Arctic Alaska OCS Region and adjoining Canadian Beaufort Sea, this Forum provides marine researchers with the opportunity to gather information on other areas of similar research and foster important future collaborative efforts. The bi-lateral nature of the Forum recognizes the shared natural resources of our two countries and the need to share research goals and results between Canada and the United States in the Beaufort and Chukchi seas. This Forum is complementary to the function and intent of the Alaska Marine Science Symposium and widens the scientific, decision-maker and stakeholder audience for BOEM Environmental Studies Program and BSEE TAR Program, thus improving the understanding of the full spectrum of research and research needs in western Arctic North America for oil and gas activity management.

**Cost Range:** (in thousands) \$40-\$60  
plus Joint Funding

**Period of Performance:** FY 2013

### **Description:**

Background: The First United States-Canada Northern Oil and Gas Research Forum, held in Anchorage, Alaska in 2008 was a tremendous success. Over 275 people registered for the Forum and it featured over 20 poster sessions and nearly 50 oral presentations under the broad topics of Technical-Engineering; Socio-cultural/Socio-economic; Biological Sciences; and Physical Sciences. In addition, there were three panel discussions—U.S. and Canadian Management Research Needs and Priorities; US and Canadian Industry Research Priorities; and Final Facilitated Wrap Up and Next Steps session. The United States and Canada supported the first Forum. A combination of funding from the MMS (now BOEM) ESP, through the association of the Forum with the 11<sup>th</sup> Information Transfer Meeting, and the North Slope Science Initiative (NSSI) paid for the venue, conference management, and logistics. The Canadian government through Department of Indian and Northern Affairs Canada funded the meeting facilitation, abstract volume, and final Forum Proceedings. The Proceedings are posted at <http://alaska.boemre.gov/ess/itm/ITMINDEX.htm>.

The Second Canada-US Northern Oil and Gas Research Forum was hosted by the Department of Indian and Northern Affairs Canada in 2010 in Calgary, Alberta. Ninety attendees

presented their research results as part of a panel discussion or in oral and poster presentations and brought together 239 participants from government, industry, academia, Aboriginal groups, and non-governmental organizations. Several common themes emerged from the Forum, including: the need for continued and improved communication and collaboration; improved data gathering, management, access, and discovery; further development of decision support tools and processes; and continued research to fill science and technology gaps. The Arctic Research Consortium of the United States (ARCUS) prepared the Final Forum Report, available at <http://www.arcus.org/meetings/2010/northern-oil-and-gas-research-forum>. The second Forum featured a reverse of the previous funding mechanisms, with the Canadian government paying for the local venue, conference management and logistics, and the U.S. paid for the meeting facilitation, registration, and production of the final Forum Proceedings report. The NSSI funded the majority of these functions and other Federal agencies contributed funding, including \$20,000 from the BOEM ESP in Alaska for finalizing the ARCUS Forum Report.

Objectives: The purpose of this study is to share information and utilize available expertise during the 3<sup>rd</sup> U.S.-Canada Northern Oil and Gas Research Forum. More specifically the objectives of the forum are to:

- Showcase current research programs, demonstrating how they have contributed to decision-making through environmental review and the regulatory process and highlighting the involvement of indigenous people in research programs;
- Identify how to move research findings into decision-making fora; and
- Discuss future oil and gas research needs, including synergies and partnerships, for the Beaufort and Chukchi seas, Mackenzie Delta and North Slope.

Methods: The third US-Canada Northern Oil and Gas Research Forum will take place in the United States and BOEM will provide a financial contribution to support the local venue, logistical, and conference management aspects of running the Forum. In addition, funding will be sought from other U.S. and Canadian Federal agencies and Departments including the BSEE, the Office of the Secretary, NSSI, Alaska Office of the Federal Coordinator for Alaska Natural Gas Transportation Projects, and the Department of Aboriginal Affairs and Northern Development Canada. Funding for the 3<sup>rd</sup> Forum will mirror the first meeting, with the U.S. covering the cost of local venue, meeting logistics and organization and the Canadian Government funding the meeting facilitation and Forum Report.

**Revised date:** April 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Alaska

**Planning Area(s):** Chukchi Sea

**Title:** Walrus Seasonal Distribution and Habitat Use in the Eastern Chukchi Sea

**BOEM Information Need(s) to be Addressed:** Data on the seasonal distribution, abundance, and habitat use of walrus (*Odobenus rosmarus*) are an integral part of assessing and managing anthropogenic risks and environmental effects of Chukchi OCS development on marine mammals. Information on these ecological parameters in the Chukchi Sea are coming to light from current USGS walrus studies, but require future dedication, especially in light of the loss of sea ice habitat and ecological changes that have occurred in recent years. This study will provide information for NEPA analyses for proposed OCS oil and gas activities, MMPA authorizations, and ESA conferences. This study will contribute information useful for developing mitigation strategies to reduce impacts to walrus from proposed oil and gas development activities. In addition, walrus in the Chukchi Sea are important to Alaska and Russian Natives for subsistence.

**Cost Range:** (in thousands) \$1,400-\$2,100      **Period of Performance:** FY 2013-2018

### **Description:**

**Background:** Joint US-Russia aerial surveys of walrus were conducted in the Chukchi Sea in the fall of 1975, 1980, 1985, 1990, and 1995. A joint US - Russia walrus aerial survey was conducted in spring of 2005 in the Bering Sea. Recent declines in summer/fall sea ice in the Chukchi Sea have resulted in walrus hauling out at coastal sites in Alaska in fall when sea ice completely disappears over the eastern continental shelf. This situation provides an opportunity to count walrus along the coast of Alaska from aerial surveys. The BOEM-funded COMIDA program has conducted opportunistic surveys of the coast to enumerate walrus over the past few years.

The USGS initiated a study in 2007, and expanded the study in subsequent years, to determine the seasonal distribution and habitat use of walrus in the Chukchi Sea. A report on walrus utilization areas in 2008-2011 is forthcoming. However, patterns of utilization are still being established by walrus in response to continued reductions in sea ice habitats in the Chukchi Sea. Also, BOEM funded a satellite tagging project in 2009 to study the movements and habitat use of selected walrus in the Chukchi Sea.

Exploration activities in the Chukchi Sea are expected to begin in 2012 and continue through at least 2014. Therefore, walrus monitoring needs to continue without interruption through at least the next five years to provide pre-development and development information and describe changes in walrus distribution and abundance associated with changing sea ice habitats. Information regarding the seasonal distribution, abundance, habitat use, and diet of

walrus across the planning area will assist in assessing potential impacts and mitigating disturbances associated with proposed exploration and development scenarios. The monitoring activities described in this study profile follow recommendations of the national Ocean Research Priorities Plan (ORPP).

Objectives: The overarching objective of the study is to obtain information on the seasonal abundance, distribution, and habitat use of walrus in the Chukchi Sea. Specific objectives of this study include:

- Estimate the abundance of walrus in the eastern Chukchi Sea in late summer/fall.
- Delineate the areas that are most important to walrus during critical times of their annual life history cycles such as feeding.
- Determine seasonal distribution and movements of walrus in the Chukchi Sea lease sale area.
- Identify habitats of importance to walrus (e.g., feeding and resting).
- Determine whether prey selection and/or foraging areas are changing over time with increased use of nearshore habitats.

Methods:

1. Conduct aerial surveys in late summer and early fall to enumerate walrus at coastal haulouts in Alaska. Effort will focus on development of necessary correction factors.
2. Deploy radio-tag instruments on a sufficient sample of walrus.
3. Use GIS and spatial analysis methods to define important habitats, identify migration pathways, and to identify areas for potential deferral from future lease sales.
4. Collect appropriate walrus tissue, fecal and/or biopsy samples and perform molecular analysis to identify prey taxa and trends in dietary taxa composition over time.
5. Utilize sound source information and satellite-tag data to track walrus location relative to industry activities.

**Revised date:** April 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**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 EIS analysts with a common, quantitative set of spill weathering parameters. However, the current Alaska OCS Region NEPA assessment process is limited by having only a small subset of lab-analyzed oil samples specific to the Alaska OCS and North Slope to run in the SINTEF oil weathering model. The addition of new low-sulphur marine diesel fuels to the library would be especially useful.

**Cost Range:** (in thousands) \$350-\$530

**Period of Performance:** FY 2013-2015

### **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, as in the OSRA, 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). The project will also evaluate the sensitivity of the models to various oil weathering parameters.

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

### **Methods:**

- Research and compile existing updated weathering data for Alaska State and OCS crude oils within the last 5 years.

- Enter existing lab weathering data for Alaskan State and OCS crude and marine fuel oils into the SINTEF oils library.
- Conduct lab and mesoscale oil weathering on 8 Alaskan crude or condensate oils (Ooguruk, Nikiakchuq, Badami, Endicott, Northstar, Point Thompson, Alpine, Alaska North Slope) and 2-4 refined oils (low-sulpher marine diesel, IFO and Bunker C).

**Revised date:** April 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**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 update baseline time-series data to monitor community impacts in the vicinity of the Chukchi Sea Lease Sale area. Systematic mapping of last decade and last twelve months subsistence harvest of terrestrial species in Wainwright, Point Lay, and Point Hope will complement 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, EPs and DPPs and in post-sale and post-exploration decision-making in the Chukchi Sea.

**Cost Range:** (in thousands) \$320-\$480

**Period of Performance:** FY 2013-2016

### **Description:**

**Background:** The oil and gas industry expressed strong interest in leasing tracts in the Chukchi Sea under Sale 193, which may be followed by further exploration and possibly development. To assure methodological continuity over time for a potentially large exploration area, appropriate planning and implementation of post-lease monitoring baselines are needed. BOEM needs to establish an updated baseline in the communities of Wainwright, Pt. Lay, and Pt. Hope, and identify key areas harvest areas, trails, camps, resource harvest locations, areas of specific harvest intensity, and duration reflecting variation in use. This effort will enable more precise assessment of impacts as well as cumulative effects analysis.

**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 view of subsistence activities over the last decade to illuminate harvest patterns, species harvested, etc., and to develop a baseline from which to understand the potential impacts of any future development action. Specific objectives include:

- Engaging subsistence harvesters from Wainwright, Point Lay, and Point Hope who will be consulted about 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.
- Determining the intensity of use per species harvested over 10-year duration and in the last year. This baseline data will be used to assess impacts and cumulative effects for NEPA analysis.
- Developing geospatial layers to be used for modeling purposes.

**Methods:** This project will entail extensive community engagement. Early procedures will involve organizations as the NSB Wildlife Management Departments, AEWC, Inupiat 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 GIS format where possible. Data sought is current information on subsistence activities and use of resources for the three communities as available from recent work conducted by scientific, private and governmental entities. The study will gather primary source data regarding current subsistence effort, and use of resources from knowledgeable key informant residents of Wainwright, Point Lay and Point Hope. The data collection effort will coordinate with other relevant BOEM studies. Anonymity of informants will be required and OMB application may be necessary.

This study will generate maps depicting where subsistence activities are currently taking place and at what level of intensity. Products will show potential changes in harvests, access to resources, competition for resources, costs, effort, and levels of risk. For each subsistence activity map, context will be provided describing in standardized and specific terms the nature and source of the data. The study will develop overlay maps depicting changes in subsistence activities and changes in industrial activity, if any; and develop analysis to address potential cumulative-effect dynamics occurring between subsistence and oil and gas activities. A descriptive context to augment the analysis will also be developed.

The study will incorporate a review and evaluation of the effectiveness of current federal and state mitigation associated with oil and gas activity regarding potential displacement of subsistence resources and resource users. Review will include graphic and written analysis with key informants and key organizations including but not limited to those identified in #1 above. 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 to provide to the BOEM for NEPA analyses. The final product will include a descriptive report that is analogous to OCS Study MMS 2009-003.

**Revised date:** April 2012

### 2.3 Profiles of Studies Proposed for FY 2014 NSL

**Table 3** Alaska OCS Region Studies Proposed for the Fiscal Year 2014 NSL

Page No.	Discipline	Title
59	MM	Seabird Distribution in the Chukchi and Beaufort Seas: Modeling Patterns Over Space and Time
61	MM	Polar Bear Movement Patterns and Habitat Use in Relation to Oil and Gas Activities in the Chukchi Sea
63	MM	Improving Estimates of Abundance and Distribution of Avian Species during Peak Spring and Fall Migration Pathways through Near Shore Areas of the Eastern Chukchi Sea
65	MM	Ecology of Beluga Whales in the Eastern-Chukchi, Western-Beaufort Seas
67	MM	*Field Evaluation of an Unmanned Aircraft System (UAS) for Studying Cetacean Distribution, Density, and Habitat Use in the Arctic
69	SS	*Baseline Nutritional Survey: Inventory and Content Analysis of Subsistence and Market Foods as Consumed by North Slope Communities
AQ = Air Quality IM = Information Management PO = Physical Oceanography		FE = Fates & Effects SS = Social Systems HE = Habitat & Ecology
		MM = Marine Mammals and Protected Species REN = Renewable Energy

\* Denotes project that remains contingent on collaboration with external groups.

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## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Alaska

**Planning Area(s):** Beaufort Sea, Chukchi Sea

**Title:** Seabird Distribution in the Chukchi and Beaufort Seas: Modeling Patterns Over Space and Time

**BOEM Information Need(s) to be Addressed:** Distribution and abundance data on rare, endemic and threatened marine bird species (e.g., Yellow-billed Loon, spectacled and Steller's Eider, Kittlitz's Murrelet, Ross' Gull, Ivory Gull, Sabine's Gull) are needed in the Arctic to address basic conservation issues, inform NEPA analyses, ESA Section 7 consultations and to assess impacts from industrial oil spills. Modeling is needed to take raw survey data and develop spatially explicit predictions about the seasonal distribution of seabirds in this region and to identify times and places within the Beaufort and Chukchi Seas that require further survey effort.

**Cost Range:** (in thousands) \$160-\$240

**Period of Performance:** FY 2013-2016

### **Description:**

Background: While comparatively well-studied at colonies along the coast or in coastal lagoons, information is needed about the distribution and abundance of seabirds in coastal or offshore waters of the Beaufort and Chukchi Seas. At-sea surveys are the only method currently available to quantify the density of seabirds that occupy discreet sections of ocean. Most pelagic seabird data available from arctic Alaska has been compiled by USGS in the North Pacific Pelagic Seabird Database (NPPSD). This recently completed archive contains records of more than 15 million seabirds observed on 306,000 transects conducted in the North Pacific (mostly Alaska) between 1974 and 2009. While a smaller subset of this database comprises observations from the Chukchi and Beaufort seas, it is still the single largest repository of data on seabirds at sea in this region. It includes broad coverage of areas in both the Chukchi and Beaufort seas, although gaps in temporal or spatial coverage become more important when we parse the data by months, seasons or years.

While the NPPSD provides extensive temporal and spatial coverage of some areas of Alaska (e.g., SE Bering Sea shelf), comprehensive coverage of seabird distribution within the Chukchi and Beaufort seas is lacking. To turn the raw survey data into a useful product for management, however, we can develop models of seabird abundance and distribution that allow us to fill in those gaps in space or time.

### Objectives:

- Estimate the number of seabirds (by species) found within and near identified study areas for each season of the year.
- Update NPPSD to include recent survey efforts, including those funded by BOEM and industry.

- Predict the spatial distribution of seabirds within the study areas, the occurrence of biologically productive areas, and their persistence.
- Identify sensitive ecological areas used by rare, endemic, threatened or ESA-listed species, where data is sufficient to adequately characterize the areas.
- Identify survey gaps in seasonal and spatial coverage within the study areas that can be filled with further survey effort.
- Compare current surveys to surveys from the 1970s-1980s to assess whether changes in abundance or distribution of important species can be detected.

Methods: This study will use data from the USGS North Pacific Pelagic Seabird Database (ver. 2.0) to model the distribution and density of species occurring within the lease areas. It will build both geographic and habitat-based models, using relevant existing GIS layers such as bathymetry, location and distances from known colonies or land, ice coverage, sea surface temperature, and possibly plankton and fish distribution. Models will allow discrimination of distributional signals from noise and generation of seasonal maps of expected density distributions by species.

Universal kriging models will allow identification of areas and seasons that have gaps in their survey coverage, currently precluding accurate estimates for the entire study area. This work will inform existing at-sea surveys that use established protocols for marine bird surveys on ships of opportunity, to allow those surveys to specifically target the identified data gaps.

If sufficient data are available, the study will look for changes in abundance and distribution between the initial surveys in the 1970s and 1980s and current surveys from the 2000s. Weighted regression will be used to look for changes in distribution (center of gravity) and residuals from the best-performing model to look for changes in abundance, and examine whether these changes are related to broad-scale environmental changes in the region, such as ice retreat or warming sea surface temperatures.

**Revised date:** April 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Alaska

**Planning Area(s):** Chukchi Sea

**Title:** Polar Bear Movement Patterns and Habitat Use in Relation to Oil and Gas Activities in the Chukchi Sea

**BOEM Information Need(s) to be Addressed:** This study examines the seasonal distribution and habitat use of polar bears in the Alaska Chukchi Sea in relation to areas of oil and gas exploration and provides information necessary for Marine Mammal Protection Act authorizations and development of related mitigation measures. Information would be used to: 1) identify areas and time periods where polar bear ranges overlap with oil- and gas-related activities, and use this information to develop appropriate mitigation measures; 2) understand the movement patterns and habitat use of polar bears in the near-shore Chukchi Sea area; 3) evaluate the body condition and diet of bears in this population in relation to annual variation in sea ice conditions; and 4) evaluate vital rates and population status. Information from this study may be used for NEPA documentation and ESA Section-7 consultations.

**Cost Range:** (in thousands) \$2,000-\$3,000      **Period of Performance:** FY 2013-2018

### **Description:**

Background: The BOEM (formerly MMS) has funded considerable research on polar bears and their populations in the Beaufort Sea during the past decade, including methodological studies evaluating RFID and FLIR technologies. Other BOEM funded studies are documenting the movements of satellite-tagged bears in both the U.S. and Canadian Beaufort Sea. However, much less research has been conducted in the Chukchi Sea and there is an urgent need to better understand the distribution, movement patterns and population status of polar bears in that Region. The Chukchi Sea has experienced a significant reduction in sea ice in the past several decades. The response of polar bears to the loss of sea ice as a platform for movement and foraging, and to changes at lower trophic levels is currently unknown. Simultaneous to environmental changes has been increased activity in the region to explore for and potentially develop access to oil reserves within open-water areas of the Chukchi Sea. As a result, information is currently needed on the distribution, seasonal movement patterns, and swimming behavior of polar bears in relation to current and planned oil and gas activities in the Chukchi Sea for analysis and spatial planning purposes. This information would serve to complement ongoing USFWS and USGS studies, funded partially by BOEM, to examine bear movement patterns, coastal habitat use and physical condition in the Southern Beaufort Sea. Since seasonal distributions appear to be changing, a better understanding of the distribution and overlap of bear populations along both the Chukchi and Southern Beaufort Sea coasts would aid in mitigating industrial activities occurring in both habitat regions and monitoring the changes since 1995 for spatial planning and assessment of long term changes. Basic information on the status of the Chukchi Sea population is also needed, including body condition, health, vital rates, and population size to better inform management of the population vitality and viability.

Objectives:

- Estimate the seasonal distribution of the polar bear population in the Chukchi Sea and the potential for interactions with oil- and gas-related activities in and near the Chukchi Sea Outer Continental Shelf lease area.
- Estimate habitat use patterns of radio-collared female polar bears through using resource selection functions. These analyses will identify seasonal habitat use patterns and will be compared to pre-1995 habitat use for evaluating climate change effects on polar bear distribution.
- Evaluate the condition and health of polar bears in the Chukchi Sea and identify the best methodology for assessing vital rates and determining population size.

Methods: Capture polar bears in the spring of each year in the eastern Chukchi Sea to collect samples, evaluate diet and body condition, and deploy approximately 25 satellite-radio collars on adult females to study movements and other behaviors. Diet will be estimated using standard laboratory techniques including fatty acid analysis. Body condition will be estimated using morphological measurements taken at capture. Develop resource selection models of contemporary seasonal habitat use to determine the potential overlap between industrial activities and bear habitat use. Use saltwater sensors on satellite radio-collars to determine the amount of open-water use in the fall of each year.

**Revised Date:** April 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Alaska

**Planning Area(s):** Chukchi Sea

**Title:** Improving Estimates of Abundance and Distribution of Avian Species during Peak Spring and Fall Migration Pathways through Near Shore Areas of the Eastern Chukchi Sea

**BOEM Information Need(s) to be Addressed:** Information gained from this research will be used in ESA Section 7 Consultations and NEPA reviews for lease sales, EPs, DPPs and other reviews for post-sale and post-exploration decision making and mitigation in the Chukchi Sea Planning Area. In particular, this work will contribute significantly to cumulative impact assessments on marine birds of concern that will be affected by proposed onshore and offshore lease sales throughout their breeding, molting, staging, and wintering habitats in Alaska. Further, results of this work may be evaluated for use to develop mitigation measures and stipulations designed to protect migratory birds, a DOI trust resource.

**Cost Range:** (in thousands) \$348-\$522

**Period of Performance:** FY 2013-2014

### **Description:**

Background: Barrier islands, lagoons, bays, and offshore leads along the Alaskan coast of the Eastern Chukchi Sea (ECS) have been identified as important breeding, feeding, staging, and molting areas for large numbers of water birds. Near shore areas of the ECS are important staging sites for several species of waterfowl and loons during migration to and from breeding areas in arctic Alaska and Canada. Waterfowl and loons acquire critical pre-breeding and pre-wintering fat reserves in the ECS with some species using the ECS during periods of flightless molt. Among the species known to use the ECS, Spectacled Eiders (*Somateria fischeri*) are listed as threatened under the U.S. Endangered Species Act, and Yellow-billed Loons (*Gavia adamsii*) are designated as a candidate species. Steller's Eiders (*Polysticta stelleri*), also listed as threatened under the U.S. Endangered Species Act, might also migrate through the ECS en route to southern molting and wintering areas. Pacific Brant is a species important to both subsistence users in Alaska and fall hunters throughout the Pacific Flyway. Pacific Brant are listed as a U.S. Fish and Wildlife Service-Migratory Bird Program focal priority species and are currently managed under a "restrictive" harvest regime due to low population size.

Recent satellite telemetry data from marked sea ducks and loons collected by the BOEM study "Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area" suggest that most birds used areas within 60 km of the northwest coast of Alaska from May through October, with peak use coinciding with spring and fall migration. However, marked birds also used areas as far as 110 km from the coast, within Lease Sale 193. Current understanding of the abundance and distribution of birds using near shore areas of the ECS is based on limited satellite telemetry data, and land and vessel based observations. Additional

information is needed to better characterize the abundance and distribution of birds that use the ECS, especially in near shore areas.

Multiple surveys have identified Kasegaluk Lagoon, proximate to the Chukchi Sea Planning Area, as an important fall staging area for Pacific Brant. Up to 49% of the world population of Pacific Brant is estimated to use this area in late summer and fall. Habitats and birds using this critical staging area could be impacted by human activities from onshore and nearshore facilities associated with offshore lease sales and by contaminants resulting from potential oil spills.

Objectives: The overall objective of this study is to estimate the abundance and distribution of avian species in near and off-shore areas of the ECS during peak spring and fall migration. Specifically it will:

- Document Pacific Brant spatial distribution, abundance, and timing of use in Kasegaluk Lagoon, landward of the Chukchi Sea Planning Area.
- Document Spectacled Eiders, Yellow-billed Loons, and Steller's Eiders spatial distribution, abundance, and timing of use within the offshore areas between Cape Lisburne and Barrow.

Methods: Aerial surveys will be conducted in spring and fall 2012 to coincide with ongoing Spectacled Eider, Red-throated Loon (*Gavia stellata*), and Yellow-billed Loon satellite telemetry studies. Within each season, surveys will be conducted over a period of 14 to 20 days. Survey areas and transects will be modified daily using near real time satellite telemetry data to optimize flight time. Surveys will be conducted within 110 km of the ECS coast of Alaska between Cape Lisburne and Barrow. The biweekly census will also include geese in following accepted methodologies.

Surveys will be conducted using established methods by 2 observers from a twin-engine, high-wing aircraft like an Aero-Commander model 690. Transects will be followed using on-board GPS and a laptop computer. Species identification and estimates of abundance will be aided by digital photography using a camera capable of producing high quality images (> 12 megapixel) with continuous shutter and image stabilization. The camera will also interface with the on-board laptop computer to georeference images and to check image quality in real time. Visual species identification, estimated abundance, and GPS locations will also be logged on the on-board laptop.

Resulting digital photographs will be used to identify species and count individuals using Adobe Photoshop CS-4 and ArcGIS 10.x. When possible, the sex and age of individual birds will also be identified. Data will be analyzed following accepted methods.

**Revised Date:** April 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Alaska

**Planning Area(s):** Beaufort Sea, Chukchi Sea

**Title:** Ecology of Beluga Whales in the Eastern-Chukchi, Western-Beaufort Seas

**BOEM Information Need(s) to be Addressed:** The beluga whale is protected under the Marine Mammal Protection Act (MMPA) and is important for subsistence use by Native Alaskans along the Chukchi Sea coastline. Subsistence use by Natives is also protected under the MMPA and cannot be compromised by other activities such as oil and gas development. This study will provide information on habitat use and selection by beluga whales in the eastern-Chukchi and western-Beaufort Seas, a region currently under intense interest for development. Satellite tracking data provides valuable information about distribution and movements of belugas. Data for assessing prey and habitat use are also needed. Understanding habitat (e.g., bathymetry, ice cover, specific geographic locations) and prey use by belugas will be instrumental in evaluating and mitigating potential impacts on subsistence within lease areas. Information from this study will be used for NEPA documentation.

**Cost Range:** (in thousands) \$2,400-\$3,600      **Period of Performance:** FY 2013-2018

### **Description:**

Background: Several stocks of beluga whales use the Chukchi and Beaufort seas. The Beaufort Sea stock migrates through the area in late April and May to summering areas in the Canadian Beaufort Sea. They migrate back through the planning areas during autumn to winter in the Bering Sea. Animals from the eastern Chukchi Sea stock move into the nearshore waters adjacent to Point Lay and Wainwright along the northwest coast of Alaska. A satellite tracking study, jointly funded by the Alaska Beluga Whale Committee, the North Slope Borough and MMS (now BOEM), showed that belugas from this stock used a large portion of the Alaska Beaufort Sea during the summer and migrated back south through the Chukchi Sea during autumn.

Belugas in the Beaufort and Chukchi Seas have been subject to seasonal survey effort by the BWASP and recent surveys in the Chukchi Sea. Limited other research has been conducted in recent years including a study of 26 belugas that were live-captured, fitted with satellite transmitters and tracked. Transmitters lasted from less than a week to up to 16.5 months and provided a great deal of information about where belugas spent the summer, portions of the autumn, and one transmitter last long enough to provide the first information about the wintering area. Transmitters also collected information about diving behavior.

With increasing oil and gas activities in the Beaufort and Chukchi seas, there is a need to better understand distribution and movements of belugas, and prey and habitat use and selection. Analysis of summer and fall habitat use of satellite-tracked belugas from the

eastern Beaufort Sea has already occurred. A similar analysis for eastern Chukchi Sea belugas is needed.

This research project will be a broad collaboration including the Alaska Beluga Whale Committee, the North Slope Borough, Alaska Department of Fish and Game and NMML as well as ChukotINRO and other Russian marine mammal researchers and hunters. Representatives of Alaska Native communities will participate in all aspects of the work and analysis.

Objectives:

- Evaluate prey and habitat use and selection of eastern-Chukchi and western-Beaufort Sea belugas relative to age and sex and determine winter distribution in the Bering Sea;
- Compare prey and habitat use and selection between whales from the proposed study and those from the eastern-Beaufort Sea;
- Evaluate overlap of beluga habitat use and selection with lease areas in the Beaufort and Chukchi seas.
- Evaluate potential conflicts between subsistence activities and oil and gas development along the Eastern-Chukchi Sea coastline.

Methods: Whales will be satellite tagged in cooperation with Chukchi Sea Native subsistence users at villages such as Pt. Lay. Local Natives will be involved in this study to the maximum extent possible and every attempt will be made to ensure that this study does not interfere with subsistence activities or intrude on life in the isolated coastal communities. Cruises will be conducted as necessary to assemble data on oceanographic conditions, prey and associations among belugas, sea ice and the former factors. This study will develop GIS based models to determine habitat use and selection relative to age and sex of belugas. In addition to data to be collected in this study, data will be used from belugas that were tracked with satellite transmitters in 1998, 1999, 2001, 2002, and 2007. The models will include location data, and attributes of those locations including: bathymetry, ice cover, distance from shore, prey and other oceanographic data. The models will evaluate habitat that is used relative to habitat that is available. Comparisons will be made between belugas of the eastern Chukchi Sea and eastern Beaufort Sea stocks. Aerial survey data of belugas, from the Bowhead Whale Aerial Survey Program and other surveys, will be evaluated for the potential of further understanding of inter-annual and intra-annual differences in distribution, habitat use and selection. A final report will be drafted providing BOEM with information about beluga habitat use and selection that will include evaluation and recommendations for mitigation of the potential impacts from oil and gas activities in lease areas on subsistence use of beluga whales by Natives in the Beaufort and Chukchi Seas.

**Revised Date:** April 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Alaska

**Planning Area(s):** Beaufort Sea, Chukchi Sea

**Title:** Field Evaluation of an Unmanned Aircraft System (UAS) for Studying Cetacean Distribution, Density, and Habitat Use in the Arctic

**BOEM Information Need(s) to be Addressed:** Bowhead whales (*Balaena mysticetus*) and gray whales (*Eschrichtius robustus*) are seasonal residents of the western Beaufort Sea and the Chukchi Sea. These Arctic waters provide important feeding grounds and migration pathways for both species. Bowhead and gray whale distributions overlap spatially with lease sale areas in this region. Their occurrence in Arctic waters coincides with the timing of industrial activities related to oil and natural gas exploration, development, and extraction, which occur mostly in the “open water” season when sea ice is minimal. Both species are protected under the Marine Mammal Protection Act, and the bowhead whale is granted additional protection as an endangered species under the Endangered Species Act (ESA). Under the National Environmental Policy Act (NEPA) and the ESA, BOEM is required to evaluate if and how federal actions associated with oil and gas exploration and development may affect these species. The density, spatiotemporal distribution, and habitat use of these species in the areas concerned may play an important role in determining where and when the oil and gas industries may conduct their activities. Standard methodologies for studying these ecological questions include the use of vessel observations, passive acoustics, and aerial surveys conducted from manned aircraft. In recent years, there has been increasing interest in using Unmanned Aircraft Systems (UASs) to survey cetaceans (especially bowheads) in the outer continental shelf region of the Arctic. The performance of UASs relative to human observers in manned aircraft for detecting cetaceans, identifying individuals to species, estimating group size, identifying sensitive age classes, and estimating population density in space and time is unknown, but must be understood prior to the acceptance of the UAS platform as a substitute to manned aircraft for conducting these investigations.

**Cost Range:** (in thousands) \$1,200-\$1,800 plus Joint Funding      **Period of Performance:** FY 2013-2015

### **Description:**

**Background:** Manned aircraft are a common platform for studying wildlife because they are relatively cost-effective for surveying large geographic areas and take advantage of humans’ ability to quickly integrate sensory information on the biological and physical environment in order to detect, identify, and count species of interest. In recent years, there has been increasing interest in using UASs to study wildlife populations. In particular, UASs have been suggested as an alternate survey platform for studying the distribution and density of the Bering-Chukchi-Beaufort (BCB) stock of bowhead whales in the western Arctic, which have been investigated using manned aircraft since 1979. The primary advantage of using UASs to survey marine wildlife in the Arctic is that they eliminate the risk of sending humans far from shore in small aircraft in areas with extreme weather conditions. Furthermore, some UASs

are relatively low cost, and some have relatively long flight times. Finally, it has been shown that UASs are less likely to disturb pinnipeds, and, therefore, might invoke less of a response from cetaceans as well.

The UAS technology with the highest probability of successfully surveying cetaceans was developed for military purposes in desert environments and only recently has been applied to the natural sciences. For surveying cetaceans, the UASs' ability to encounter, detect, and identify cetaceans and quantify their abundance must be understood relative to the proven capabilities of human observers in manned aircraft. The effectiveness of UASs in surveying cetaceans has yet to be demonstrated. A small number of limited field tests have been conducted and provided initial insight into the levels of success that may be achieved using UASs. The results from these preliminary studies warrant further investigation into the use of UASs for studying cetaceans. Additional insight will be gained only through direct comparisons of UASs and the human eye in the field, with large whales (bowheads and gray whales) as the primary targets.

#### Objectives:

- Evaluate detection rates and ability to identify cetaceans in Arctic waters using available UAS technology.
- Compare cetacean encounter rates, detection probabilities, identification abilities, and group size estimates between a UAS and human observers during simultaneous field tests and surveys.
- Describe improvements needed in UAS technology (payloads, cameras, etc.).
- Provide recommendations for the types of monitoring or mitigation requirements that can likely be met by UASs.

Methods: The BOEM will pursue joint-funding opportunities for this project. Potential partners include NMFS-NMML, Office of Naval Research, UAF, and industry. Planning and permit application will occur during the first year. Field experiments will occur in the second year in the eastern Chukchi or western Beaufort Sea during the open water season (June – October), a season when both bowhead and gray whales have reliably been found feeding in and migrating through the region. Well-trained marine mammal observers will search from aircraft or vessels either by unaided eye or through binoculars. A UAS will operate concurrently in the same area, with a well-trained marine mammal observer on the team, viewing digital video in real-time to detect, identify, and count cetaceans visible in the video feed. The digital video footage will be saved to enable additional analyses into UAS performance later.

This study will be integrated with other ongoing BOEM studies in the region, including aerial surveys studying the distribution, density, and feeding ecology of cetaceans.

**Revised Date:** April 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Alaska

**Planning Area(s):** Beaufort Sea, Chukchi Sea

**Title:** Baseline Nutritional Survey: Inventory and Content Analysis of Subsistence and Market Foods as Consumed by North Slope Communities

**BOEM Information Need(s) to be Addressed:** This study will facilitate scientific understanding and analysis of potential health impacts that could derive from oil and gas industrial activities. It will also address longstanding concerns about potential cumulative effects of oil and gas activities on the North Slope. Additionally, it will provide useful information to decision-makers in Environmental Assessments and Environmental Impact Statements for upcoming and future Beaufort Sea and Chukchi Sea Lease Sales. The study will strengthen BOEM compliance with Executive Order 12898 on Environmental Justice and will facilitate BOEM research coordination with multi-agency initiatives.

**Cost Range:** (in thousands) \$200-\$300  
plus Joint Funding

**Period of Performance:** FY 2014-2016

### **Description:**

Background: Many previous MMS/BOEM studies have documented various aspects of Native subsistence production, distribution, and consumption in coastal Alaskan communities over the last three decades. However, more research is needed on the nutritional composition of representative dietary patterns for various resident groups on the North Slope. This study will involve a nutritional survey and analysis of subsistence and market foods as actually consumed, using standard methods of nutritional investigation to characterize the mixed and changing nutritional system of three villages, preferably Wainwright, Point Lay, and Kaktovik. Key sampling variables for each community would likely be at the household level, and include ethnicity, gender, age group, and lifestyle attributes, especially level of subsistence effort. The project will remunerate informants to reduce non-response.

The study would seek to establish interim baseline data regarding normative dietary patterns and corresponding nutritional content for a broad range of discrete social groups. The study would thereby contribute toward understanding whether and how incremental changes to subsistence activities on the North Slope might produce substantial impacts on the dietary behaviors and health status of identifiable Native groups. A significant body of research has emerged to indicate that different categories of North Slope residents increasingly manifest serious health problems that are related to changes in diet and consumption patterns, including diabetes, botulism, iron deficiency anemia, caries, heart disease, obesity, and substance abuse. This study would contribute to a better understanding of the social complexities of emergent pathologies and investigate if any are attributable to incremental subsistence sector disruptions that may be reasonably associated with oil and gas activities.

The study is envisioned as a collaborative, inter-agency effort, with a state agency such as Alaska Department of Health and Human Services or the North Slope Borough possibly assuming the lead role. Other cooperative funding institutions may include NSSI, BLM, USFWS, the U.S. Department of Agriculture, Alaska Native Tribal Health Consortium (ANTHC), the North Slope Borough, and private industry.

**Objectives:** This study will investigate whether any emergent pathologies are attributable to incremental subsistence sector disruptions that may be reasonably associated with oil and gas activities to assess if there is a direct or indirect causal relationship between oil and gas activities and food choices. Specific objectives include:

- Improving understanding of contemporary patterns of food consumption within each sampled community.
- Assessing representative food consumption patterns and portions for nutritional value and potential contaminants.
- Developing estimates of the percentage and dosage of food energy derived from subsistence and market sources for sampled subgroups in each community.
- Enhancing analysis of potential health impacts from oil and gas development by linking nutritional data to existing subsistence surveys and sharing network studies.

**Methods:** Investigators will: 1) secure collaborative participation of selected host communities with appropriate input on final study design and methods; 2) conduct a nutritional analysis using standard methods to characterize the mixed market-subsistence nutritional system of participating communities and provide incentives to ensure participation in survey; 3) create an inventory of market foods by purchase and consumption preference; 4) create a food consumption database of subsistence and market foods for sampled individuals based on a combination of informant journals and empirical observation; 5) assess the nutritional value of foods consumed to establish an estimate of food energy per person per day (grams/person/day) for a variety of resident groups; 6) collaborate with health science data collection activities already initiated among North Slope communities to integrate household subsistence data with dietary questionnaires; 7) compare and assess study findings against other relevant research and traditional knowledge within each community; and 8) report the results to North Slope communities through public meetings or workshops.

**Revised Date:** April 2012

## **SECTION 3.0 TOPICAL AREAS FOR FY 2015**

This section presents a general forecast of significant topical issues and concerns to be addressed by studies to be proposed for FY 2015 and beyond. In general, these topics conform with the research themes of the ESP. Due to the great differences existing between Alaskan environments and other OCS areas, the uniqueness of issues in Alaska has dictated the need to anticipate new topical areas for implementation 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. Specific geographic emphases are likely to change due to potential changes in leasing or development schedules, as well as the release of the next five-year *Oil and Gas Leasing Program*.

Many of the studies proposed for FY 2013 and FY 2014 address the topical areas described below. These will be re-assessed as part of the FY 2014 planning process.

As noted in Section 1.2.1 of this document, the *Revised Program Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOJ, BOEMRE, 2010) pointed to a need for more environmental research in the Arctic before additional leasing occurs. It will also be important for BOEM to continue post-lease monitoring studies and other priority studies of key species and marine communities in the Beaufort and Chukchi seas. Studies of bowhead whales will continue to be a priority for the region. Many studies of other sensitive marine mammals, including cetaceans, polar bears, pinnipeds and other marine mammals are expected to continue into 2015 and beyond. Additional studies may be brought online which address fish and migratory waterfowl. Future studies will include those aimed at determining spatial and temporal habitat use patterns, habitat description and monitoring and evaluations of health over time. Studies aimed at understanding potential impacts to subsistence species and subsistence practices will continue to be important. Additional studies of the physical environment, such as current regimes and ice characteristics, will be proposed to support interpretation of data from living resource investigations and to provide a better understanding of the fate and dispersion of OCS discharges.

### **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 Alaskan OCS from the EPA to BOEM. While implementing this authority, BOEM will require 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 EISs, environmental assessments (EAs), and oil-spill contingency 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**

Production at the Northstar site and at 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—as well as 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 is needed about the biology and ecology of many marine fish species inhabiting the Alaska lease areas. The highest priority BOEM information needs include species presence, distribution, abundance and potential effects of oil spills, particularly during periods when ice is present. As offshore oil development interest expands to deeper and more widespread areas, additional fisheries information is required.

As a result of the Magnuson Fishery Conservation and Management Act, effects on Essential Fish Habitat must be evaluated in NEPA analyses. In the Bering and Chukchi Seas, more information is needed to evaluate Essential Fish Habitats in the Chukchi Sea as commercial fish species move northward from the Bering Sea. Beaufort waters are also considered Essential Fish Habitat for salmon, and future research on salmonid reproduction in Beaufort Sea drainages is indicated to clarify environmental assessment and mitigation needs.

Seismic exploration and its effects on fish is 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 subsistence utilization. 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.

A significant body of research has emerged to indicate that some North Slope residents increasingly manifest serious health problems that are related to changes in diet and consumption patterns, including diabetes, botulism, iron deficiency anemia, caries, heart disease, obesity, and substance abuse. The study “Baseline Nutritional Survey: Inventory and Content Analysis of Subsistence and Market Foods as Consumed by North Slope Communities” proposed for FY 2014 would contribute to a better understanding of whether and how incremental changes to subsistence activities on the North Slope might produce substantial impacts on the dietary behaviors and health status of identifiable Native groups.

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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**Offshore Environmental Studies Program**

**Fiscal Years 2013-2015  
Studies Development Plan  
Atlantic OCS Region**

**U.S. Department of the Interior  
Bureau of Ocean Energy Management  
Atlantic OCS Region  
Herndon, VA  
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## Abbreviations and Acronyms

ACPARS	Atlantic Coast Port Access Route Study
AIS	Automatic Identification System
AMI	Area of Mutual Interest
AWC	Atlantic Wind Connection
BOEM	Bureau of Ocean Energy Management
Call	Call for Information and Nominations
CEQ	Council on Environmental Quality
COP	construction and operations plan
CMSP	Coastal and Marine Spatial Planning
CZMA	Coastal Zone Management Act
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
EA	environmental assessment
EERE	Office of Energy Efficiency and Renewable Energy
EEZ	Exclusive Economic Zone
EIS	environmental impact statement
EBRE	Environment Review Branch for Renewable Energy
FAU	Florida Atlantic University
FERC	Federal Energy Regulatory Commission
FOA	Funding Opportunity Announcement
FWS (or USFWS)	U.S. Fish and Wildlife Service
FY	Fiscal Year
GHG	greenhouse gas
GIS	Geographic Information System
MHK	Marine Hydrokinetic
MMC	Multipurpose Marine Cadastre
MMS	Minerals Management Service
MOU	memorandum of understanding
MSDS	Material Safety Data Sheet
MTB	mooring and telemetry buoy
NCEP	National Center for Environmental Prediction
NCAR	National Center for Atmospheric Research
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMSP	National Marine Sanctuary Program
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent

NOPP	National Oceanographic Partnership Program
NREL	National Renewable Energy Laboratories
NSL	National Studies List
OCS	Outer Continental Shelf
OREP	Office of Renewable Energy Programs
OCSIRAS	Outer Continental Shelf Interactive Registry of Archaeological Surveys
OSRAM	Oil Spill Risk Analysis Model
ROW	right-of-way
SAP	site assessment plan
SHPO	State Historic Preservation Officer
TA&R	Technology Assessment and Research Program
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
USEPA	U.S. Environmental Protection Agency
WEA	Wind Energy Area
WTG	wind turbine generators



## **SECTION 1.0 PROGRAMMATIC OVERVIEW**

### **1.1 Introduction to the Region**

The Atlantic Region extends from Maine to Florida and is divided into four planning areas (Figure 1). The 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 National Oceanic and Atmospheric Administration (NOAA).

Initially, the regional focus was on the oil and gas potential of the Atlantic Outer Continental Shelf (OCS). Seismic surveys were conducted from the 1960s to the 1980s to delineate the resource potential of the region. Lease sales occurred from the inception of the program through the 1980s 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 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 lease sale 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 Planning areas for leasing. After the Macondo incident, 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, Bureau of Ocean Energy Management (BOEM) has conveyed rights to about 56 million cubic yards of OCS sand for 29 coastal restoration projects in five states. These projects have resulted in the restoration of 125 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. Most of these projects used sand that was identified previously by BOEM through its cooperative sand evaluation program with coastal states. Several Negotiated Noncompetitive Agreements have been completed on the Atlantic OCS offshore Virginia, Maryland, South Carolina and Florida.

On August 8, 2005, Energy Policy Act of 2005 (P.L. 109-58) granted the Department of the Interior's (DOI) Minerals Management Service (MMS), now 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 task forces, state consultation, and post-lease permitting in Federal waters off the East Coast

(Figure 1). The Environment Branch for Renewable Energy (EBRE) is responsible for coordinating the studies program for the Atlantic OCS Region, 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 increase in these types of projects in the North and Mid-Atlantic Planning Areas.

OREP has established inter-governmental task forces to coordinate and collaborate with affected state, local, and tribal governments and relevant Federal agencies, as mandated by Energy Policy Act of 2005, 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. By January 2012, task force meetings have been held in ten Atlantic states. These 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.

BOEM is coordinating with other Federal agencies responsible for permitting or authorizing portions of offshore renewable energy projects. Part of these efforts includes identifying information needs from these agencies for integration into the BOEM Environmental Studies Program. DOI has established memoranda of understanding (MOUs) with other Federal agencies to facilitate coordination on OCS renewable energy development, including the Department of Energy (DOE), U.S. Fish and Wildlife Service (FWS), and 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 appropriate identified areas, coordinated environmental studies, large-scale planning and expedited approval processes.

One of the key aspects of the "Smart from the Start" initiative (decoupling the renewable energy leasing and development process) is changing how studies are developed and used.

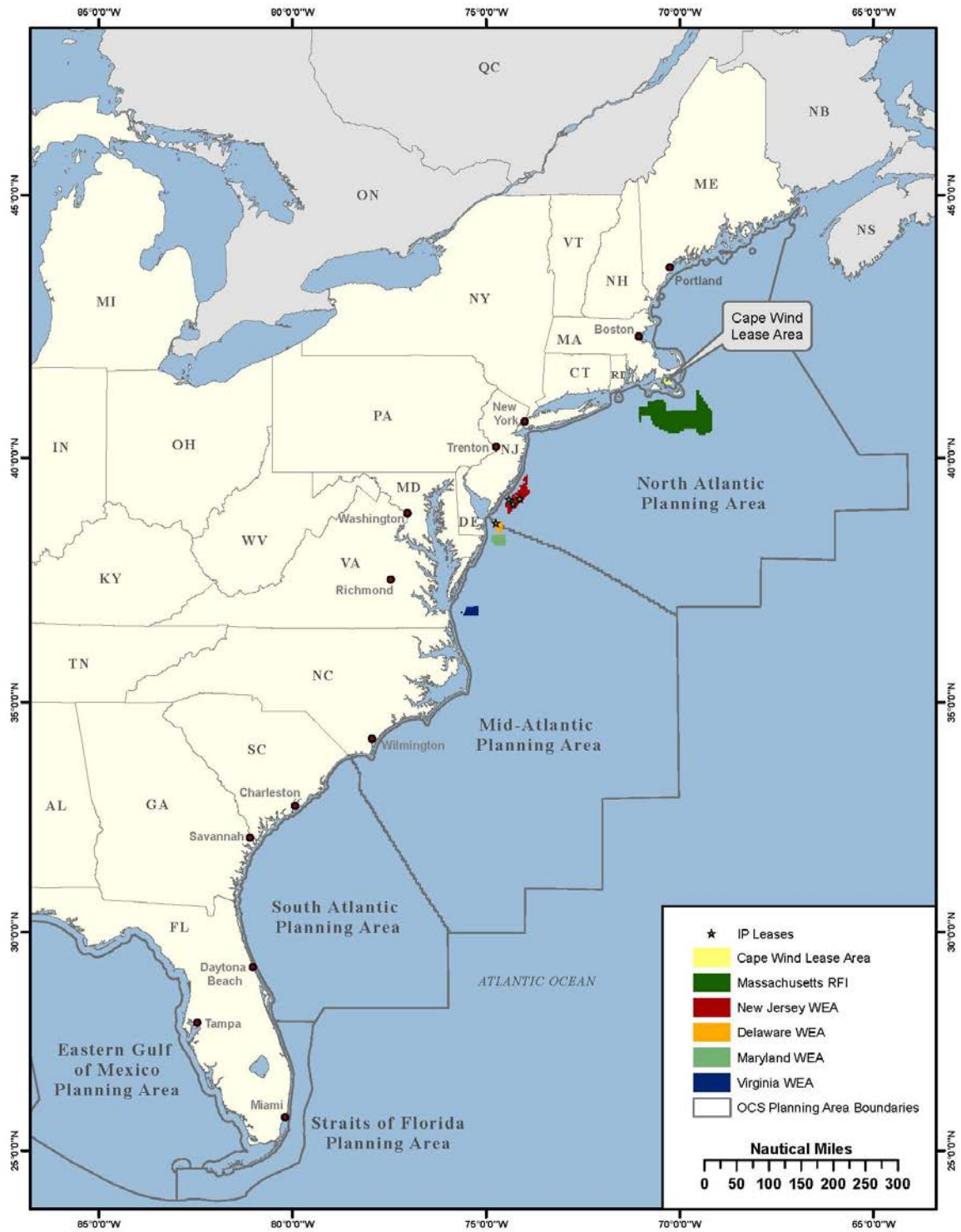
There are generally three phases of renewable energy development on the OCS: lease issuance; site assessment; and construction, operation, and decommissioning of a renewable energy facility. A renewable energy lease gives the lessee an exclusive right to apply for subsequent approvals that are necessary to advance to the next stage of the renewable energy development process. The second phase is BOEM review and approval of a site assessment plan (SAP) that allows the construction and installation of a meteorological tower and 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 major steps forward in support of offshore wind energy, including new funding opportunities for up to \$50.5 million for projects that support offshore wind energy deployment and several high priority wind energy areas (Fig. 1) in the Mid-Atlantic that will spur rapid, responsible development of this abundant renewable resource.

On February 9, 2011, BOEM issued a Notice of Intent (NOI) to prepare an environmental assessment (EA) for lease issuance and approval of site assessment activities in Wind Energy Area (WEA)s offshore New Jersey, Delaware, Maryland, and Virginia. The *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia - Final Environmental Assessment* was published on February 2, 2012 (U.S. Department of the Interior, 2012). On August 18, 2011, BOEM issued an NOI to prepare an EA for an area offshore Rhode Island and Massachusetts. This area was chosen after Massachusetts and Rhode Island agreed to work together to coordinate development in an area of mutual interest. In February 2012, based on comments from the NOI, task forces and other public comments, the WEA was identified for analysis in the EA. On February 6, 2012, BOEM issued an NOI to prepare an EA for an area offshore Massachusetts, which is a reduction of the area identified in the Request for Information based primarily on concerns from the fishing community. A similar process will follow shortly after for the South Atlantic region, namely North Carolina.

## 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 will be 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. 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 and offshore Massachusetts under research leases. 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.

#### **1.3.4 Wind Energy Activities**

For the near term, wind energy activities are primarily focused on site characterization, both prior to leasing and for interim leases that have already been granted for such purposes. Three leases offshore New Jersey and one offshore Delaware have been issued to authorize site assessment activities. Currently, BOEM has received two final project plans for meteorological buoys offshore New Jersey. Project plans for either meteorological towers or buoys have not been submitted for the remaining New Jersey lease or the lease offshore Delaware.

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 a 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 preparing an EA to analyze the potential impacts of proposed lease issuance, site characterization surveys, and technology testing activities.

Southern Company submitted a lease application for three OCS blocks offshore Georgia for offshore wind energy resource assessment including the possible use of meteorological buoys.

### 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 is working with FWS to ensure the adequacy of the 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 as well as the Massachusetts Executive Office of Energy and Environmental Affairs and the University of Massachusetts Dartmouth Marine Renewable Energy Center proposing research related to marine-based renewable energy generation, including offshore wind, tidal, and wave energy.

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.

## **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 recent 2011 Atlantic Wind Energy Workshop identified additional needs. Although many of the information categories identified in 2007 remain key needs for FY 2012 and 2013, data gaps are being filled by BOEM and partner studies since that time.

#### 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. Coastal and Marine Spatial Planning (CMSP) is a process for implementing ecosystem-based management. As defined in the policy, CMSP 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. CMSP identifies areas most suitable for various types or classes of activities in order to reduce conflicts among uses, reduce environmental impacts, facilitate compatible uses, and preserve critical ecosystem services to meet economic, environmental, security, and social objectives.”

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

Of concern for offshore wind development is the potential for impacts with avian species, both birds and bats. BOEM began to address these concerns through two studies “Potential for Interactions between Endangered and Candidate Bird Species with Wind Facility Operations on the Atlantic OCS,” which focused on endangered, threatened, and candidate species while the “Compendium of Avian Occurrence” aggregated existing observations of birds on the Atlantic OCS. Adding to the existing knowledge of these offshore birds are more targeted studies using state of the art technology which includes the satellite tracking of long-tailed ducks and the movement of multiple diving birds (loons, gannets, and others) along the Atlantic OCS. An additional study is proposed to focus on the movements of terns and oystercatchers using conventional radio telemetry in the Northeastern Atlantic Region.

Another concern is the siting of areas for wind energy development. The “Compendium of Avian Occurrence” has been extended to further compile more survey data sources along the Atlantic OCS. In addition, the USGS team has partnered with NOAA to produce maps predicting the distribution and abundance of seabirds in the Mid-Atlantic. This effort is proposed for expansion in order to develop predictive maps of seabird distribution and abundance for the entire Atlantic OCS.

### 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, especially regarding habitat affinity at the scale of an individual wind energy facility. Appropriate survey protocols also need to be developed at the wind facility scale in order to design and/or require third parties to acquire this data.

### 1.4.4 Socio-Economic Studies

Space-use conflict, particularly with shipping, cultural resources, and commercial and recreational fishing, is the most frequent issue-specific comment BOEM has received in response to recent planning and NEPA notices. In addition to potential space use conflicts on the OCS, there is the issue of visual impacts of an offshore wind facility on coastal areas. These impacts can either be on cultural sites that are historic properties or Native American sites or have implications for recreation and tourism. BOEM is working with the USCG on evaluating conflicts with shipping using the Automated Information System (AIS) operated by the USCG. However, this system only tracks larger commercial vessels. The Atlantic Coast also has vessel traffic, such as tugs and barges that use the coastal areas. Offshore wind facilities could alter the traffic patterns of these smaller vessels and an evaluation is proposed.

Cultural resources on the OCS are required to be preserved under the National Historic Preservation Act. Determination of whether a resource, specifically a shipwreck, is significant and warrants listing as a historic property depends on the historical context of the vessel and its relevance to the history of our Nation. This evaluation requires archival research and a study is proposed to help identify the resources to determine the historical context of the many vessels that sank along the Atlantic Coast. In addition, evaluation of these locations requires ready access to the information and the use of a geographic information system can aid analysts in efficiently reviewing the available information.

Not all ports on the East Coast are equipped currently to handle the needs of offshore commercial wind and hydrokinetic energy development. Thus, one or more Atlantic ports may become offshore energy hubs. Due to the substantial role a single energy project could play in a port's operations and expansion, an identification of the most likely ports for expansion, the amount of expansion needed and the environmental consequences of the expansion is needed.

### 1.4.5 Information Sharing

One of the conclusions from the 2007 Workshop was that "Coordination and collaboration with stakeholders and potential partners are key to the success of alternative energy studies. Tapping into existing resources will minimize duplication of effort, ensure that all concerns are addressed, and result in better scientific products. Drawing upon expertise in the



international community will be important to continue, and that dialog will enhance study designs” (Michel and Burkhard, 2007). Since the 2007 Worldwide Synthesis and Workshop, numerous renewable energy studies have been conducted through Federal and state initiatives. For this reason, BOEM conducted a similar workshop in the summer of 2011 (Cahill et al. 2011), will be holding a workshop in FY 2012 to learn from the European experience and is proposing another workshop in FY 2013 to focus on areas where the information needs are most critical.

#### 1.4.6 Water and Air Quality

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.

Each turbine as well as the electrical service platform will have chemicals associated with them. The platform will have capacitors containing mineral oil and each turbine will have some oils needed for the machinery. While an analysis of a mineral oil spill was conducted for the Cape Wind Project, there is still a concern about the impacts from these chemicals should a catastrophic event occur resulting in the release of the chemicals. It is anticipated that between 500-1,000 gallons of coolants, lubricants, and other mechanical fluids will be present in offshore wind turbines. Future COP EISs will have to analyze the impacts of these chemicals on benthic habitats and marine life if these chemicals are released, alone or in combination.

Another indirect effect to be considered for offshore wind energy activities is allision impact analysis and modeling related to wind turbine siting. A vessel striking a fixed object (i.e., allision), such as a wind turbine, is a serious concern for offshore wind facilities sited around major and minor ports along the Atlantic coast. The consequences of allision for different vessel classes and different sea states may impact water quality significantly. A proposed study will assess the potential range of consequences not only for the purposes of environmental impact analysis but also for the potential impact to design standards of wind facilities sited in areas of high allision risk.

#### 1.4.7 Guidelines for Lessees and Developers

In response to developer requests, BOEM is preparing additional guidelines to provide explanation and suggest methods for collecting survey results required to be submitted with plans under the renewable energy regulations. In April 2011, BOEM posted guidelines for submittal of geological, geophysical, and archaeological surveys on its website, and BOEM is currently in the process of updating these guidelines. In addition, BOEM is working guidelines with National Marine Fisheries Service (NMFS) for benthic habitat and marine fauna surveys and FWS for avian survey. For avian guidelines, BOEM plans to include information from the University of Rhode Island study “Developing Protocols and Modeling

Tools to Support Renewable Energy and Stewardship” and the study “Statistical Guidelines for Marine Avian Surveys,” an interagency agreement with NOAA.

Besides providing guidelines for data collection and monitoring of wind facilities, BOEM needs to have an understanding both of the quality of the data being received in plans, as well as the effectiveness of survey methods used in the identification of archaeological sites in the marine environment for which BOEM has stewardship. Inefficient or unreliable survey methods can be costly, both in terms of impacts to missed archaeological sites, but also in terms of requiring unnecessary levels of effort from developers underwriting the cost of these surveys.

#### 1.4.8 Site Assessment

Prior to the placement of a structure or buoy on the OCS, BOEM requires a site assessment. Evaluation of the environmental consequences of both the site assessment, which may include the use of geophysical, geotechnical, archaeological and biological surveys, and the structure that is put in place (meteorological buoy or tower) is required. These evaluations are based on the best available information and expert analysis prior to the conducting of the activities. These analyses could be improved with more accurate and real-time observations of the impacts.

### 1.5 New Starts for FY 2012 and Ongoing Studies Table

Table 1 lists new studies planned to start in FY 2012 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.** Atlantic OCS Region Planned for FY 2012 and Ongoing Studies

NSL #	Study Title	Planning Area (s)	Start FY	Partners
<b>New Starts</b>				
<b>Habitat &amp; Ecology</b>				
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	
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	
<b>Social Sciences</b>				
AT-11-01	The Socioeconomic Impact of OCS Wind Development on Fishing	N. ATL	2012	
AT-	Developing Protocols for Reconstructing	N. ATL	2012	

12-01	Submerged Paleocultural Landscapes and Identifying Ancient Native American Archaeological Sites in Submerged Environments			
AT-12-04	Atlantic Offshore Wind Development: Public Attitudes, Values, and Implications for Recreation and Tourism	N.-, Mid.-, S. ATL	2012	
<b>Information Management</b>				
AT-12-03	Atlantic Renewable Energy Workshop	N.-, Mid.-, S. ATL	2012	
<i>*Note: The procurement of any study is contingent upon availability of funding</i>				
<b>Ongoing Studies</b>				
<b>Air Quality</b>				
AT-11-03	Synthesis, Analysis, and Integration of Air Quality and Meteorological Data for the Atlantic Region	N.-, Mid.-, S. ATL	2011	
<b>Fates and Effects</b>				
AT-10-x13	Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the OCS (II)	N.-, Mid.-, S. ATL	2010	NOPP
<b>Habitat &amp; Ecology</b>				
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
AT-10-x16	Developing Environmental Protocols and Modeling Tools to Support Ocean Renewable Energy and Stewardship	NAT	2010	NOPP
<b>Information Management</b>				
AT-11-02	Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities	N.-, Mid.-, ATL	2011	
<b>Marine Mammals and Protected Species</b>				
AT-	Atlantic Marine Assessment Program for	Mid.-, S.	2010	



## 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 found at: <http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Renewable-Energy/Renewable-Energy-Research-Completed-Studies.aspx>

The following sections focus on the proposed studies for FY 2013 and FY 2014.

### 2.2 Profiles of Studies Proposed for FY 2013 NSL

**Table 2.** Atlantic OCS Region Studies Proposed for the FY 2013 NSL

Page #	Discipline	Title	Rank
15	HE	Pilot Study: Tracking Offshore Occurrence of Common Terns and American Oystercatchers with VHF Arrays	1
17	SS	Environmental and Social Consequences of Port Modifications to Accommodate Operations Associated with Offshore Commercial Wind Energy on the Mid-Atlantic OCS	2
19	HE	Integrative Statistical Modeling and Predictive Mapping of Seabird Distribution and Abundance on the Atlantic OCS	3
21	SS	Small Coastal Vessel Usage Patterns and Density Levels on the Atlantic OCS	4
23	SS	Atlantic OCS Cultural Resources Survey and Archaeological Inventory Geographic Information System	5
25	SS	Development of a Historic Context for Shipwrecks located on the OCS Offshore the Mid-Atlantic	6
27	HE	Fishery Physical Habitat and Epibenthic Invertebrate Baseline Data Collection	7
29	FE	Literature Review: Environmental Risks, Fate and Effects of Chemicals Associated with Wind Turbines on the Atlantic OCS	8
31	IM	3 <sup>rd</sup> Annual Atlantic Wind Energy Workshop 2013	9
AQ = Air Quality                      HE = Habitat & Ecology                      SS = Social Sciences IM = Information Management      FE = Fates & Effects			

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## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015

**Region:** Atlantic

**Planning Area(s):** North Atlantic

**Title:** Pilot Study: Tracking Offshore Occurrence of Common Terns and American Oystercatchers with VHF Arrays

**BOEM Information Need(s) to be Addressed:** The common tern and American oystercatcher are non-listed migratory birds identified by the USFWS as species of high concern. Movements of terns and shorebirds around Nantucket Sound and along the mid-Atlantic have been poorly documented. This information is needed to assess the potential impacts of renewable energy development on these species and to help discriminate between sites suitable for wind energy development and sites unsuitable because of activity of bird species of high conservation concern. Because the common tern in Nantucket Sound is regularly found in mixed flocks with the endangered roseate tern, it is also an excellent surrogate for that species. Movement information on these two species will also improve BOEM's ability to assess likely impacts of wind energy development on other similar species of terns and shorebirds.

**Cost Range:** (in thousands) \$280-\$420

**Period of Performance:** FY 2013-2014

### **Description:**

Background: Information is needed to document movements of terns and shorebirds from Nantucket Sound and along the Mid-Atlantic region to inform the review process for proposed wind energy development in the Mid-Atlantic region. Common terns and American oystercatchers are the FWS recommended high priority, non-listed species around Nantucket Sound and the Mid-Atlantic region. This information on oystercatchers and common terns will complement other bird studies either recently completed (listed roseate terns and piping plovers and candidate red knot) or in progress (surf scoter, red-throated loon, and northern gannet) designed to document movements, timing and migratory corridors from Massachusetts south to the Outer Banks of North Carolina. All these bird species were identified by the Fish and Wildlife Service as high priority species in the area. American oystercatchers are of particular interest because the Nantucket Sound area where they will be captured is the northern extreme of their current breeding range, which formerly extended as far north as Maine. A recent survey indicated just 16 nesting pairs around the perimeter of Nantucket Sound.

Objectives: The objectives of this study are:

- to determine the movements and pathways of common terns and American oystercatchers around Nantucket Sound and the larger Mid-Atlantic region.
- to improve assessments of the potential impact of offshore wind development on terns and shorebirds.

- to improve BOEM's ability to discriminate between sites potentially suitable for wind energy development and sites that are unsuitable because of local activity by birds of high conservation concern.

Methods: Up to 15 American oystercatchers and up to 50 common terns will be captured during the nesting season and fitted with externally attached backpack VHF transmitters lasting as long as possible given acceptable battery weight (i.e., <5% of body mass). An array of VHF transmitter receiving stations will be strategically deployed around the perimeter of Nantucket Sound and surrounding areas such as Long Island and Block Island to detect transmitter signals and document movement of individual birds among stations. VHF signals will be logged at receiving stations during breeding and migratory periods when birds occur in the study area.

**Revised Date:** March 29, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2012–2013**

**Region:** Atlantic

**Planning Area(s):** Mid-Atlantic

**Title:** Environmental and Social Consequences of Port Modifications to Accommodate Operations Associated with Offshore Commercial Wind Energy on the Mid-Atlantic OCS

**BOEM Information Need(s) to be Addressed:** The large scale of offshore wind turbine components, towers and foundation structures limits overland transportation options and creates a need for port facilities that can handle such large payloads. Not all East Coast ports are currently equipped to handle the needs of offshore commercial wind development thus a few ports may become offshore wind energy hubs and/or staging areas and port expansion and modifications would be 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 social consequences of such development, including the impacts from port expansion and changes in port operations. Due to the substantial role a single project will play in a port operations and expansion, project-specific EISs prepared by BOEM will need to evaluate the potential environmental and social consequences of the expansion and use of these hubs.

**Cost Range:** (in thousands) \$240-\$300

**Period of Performance:** FY 2013-2014

### **Description:**

**Background:** BOEM opened to 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. Onshore facilities to support activities on these leases would likely to be located at existing ports near the areas proposed for leasing ( U.S. Department of the Interior, 2012). Offshore wind energy development on the OCS 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). The expansion and operation of such facilities can produce a variety of environmental impacts, such as impacts of emissions, expansion into undeveloped areas, vessel induced wake erosion, increased dredging, and discharges on air and water quality and coastal habitats. 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 social 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,” which is projected to be completed

by May 2012; “OCS Renewable Energy and Space-Use Conflicts and Related Mitigation” which is projected to be completed in late June 2012; and “Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development” which is projected to be completed by September 2012.

This study should take into consideration and build on progress made under DOE’s research of market barriers, such as additional criteria for identifying potential hubs and possible improvements (*See:*

[http://www1.eere.energy.gov/windandhydro/pdfs/national\\_offshore\\_wind\\_strategy.pdf](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 social impacts resulted from those alterations. The USACE should also be used as a source for historical data on the environmental and social impacts of past port improvements.

**Objectives:** The objectives of this study are to achieve:

- improved understanding of current port capacity, specifically ones that could handle offshore wind;
- improved assessment of environmental and social consequences from modifications to ports that support offshore renewable energy facility construction, as well as the consequences of alterations to port operations;
- understanding of the effectiveness of potential mitigations measures for the environmental and social impacts of port modifications to accommodate offshore renewable energy facility construction.

**Methods:** This study will identify ports that have the ability to accommodate the type of vessels required for offshore wind development in the four WEAs offshore New Jersey, Delaware, Maryland and Virginia. 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 further refine the list of potential hubs. The study will not discuss smaller ports that may only be associated with one aspect of offshore renewable energy projects (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 improvements 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 social (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 should be utilized for this analysis. The cumulative impacts of improvements and operations at each port should also be described. In addition, mitigation measures should be identified and an analysis of their effectiveness when implemented for similar projects should be conducted.

**Revised Date:** April 5, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Atlantic

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

**Title:** Integrative Statistical Modeling and Predictive Mapping of Seabird Distribution and Abundance on the Atlantic OCS

**BOEM Information Need(s) to be Addressed:** 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. To assist in the environmental review of wind energy areas and in the evaluation of sites for new offshore projects, BOEM needs maps illustrating the seasonal distribution patterns of bird species using the Atlantic OCS.

**Cost Range:** (in thousands) \$400-\$600

**Period of Performance:** FY 2013-2015

### **Description:**

**Background:** 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. Discussions during the FWS 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.” In response, the Atlantic Marine Bird Conservation Cooperative has partnered with The North Atlantic Landscape Conservation Cooperative to implement Phase I of the “Best Darn Bird Map” by holding a workshop to identify and quantify risk factors for marine birds in the Northwest Atlantic. In addition, BOEM is funding a study by USGS, “Compendium of Avian Occurrence,” to create maps of seabird statistical distributions for the Mid-Atlantic in FY2012.

Given that there is also interest in leasing for wind energy development in the North and South Atlantic, geographical expansion of this effort is warranted. This effort will create maps that span the entire Atlantic OCS, update the Mid-Atlantic maps, and develop a process for updating the maps as new data becomes available. In addition, these maps will be made available through the Multipurpose Marine Cadastre (MMC), a tool developed for viewing and sharing geographic data related to offshore renewable energy development.

This study will incorporate all available science-quality seabird survey data (including data derived from ships, planes, telemetry, and other emerging platforms) into high-resolution predictive maps of seabird occurrence and abundance along the Atlantic OCS. It will build on previous efforts to synthesize seabird data (e.g., Compendium of Avian Occurrence) and pilot statistical mapping projects for smaller regions (e.g., the NOAA Biogeography Branch’s work in the New York Bight and Mid-Atlantic Bight). The statistical modeling effort will use data on available environmental features (e.g., oceanography, geomorphology, prey distribution) to predict probabilities of seabird occurrence and abundance in between survey locations.

Objectives: The objective of this study is to provide easily understandable information to aid offshore wind development siting decisions and reduce the risk of impacts to birds.

Methods: This study will: 1) develop, validate, and apply statistical models that combine existing survey data and environmental predictors to create continuous gridded seabird occurrence and abundance maps along the entire Atlantic OCS; 2) create a flexible product that supports updating these maps as new data becomes available; and 3) assemble data layers into a common spatial format and made publicly available in the MMC. Prior to modeling, there will be a review of the seabird data by bird experts to insure that there is consistent use of species codes, assignment of survey platforms, etc. Predictive accuracy will be assessed with a variety of diagnostic and validation statistics and the effort will also generate maps to illustrate areas of uncertainty which will facilitate interpretation of the predictive maps and can be used to guide future survey efforts. All maps and model 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 MMC and other public data portals.

**Revised Date:** March 28, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Atlantic

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

**Title:** Small Coastal Vessel Usage Patterns and Density Levels on the Atlantic OCS

**BOEM Information Need(s) to be Addressed:** Previous studies and stakeholder input has demonstrated that offshore wind development has the potential to impact existing maritime uses and navigational safety. A complete understanding of both large and small maritime vessels usage will be crucial for environmental analysis and mitigation of potential impacts from offshore wind development on other uses of the OCS. This study would provide information on small vessel usage to develop an understanding of the total offshore maritime vessel traffic on the Atlantic OCS. This information is necessary to assist in preparation of environmental analyses under the NEPA, and to meet BOEM’s regulatory obligations under the Coastal Zone Management Act (CZMA) which require that Federal agencies consider any reasonably foreseeable coastal effect on coastal uses or resources from a Federal agency activity.

**Cost Range:** (in thousands) \$250-\$370

**Period of Performance:** FY 2013-2014

### **Description:**

Background: This study will investigate small vessel (tugs, barges, other commercial vessels not tracked by the Coast Guard) usage patterns and densities on the Atlantic OCS. Recently, BOEM acquired and analyzed geo-referenced AIS data for ships showing location and type of ships on the Mid-Atlantic OCS. AIS is required on vessels greater than 300 gross tons but is optional for vessels of smaller size. Therefore, smaller vessel usage patterns and densities are omitted in analysis of AIS data. This study will add on to the current BOEM space-use conflict study “OCS Renewable Energy and Space-Use Conflicts and Related Mitigation,” which is in part an ethnographic field study of commercial and recreational fisherman that includes a compilation of Geographic Information System (GIS) maps of shipping lanes, high-use fishing areas, military use areas, etc., and the U.S. Coast Guard’s Atlantic Coast Port Access Route Study (ACPARS) which is investigating total commercial vessel use of the Atlantic seaboard, with an emphasis on large vessel types.

Objectives: The objective of this study is improve assessments of small vessel traffic usage along the Atlantic coast by identifying spatial and temporal distribution patterns and usage along the nearshore Atlantic OCS that is not currently captured through existing data sources such as AIS.

Methods: The methodology will consist of data collection from public sources, relevant use of *PortVision* maritime knowledge system (used by BOEM’s Gulf Of Mexico region), use of the U.S. Coast Guard’s ACPARS data, discussions with representatives from other relevant government agencies, and interviews and surveys of small vessel operators and associations engaged in the small vessel industry, including the tug/towboat industry, recreational and

commercial fishing industry, and coastal tourism industry (i.e., whale watching, SCUBA, etc.). The methodology will include conducting interviews and surveys of small vessel operators, and an analysis and synthesis of collected and existing data and information.

The deliverables will consist of a final report that will include a review of current small vessel usage, estimations of future usage patterns and densities, and a GIS database comprised of small vessel ports (locations and use levels), traffic routes and usage patterns. The GIS database will provide a series of spatial and temporal maps, including identification of routes and vessels by type (i.e., tug routes, recreational fishing routes, tour routes, etc.), seasonality of use, traffic type by port, and current and future vessel traffic levels expected to transit near existing and potential future wind energy areas. The GIS products will be designed to be compatible with the Multipurpose Marine Cadastre and any appropriate regional CMSP process. A final report will provide a comprehensive list of stakeholders and associations representative of the small vessel community, and a summary of information by state, by port, and by seasonality of use.

**Revised Date:** January 27, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Atlantic

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

**Title:** Atlantic OCS Cultural Resources Survey and Archaeological Inventory Geographic Information System

**BOEM Information Need(s) to be Addressed:** This study will create a geo-referenced, digital storage database (or geo-database) to integrate multiple datasets, including those resulting from cultural resources surveys and archaeological inventories associated with BOEM-permitted or -funded actions. The resulting geo-database will be used by BOEM archaeologists for environmental analyses, consultations, resource stewardship and management, and future plan reviews.

**Cost Range:** (in thousands) \$240-\$360      **Period of Performance:** FY 2013-2014

### **Description:**

**Background:** Essential to responsible stewardship and efficient use of data gathered in the course of BOEM-funded research and BOEM-permitted actions is the creation of a geo-referenced, digital storage database (or geo-database) in the form of a geographic information system. Digital data produced in the course of studies and collected as a result of permitting actions, NEPA reviews, consultations under Section 106 of the NHPA, and post-review discoveries should be centralized in a geographic information system and integrated with other, publically-available datasets, for the purposes of efficient management of resources BOEM oversees; informing future reviews and consultations; and sharing of non-sensitive information with other researchers and developers.

A geographic information system focused on the results of cultural resources surveys and archaeological inventories conducted on the Atlantic OCS does not presently exist. There exist databases dedicated to identified shipwrecks and obstructions, many of which have been incorporated in the Atlantic Shipwreck Database (funded by BOEM in 2011), as well as databases that house cultural resources surveys and archaeological inventories conducted onshore, such as those owned by the State Historic Preservation Offices. However, there presently is not any system that indexes and/or geo-references data collected through cultural resources surveys and archaeological inventories undertaken on the Atlantic OCS. Furthermore, the Atlantic Shipwreck Database is only one particular set of data – the once-recorded locations of shipwrecks and other obstructions. It cannot accommodate survey data; nor can it accommodate the marine environment’s effects on archaeological sites; nor can it accommodate other identified cultural resources that BOEM must consider in its stewardship responsibilities. Currently, no geographic information system and/or database exists that stores these data, let alone integrates them, geo-references them, updates them, and efficiently automates their usefulness in informing future review, consultation, and research.

This geo-database will create a platform to integrate BOEM's data with a number of widely-relevant and exponentially-growing datasets relating to other sources of cultural resources data, such as survey, inventory, and consultation, all of which BOEM has a responsibility to include in its environmental analyses. Given BOEM's extensive permitting activities planned in this region in the 2013-2015 timeframe, and the geological and geophysical activities (including marine archaeological surveys) and NEPA review and consultations that will occur as a result, BOEM has both an immediate need and a responsibility to collect, organize, and store these digital data. Although this information should be gathered and organized in concert with other coordinated efforts, because some of this information is sensitive and because BOEM has a responsibility to limit access to it, it cannot be made part of any larger or wider geographic information system.

Objectives: The objective of this project is to create the (Atlantic) Outer Continental Shelf Interactive Registry of Archaeological Surveys (OCSIRAS), providing BOEM archaeologists the ability to conduct more efficient environmental analysis, including:

- comparing the effectiveness of survey methods and results from future surveys conducted on the same portions of the OCS;
- refining future survey methods recommended by BOEM for plan approval;
- finding resources and conducting compliance work; and
- generating spatially-based statistical queries for reporting and environmental analyses.

Specifically, OSCIRAS will allow BOEM archaeologists to efficiently:

- identify or update the geographic location, nature, manner, methods, and results of newly- and previously-conducted marine archaeological surveys;
- identify or update the presence (or absence) and locations of newly- and previously-identified cultural resources and update those locations when necessary;
- locate areas within future lease blocks that will – or will not – require future survey;
- access other, applicable databases both internal and external by links, without having to house externally-maintained data;
- access other forms of data and primary and secondary historic sources, such as photographs, newspaper clippings, bathymetric images, side-scan sonar images, etc.;
- overlay new information collected from surveys, studies, and other research with existing spatial data already in use by BOEM; and
- query data for research purposes.

Methods: The main methods involve a systematic search via the internet and communications with experts, etc. to identify the needed software and hardware, including server space for BOEM-owned and –managed data, followed by design of an integrated geo-database. Initial “layers” or “datasets” will efficiently link to other existing databases, both locally-housed as well as publically-available online, such as the NOAA's bathymetric data. BOEM-owned and –managed data will be stored locally on BOEM's servers, with appropriate user access given based on specific privileges. Once sensitive data and information has been removed, a component of the database will be made publically available.

**Revised Date:** April 2, 2012



## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015

**Region:** Atlantic

**Planning Area(s):** Mid-Atlantic

**Title:** Development of a Historic Context for Shipwrecks located on the OCS Offshore the Mid-Atlantic

**BOEM Information Need(s) to be Addressed:** As part of the decision-making process for renewable energy projects on the Atlantic OCS, BOEM is required to consider the effects of these actions on historic properties under Section 106 of the National Historic Preservation Act (NHPA). With over 4,000 known shipwrecks, and more likely to be identified through surveys conducted for renewable energy projects, the OCS offshore the Mid-Atlantic states has the highest concentration of historic period cultural resources in the Atlantic. These waters were utilized from the seventeenth century to the present; experienced maritime activities associated with all periods of the nation's history; and played an important role in the development of the global connections between the Americas, Europe and Africa through colonialism, commerce, and the trans-Atlantic slave trade.

BOEM is in need of a historic context specific to this region to assist in the planning for renewable energy activities on the OCS. As outlined in the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation*, a historic context is a planning tool that provides a thematic framework of global, regional and local significance and outlines major historical themes and concepts all of which are tools used to assist in determining the eligibility of a site for listing in the National Register of Historic Places. A historic context also serves as the foundation for decisions regarding the identification, evaluation, and management of cultural resources. This study will employ a cultural landscape approach that considers how diverse cultural groups have interacted with the maritime environment in the Mid-Atlantic region over thousands of years.

**Cost Range:** (in thousands) \$120-\$180

**Period of Performance:** FY 2013-2014

### **Description:**

**Background:** BOEM, OREP is responsible for implementing and managing offshore renewable energy programs within Federally-managed waters on the OCS. Under the “Smart from the Start” wind energy initiative four WEAs have been identified offshore the Mid-Atlantic States of New Jersey, Delaware, Maryland, and Virginia as potentially suitable for responsible wind energy development on the Atlantic OCS. Beginning in the 2013-2015 timeframe BOEM anticipates that extensive renewable energy permitting activities will occur in this region related to leasing, site assessment activities, site characterization activities, and the proposed development of large-scale regional energy transmission systems.

A wealth of information exists regarding maritime commerce, history, culture, and the greater influence of maritime activities on the development of both the Mid-Atlantic region and the

nation. This information exists in secondary sources and also primary archival materials housed in various repositories in the seaboard urban areas that grew from these maritime activities, such as Philadelphia, Baltimore, Annapolis, and Alexandria. This study will augment the previous Atlantic region archaeological studies, including the development of the Atlantic Shipwreck Database (ASD), by providing a means to capture and organize relevant contextual information that is necessary for evaluating the significance of cultural resources on the OCS. This information also facilitates a perspective that places individual archaeological sites within a larger historical and social context rather than viewing them as isolated and unrelated anomalies on the OCS. A cultural landscape approach has been successfully implemented in the study of cultural resources as part of the Rhode Island Special Area Management Plan (SAMP) and BOEM seeks to consider this approach for other areas of the Atlantic OCS.

#### Objectives:

The objective of this study is to prepare a regionally-specific historic context for the Mid-Atlantic region of the OCS as a management tool to aid BOEM in the consideration of shipwrecks during the planning and decision-making process for renewable energy projects on the Atlantic OCS.

#### Methods:

A cultural landscape approach will serve as the framework for conceptualizing and organizing the context study. Using secondary sources and primary historical documents, the study will identify and describe major historical periods from the seventeenth century to the twentieth century and outline a thematic framework of global, regional and local significance and the types of cultural resources that may be associated with each of these themes. The study will identify repositories of primary archival materials and provide a synopsis of the material available for future research. The study will also include limited archival research at regional repositories that contain relevant primary source documents. The study will provide a baseline of contextual information for the region to be used as a starting point for planning, analysis, project review, and interpretation of known and newly identified sites. The study is not intended to be exhaustive, but rather to be a framework that is expandable and adaptable to the agency's historic preservation planning needs. The study will serve as a prototype to test the feasibility and usefulness of preparing similar contexts for other planning areas of the Atlantic OCS.

**Revised Date:** April 4, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Atlantic

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

**Title:** Fishery Physical Habitat and Epibenthic Invertebrate Baseline Data Collection

**BOEM Information Need(s) to be Addressed:** WEAs have been, or are in the process of being identified throughout the North and Mid-Atlantic planning areas. Lessees must collect data characterizing the habitat of the potential lease area. However, at present there is a lack of a systematic baseline characterization of these proposed and actual WEAs to inform BOEM and the lessees. This 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.

**Cost Range:** (in thousands) \$500- \$700K

**Period of Performance:** FY 2013-2014

### **Description:**

Background: This project would build upon previous efforts to collect baseline habitat data and to analyze the data in the context of potential impacts from renewable energy development. There is a lack of standard regional or WEA scale baseline benthic habitat data that includes areas for potential wind energy development along the Atlantic OCS. Previous habitat characterization efforts have primarily been inshore or designed for other specific purposes in areas that do not overlap with potential wind energy lease areas.

This study would assess and characterize benthic habitat and the epibenthic macro-invertebrate community in existing and proposed WEAs from Maine to South Carolina. This survey will collect data allowing the selection of appropriate control study sites and setting a baseline of species presence, abundance, and sediment/seabed type. This study may include analysis of previously collected data of similar type as well as new data collection and analysis.

Objective: The objective of this study is to establish baseline benthic habitat characteristics at regional/WEA scales. This data would allow for improved siting, impact assessments, and provide a baseline to evaluate project-scale habitat surveys submitted by lessees. The collected data would also serve to ground-truth remotely sensed data from echosounder surveys.

Methods: The study would conduct imaging surveys (video and still photography) of benthic habitat at present and proposed WEAs on a minimum of a 3 nautical mile grid or along a continuous transect. Currently, 11 areas have been identified from Massachusetts to North Carolina, additional areas may be identified in Maine, New York, and South Carolina (not including unsolicited applications for a single project). Sampling resolution may be

increased based upon diversity of habitat types found. The survey would use high resolution videography and still imagery of each station/transect. This survey will provide distribution and density estimates of prevalent megafauna and a classification of substrate type across the survey domain. The number of stationary quadrats per station and/or length of survey tows will be refined prior to a formal request for quotes.

**Revised Date:** April 6, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Atlantic

**Planning Area(s):** North and Mid-Atlantic

**Title:** Literature Review: Environmental Risks, Fate and Effects of Chemicals Associated with Wind Turbines on the Atlantic OCS

**BOEM Information Need(s) to be Addressed:** Based on data within proposals submitted to BOEM for Atlantic offshore wind turbines, a wind turbine array consisting of 100-130 wind turbine generators, roughly the amount of turbines needed to provide almost 250,000 homes with power, contains approximately 40,000 gallons of hazardous fluids, primarily electrical insulating oil, diesel fuel, and lubricating oil. Models developed to estimate the transport, ending concentrations, and environmental effects of these hazardous chemicals have greatly enhanced the information available to turbine operators, regulatory and permitting agencies, and chemical spill response teams. Future EISs for wind energy proposals must analyze the impacts these chemicals may have on benthic habitats, marine flora and fauna, and water quality, and the environments likely affected by transport of these hazardous materials. This study will review the literature and modeling available for assessment of the environmental risks, fates and effects of chemicals associated with offshore wind turbines. BOEM would incorporate these references and model estimates to draft future EISs and would use the study to identify potential mitigation measures for chemical spills associated with offshore wind turbines.

**Cost Range:** (in thousands) \$80-\$140

**Period of Performance:** FY 2013

### **Description:**

Background: According to the Final Alternative Energy Programmatic Environmental Impact Statement (MMS, 2007), hazardous materials are subject to the requirements for classification, documentation, packaging, labeling, and handling established under the Hazardous Materials Transportation Act (HMTA), implemented by the USCG, and detailed in 40 CFR Part 302. From submitted leasing applications, BOEM approximates that 500-1,000 gallons of coolants, lubricants, and other mechanical fluids will be present in offshore wind turbines. The synergistic effects of these chemicals must be assessed if an accident occurs in which these chemicals are released simultaneously. The solubility and volatility of these chemicals must be determined in order to more accurately estimate chemical transport within the environment and the potential impacts to water quality and the benthos.

Objectives: The objective of this study is to provide an evaluation of the potential environmental consequences of a spill of the chemicals typically found on wind turbines.

Methods: This study will: 1) identify the chemicals and quantities that could be present in different types of commercial wind turbines designed for offshore use (direct drive, 3.5 MW, 5 MW, 10 MW, etc.); 2) explore the models available to determine the transport and fate of the identified chemicals; 3) evaluate the risk of spill occurrence through a combination of

reviewed literature and available models (e.g., Oil Spill Risk Analysis Model (OSRAM), CHEMMAP Chemical Discharge Model System, etc.); and 4) use available literature and models to describe the fate and toxicity of identified chemicals (alone and in combination).

Anticipated methods include incorporation of domestic and international knowledge, discussions with turbine manufacturers, and discussions with relevant government agencies like the U.S. Environmental Protection Agency (USEPA), NMFS, and USCG. Technology Assessment and Research Program (TA&R) Study 633, “Wind Farm/Turbine Accidents and the Applicability to Risks to Personnel and Property on the OCS, and Design Standards to Ensure Structural Safety/Reliability/Survivability of Offshore Wind Farms on the OCS,” identifies accidents that could result in a release of these chemicals. A review of relevant literature and modeling systems can provide a more complete description of the overall environmental risks of spills associated with the identified chemicals and the fates and effects of the identified chemicals on water quality, benthic habitats and marine life.

**Revised Date:** April 2, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Atlantic

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

**Title:** 3rd Annual Atlantic Wind Energy Workshop 2013

**BOEM Information Need(s) to be Addressed:** Offshore wind energy is a nascent industry that is rapidly evolving. New technologies are continuously proposed and the potential environmental effect from the deployment of these technologies is often changing. To stay attuned to these changes, BOEM must seek the most up to date information. This is most easily achieved through presentations at a workshop that focuses on the current questions. In addition, BOEM has a responsibility to share with the offshore wind community the most recent results of studies funded through the Environmental Studies Program.

**Cost Range:** (in thousands) \$180-\$270

**Period of Performance:** FY 2013

### **Description:**

Background: The Renewable Energy Program was initiated with the signing of the Energy Policy Act of 2005. Since then, the offshore wind energy industry has expanded bringing innovation and new ideas about technology to the forefront. In addition, BOEM has funded numerous studies to address the potential impacts from offshore wind development on the Atlantic Outer Continental Shelf. Other agencies, such as DOE, as well as states, have also aggressively funded studies to fill the information needs about the industry including the environmental consequences. With the plethora of information being accumulated, it is an imperative that BOEM stay on top of the continuously evolving sources of information. Workshops are one mechanism to gather information from a variety of sources in a condensed format. A workshop focusing on the current state of knowledge is warranted in calendar year 2013 as many BOEM-funded studies will be completed or near completion. In addition, a workshop is an opportunity to improve collaboration between agencies and other stakeholders engaged in collecting relevant environmental information.

Objectives: The objectives for the workshop are:

- 1) Update participants on current research activities at BOEM and other agencies related to environmental effects of offshore wind development.
- 2) Enhance collaboration between those involved in funding and gathering scientific information about the marine environment where offshore wind development is occurring.
- 3) Identify future areas to focus research.

Methods: The workshop will: 1) provide a summary of ongoing and completed environmental, socio-economic and technology/safety studies that are relevant to offshore wind energy development on the Atlantic OCS; 2) identify information needs and gaps; and 3) develop partnerships and identify potential synergies for future studies. Prior to the workshop, a technical summary of studies conducted and partnerships formed since the previous workshop will be prepared to assist the workshop participants. The workshop would be attended by experts conducting studies relevant to the Atlantic wind energy development and representatives of state and Federal agencies. The

environmental studies, social economic studies and technology and safety assessments with cover a range of topics pertaining to the known environmental impacts and development requirements. This workshop will result in a synthesis report containing: 1) a glossary of Federal and state agencies involved in offshore wind energy development that includes their roles and responsibilities; 2) abstracts and presentations; 3) information gaps identified during breakout sessions; 4) recommended studies; 5) list of partnerships and potential synergies for future studies.

**Revised Date:** April 6, 2012



### 2.3 Profiles of Studies Proposed for FY 2014 NSL

**Table 3.** Atlantic OCS Region Studies Proposed for Fiscal Year 2014 NSL

<b>Page #</b>	<b>Discipline</b>	<b>Title</b>
35	SS	Offshore Wind Turbine Allision Impact Analysis and Modeling
37	SS	Efficiency and Effectiveness of Marine Archaeological Survey Methods on the Atlantic Outer Continental Shelf
39	SS	Improving the Accuracy of Scenarios used in Environmental Evaluations in Support of Wind Energy Leasing and Development on the Atlantic OCS
41	AQ	Microclimate Formation within Wind Turbine Arrays on the Atlantic OCS
AQ = Air Quality                                      FE = Fates & Effects                                      SS = Social Sciences IM = Information Management		



## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015

**Region:** Atlantic

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

**Title:** Offshore Wind Turbine Allision Impact Analysis and Modeling

**BOEM Information Need(s) to be Addressed:** Allision, the maritime term for a vessel striking a fixed object versus a moving object, is a serious concern for offshore wind facilities sited around major and minor ports along the Atlantic coast. There is little known regarding the consequences of allision for different vessel classes and different sea states.

Understanding the potential range of consequences is important for evaluating the potential environmental impacts should an allision occur as well as the probability of the occurrence. The information is also useful to potential design standards for wind facilities sited in areas of higher allision risk.

**Cost Range:** (in thousands) \$150-\$230

**Period of Performance:** FY 2014

### **Description:**

**Background:** Due to the access and proximity to certain infrastructure, offshore wind facilities are often sited near port facilities. Vessel traffic around the ports may be heavy and not necessarily constrained to established traffic lanes. As with any structure placed the ocean, there is a chance that a vessel, other than a maintenance or construction vessel, could allide with the structure causing catastrophic damage to the vessel, fixed structure or both. This type of allision is unanticipated since it would require a loss of vessel power or steerage, high winds or a sea state that would drive the vessel toward the structure, and failure of the vessel's and/or structure's design to withstand the impact. In the absence of these factors the current mitigation measures for placement of wind turbines outside of traffic lanes, lighting, and mariner notifications of structures should prevent allisions of this type from occurring. If an unanticipated allision were to occur, and a vessel's cargo was discharged, the impacts would depend upon the type and amount of cargo discharged, whether oil, liquefied natural gas, chemicals, or other commodities. Thus, although the potential for allision is considered minor under normal circumstances, the USCG has raised concerns for allision during severe weather and in the event of vessel navigation failure.

Little is known about the consequences of allision between a vessel and a wind turbine. Various factors such as vessel size/tonnage, sea state, and turbine design can all influence what the consequences of an allision would be. The BOEM intends to partner with USCG, through an interagency agreement, to evaluate the risk of vessel strikes with wind turbines along certain routes, but is not expected to evaluate the consequences of such an allision. This proposed study would supplement the BOEM/USCG study.

Understanding allision consequences will inform BOEM of possible risks associated with allisions, especially in cases where the consequence may include the discharge of pollutants into the environment (e.g. oil). Additionally, allision analysis may inform the necessity of certain wind turbine design standards for wind turbines located near areas at higher risk of

vessel allision as determined by the USCG. An example of such a design standard could be requiring induced structure failure at the mudline during an allision in high risk areas.

Objectives: The objective of the study is to enhance the understanding of the range of consequences associated with wind turbine allision under multiple scenarios.

Methods: This study will include a synthesis of current information regarding vessel allisions with offshore wind facilities and the development of a model to evaluate allision consequences under various scenarios. The deliverables will consist of a literature review (national and international), model development and analysis, and a final report summarizing the findings. It is envisioned that the model scenarios would be informed by the literature review and consultation with appropriate Federal agencies including the USCG and NOAA's National Weather Service for vessel characteristics and sea state information, respectively. Since direct measurement of allision is highly impracticable the model would be a conceptual simulation utilizing impulse and momentum principles under appropriate durations. It is expected that model impact outputs would include ranges of structural failures for the identified vessel classes and designs, and wind energy structure designs, under likely sea states including 25, 50, and 100-year storm events. The model analyses would include the ultimate physical fate of the vessels and wind turbines (e.g. vessel cargo discharge, failure of wind turbine support structure) as well as other impacts as informed by the model.

**Revised Date:** April 6, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Atlantic

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

**Title:** Efficiency and Effectiveness of Marine Archaeological Survey Methods on the Atlantic Outer Continental Shelf

### **BOEM Information Need(s) to be Addressed:**

The collection of submerged archaeological resources baseline data prior to development continues to be of critical importance to BOEM in the preparation of NEPA review documents; consultations under Section 106 of the National Historic Preservation Act; and post-lease management comparisons for evaluating the effectiveness of mitigation measures and lease stipulations for unanticipated discoveries of archaeological resources. A critical component of collecting submerged archaeological resources baseline data is that BOEM must have an understanding both of the quality of the data being received in SAP, COP, and General Activities Plans for renewable energy projects; as well as the effectiveness of survey methods used in the identification of archaeological sites in the marine environment for which BOEM has stewardship. Inefficient or unreliable survey methods can be costly and both in terms of impacts to missed archaeological sites, but also in terms of requiring unnecessary levels of effort from developers underwriting the cost of these surveys.

A controlled comparison of the efficiency and effectiveness of marine archaeological survey methods on the Atlantic OCS will serve two of BOEM's needs simultaneously: it will provide baseline data prior to development, and it will provide a means of empirically measuring both cost and effectiveness of differing survey methods. This in turn will allow BOEM to refine – and improve – its archaeological survey guidelines; provide a higher level of confidence in the quality of data being used for Section 106 consultations and NEPA reviews; and ensure that funds – both BOEM's and developers' – that are dedicated to the identification of marine archaeological resources are used effectively and responsibly.

**Cost Range:** (in thousands) \$230-\$270

**Period of Performance:** FY 2014-2016

### **Description:**

Background: Most archaeological identification survey conducted in the United States and its waters is driven by the need to acquire federal permits for development. Additionally, marine archaeological survey methods are selected on the basis of factors such as equipment specifications, survey area variables, the types of sites expected in the survey area, permitting requirements, cost (and time), and surveyor experience and preference. Multiple survey methods are rarely, if ever, utilized over the same survey area, a practice that would, on the one hand, be more costly and unnecessary from a perspective that is permit-driven and focused on cost-competitiveness, but on the other hand, would provide the necessary empirical data to compare the effectiveness of the methods in question. Varying certain elements of the methodology against a control and surveying the same area will demonstrate, with empirical evidence, which methods are 1) most effective; 2) least costly, and both,

specifically for surveys conducted on the Atlantic OCS. Additionally, the baseline data collected will inform a number of BOEM initiatives and serve to test the accuracy of existing databases, such as the Atlantic Shipwreck database BOEM funded in 2011. The products of the study will include a technical report and supplementary raw data files of the survey areas that will be incorporated into BOEM's GIS for archaeological sites and surveys. An anticipated result of this study is the identification of baseline equipment and survey protocols that will inform BOEM's guidelines for archaeological survey.

Objectives: The objectives of the study are to:

- improve survey techniques for archaeological identification, and
- add to the baseline information about archaeological resources.

Methods: First, the study will provide empirical data to quantifiably demonstrate the method or methods most effective and most efficient (least costly) at identifying both submerged archaeological resources on the Atlantic OCS in waters up to 50 m (150 ft) deep, the results of which are 1) of high spatial resolution; 2) quantifiable and repeatable; 3) measured accurately, in terms of geographic position, and; 4) can be easily integrated with other scientific data in a geographic information system. Second, the study will provide baseline data on the presence or absence of archaeological resources within selected lease blocks and/or wind energy areas identified as part of the "Smart from the Start" wind energy initiative in the North and South Atlantic.

Multiple marine archaeological surveys will be conducted within the same selected lease blocks to compare and contrast independent methodological variables. Effectiveness will be measured in terms of more (number of) genuine positives successfully identified less false positives identified; efficiency will be measured in terms of less time and cost per area. The project will incorporate BOEM's previous studies that have evaluated remote-sensing technology, line spacing, and post-processing methods, as well as recent recommendations that multi-beam and interferometric sonars be added to remote-sensing requirements. Additionally, the project will involve a comparison of survey and post-processing practices utilized internationally in the final suite of variables considered.

Independent variables to be considered include:

- suite of equipment utilized, such as high-resolution multibeam sonar, side-scan sonar, sub-bottom profiler, magnetometer, ROV, and interferometric sonar;
- line spacing, orientation, and arrangement of survey transects;
- equipment settings, such as frequency, range, gain, and sensitivity to depth suitable for resolving the extents of possible Paleolithic deposits;
- depth of survey area; and
- post-processing methods

**Revised Date:** April 2, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Atlantic

**Planning Area(s):** North and Mid-Atlantic

**Title:** Improving the Accuracy of Scenarios used in Environmental Evaluations in Support of Wind Energy Leasing and Development on the Atlantic OCS

**BOEM Information Need(s) to be Addressed:** Offshore wind energy development is still in the planning phase with only one meteorological tower installed. Prior to the approval for the installation of site characterization equipment or site surveys, BOEM must prepare a NEPA document. The evaluation of the environmental impacts in these documents is necessarily based on predicted effects, i.e. scenarios, rather than actual effects. These assessments could be improved through direct observations of environmental consequences during installation or use of site characterization equipment.

**Cost Range:** (in thousands) \$500-\$700

**Period of Performance:** FY 2014

### **Description:**

Background: BOEM has already prepared several NEPA documents addressing the environmental and socioeconomic analyses of site characterization and assessment activities. These documents were prepared using the best available information about the proposed methodology, but still required reasoned analysis about the environmental consequences of the proposed activities. These analyses could be improved through direct observation of the activities and the environmental effects. The types of information collected would include measuring the duration of the activity, direct measurement of the environmental effect such as the sound generated during pile driving, and other identified information that would be most useful in making accurate analyses through creation of scenarios that more accurately reflect real world activities.

This study would determine the accuracy of the assumptions and findings of previous NEPA documents related to site characterization surveys (including geophysical, geotechnical, archeological, and biological surveys) and assessment activities (including the installation and operation of meteorological towers and buoys), which will lead to improved NEPA documents for better informed decision making.

Objectives: The objective of this study is to improve environmental analyses based on accurate information about the environmental effects of site characterization activities.

Methods: The study will determine and document:

- the accuracy of scenario assumptions (e.g., timeframe and frequency of activity, port usage, and number of vessel trips);

- accuracy of predicted impacts (e.g., bottom disturbances and visibility from shore) of site characterization and assessment activities; and
- The effectiveness of mitigation measures such as ramping up of sound producing devices.

This study will investigate selected meteorological towers and buoys that have been installed (summer 2012) or are in the process of being installed (summer 2013) on the Atlantic OCS. There will be several opportunities to investigate site characterization surveys, which have already begun offshore Delaware and will likely be taking place over multiple areas during the study period. Investigations of these activities could include a combination of interviews with lessees, site visits, ROV surveys, and vessel observers. Investigations can be augmented with information from meteorological towers installed offshore Europe. In order to serve as a reference guide for future NEPA documents, observations should be included in a report that follows a similar outline to BOEM NEPA documents.

**Revised Date:** April 6, 2012



## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015

**Region:** Atlantic

**Planning Area(s):** North and Mid-Atlantic

**Title:** Microclimate Formation within Wind Turbine Arrays on the Atlantic OCS

**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 to marine life, commercial and recreational activities, and navigation in the vicinity of a wind energy facility that need to be analyzed as part of the NEPA process.

**Cost Range:** (in thousands) \$400-\$600

**Period of Performance:** FY 2013 - 2015

### **Description:**

**Background:** During the public comment periods of the Cape Wind Energy Project there were concerns that wind turbine generators (WTGs) can create their own microclimate in Nantucket Sound. A microclimate is a small, local area having distinct weather or weather effects. Studies have been submitted that support 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.

**Methods:** The analysis will include modeling the Atlantic OCS climate and meteorological conditions for WEA identified in the North and Mid-Atlantic Planning Areas for different times of the year. This can be done using National Center for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR) Reanalysis data. The analysis will be repeated by inserting a wind turbine array consisting of approximately 100 turbines to simulate what will likely happen with respect to microclimatology at the different locations during the different times of the year. Meteorological parameters to be considered include, but are not limited to, temperature, humidity and water vapor pressure. Other parameters to be considered include turbulence and drag. In addition, the frequency of such an event taking place in the different locations will be determined. To test method and verify results, data from other offshore wind energy facilities should be obtained and inserted in to

model analysis to simulate conditions before and after the presence of the facility. (See Baidya Roy et al., 2010; Baidya Roy, 2011; and Emeis, 2010 for methodology used in other scenarios.)

**Revised Date:** January 31, 2012

## **SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2015 AND BEYOND**

BOEM's immediate information needs for the Atlantic OCS are related to renewable energy, including the impacts of site characterization and assessment activities, collecting and compiling broad scale baseline information for identification of WEAs, and developing pre-construction monitoring protocols. 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 WEAs – 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 for 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**

Of critical importance will continue to be the collection of baseline data prior to commercial development plan submittal. According to Council on Environmental Quality's (CEQ's) NEPA implementing regulations at 40 CFR 1502.15, the affected environment component of a NEPA document must describe the environment of the areas to be affected by the alternatives under consideration, and establish a basis for the comparison and selection of the alternatives. Until now, most of BOEM's planning notices and applications received related to wind energy have focused on shallow water from North Carolina to Maine. As offshore wind energy continues to develop, baseline studies will need to expand to deeper water and farther south. This will include collecting "finer-grained data on the distribution and life history for key species in each regional ecosystem; environmental assessments for specific projects need more detailed data on benthic habitats and multiyear studies of seasonal abundance and distribution of key species of each resource" as previously identified by Michel et al. 2007.

### 3.1.2 Post Construction Monitoring

BOEM is in the process of developing standardized monitoring protocols, including protocols for monitoring fish, turtles, marine mammals, birds, and benthos. 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 including gravity foundations (Thornton Bank-dredge hole 23 ft deep x 164' x 262' with handling of more than 3 million cu ft of dredged material and installation and leveling of gravel, scour material and filter layer) and floating foundations. As turbines become taller, there may be impacts to visual flight rule plane operations, particularly in the northeast where fog is common. This could also impact economics related 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.

BOEM anticipates that in the 2013-2015 time period questions will move beyond the identification of space-use conflicts to the potential social and economic impact to the other uses of the OCS. For instance, it is well known that the operation of wind turbines can interfere with weather and navigation radars. Other broadcasted forms of electromagnetic radiation may also be impacted, hence the topic of 2012 one year DOE study "Assessment of Offshore wind Farm Effects on Sea Surface, subsurface and Airborne Electric Systems". BOEM anticipates that a follow-up study may be needed by 2014 at the very least to map-out the areas of potential conflict.

### 3.1.5 Transmission

The cumulative effects of multiple projects along the coast are 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? Transmission

In the face of applications for ROW grants, BOEM needs to collect environmental information, particularly on benthic habitats, to inform the assessment of installation of multi-state transmission cables. This type of information will allow BOEM to assess whether these types of systems would make commercial wind energy projects more feasible, potentially increasing the total number of facilities and the subsequent environmental effects. In addition, effective ways to monitor whether cables have become unburied in areas that utilize bottom gear fishing to minimize use conflicts with this activity and fishermen snags.

## 3.2 Marine Hydrokinetic Projects on the OCS

The extraction of energy from ocean currents requires a location that has strong, steady currents. The only known ocean current that has these characteristics on the OCS is the Florida Current, located off the eastern coast of North America. Ocean currents are relatively constant and flow in one direction only, in contrast to the tidal currents closer to shore where the varying gravitational pulls of the sun and moon result in diurnal high tides. Only a small number of prototypes and demonstration units have been tested to date. One such technology involves submerged turbines. Energy can be extracted from the ocean currents by using submerged turbines that are similar in function to wind turbines, capturing energy through the processes of hydrodynamic, rather than aerodynamic, lift or drag.

Mechanisms such as posts, cables, or anchors are required to keep the turbines stationary relative to the currents with which they interact. Turbines may be suspended from a floating structure or fixed to the seabed. Turbines may be anchored to the ocean floor in a variety of ways. They may be tethered with cables, with the relatively constant current interacting with the turbine used to maintain location and stability. In large areas with powerful currents, it would be possible to install turbines in groups or clusters to create 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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**Offshore Environmental Studies Program**

**Fiscal Years 2013-2015  
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  
2012**



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## Abbreviations and Acronyms

ABL	atmospheric boundary layer
ARA	Applied Research Associates
AUV	autonomous underwater vehicle
BCR	Bird Conservation Region
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BLM	Bureau of Land Management
BRD	Biological Resources Division, U.S. Geological Survey
BSEE	Bureau of Safety and Environmental Enforcement
CAAA	Clean Air Act Amendments
CMI	Coastal Marine Institute
DOCD	Development Operations Coordination Document
DWH	Deepwater Horizon
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EP	Exploration Plan
EPA	U.S. Environmental Protection Agency
EPAct	Environmental Policy Act
ESA	Endangered Species Act
ESP	Environmental Studies Program
FGBNMS	Flower Garden Banks National Marine Sanctuary
FWS	U.S. Fish and Wildlife Service
FY	Fiscal Year
G&G	Geological and Geophysical
GCCESU	Gulf Coast Cooperative Ecosystem Studies Unit
GIS	Geographic Information System
GMU	George Mason University
GOADS	Gulfwide Offshore Activity Data System
GOM	Gulf of Mexico
GOMR	Gulf of Mexico Region
HAPC	Habitat of Particular Concern
LSU	Louisiana State University
LUMCON	Louisiana Universities Marine CONSortium
MAFLA	Mississippi, Alabama, and Florida
MAMES	Mississippi-Alabama Marine Ecosystem
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service

NAAQS	National Ambient Air Quality Standards
NCAR	National Center for Atmospheric Research
NCCOS	National Centers for Coastal Ocean Science
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
NRL	Naval Research Laboratory
OA	ocean acidification
OCS	Outer Continental Shelf
PAM	passive acoustic monitoring
ROV	Remotely Operated Vehicle
SCAT	Spill Cleanup Assessment Team
SIA	Social Impact Assessment
SIP	State Implementation Plan
SVOC	Semi Volatile Organic Compounds
USGS	U.S. Geological Survey
VOC	Volatile Organic Compounds
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 6,641 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 is conducting several studies for the GOMR.

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 sociological 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 whose 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 Area



## **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 current five-year program (2007-2012) proposed one lease sale per year in each of the central (2007-2012) and western (2007-2011) planning areas. Lease sales in the eastern planning area were held in December 2001, 2003, 2005 and 2008. On December 1, 2010, Secretary Salazar announced an updated oil and gas leasing strategy for the period 2012-2017. The Central Planning Area and 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 three remaining sales of the 2007-2012 five year program were Western Planning Area Lease Sale 218 and Central Planning Area Lease Sales 216 and 222. The 218 sale was held on December 14, 2011. The combined 216 and 222 lease sale is scheduled for June 20, 2012 prior to the end of the 2007-2012 program on June 30, 2012.

## **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 100 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 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, but we are expanding into spill research as well. 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. Data from a set of moorings deployed in the western Gulf are analyzed in a report soon to be published. Currently, BOEM started an effort to hindcast an oil spill plume in the vertical and horizontal directions and validate these results using available observations. A new Request for Proposals for FY 2012 focuses on conducting a remote sensing assessment of surface oil transport and fate during an oil spill.

#### 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. Emissions inventories are used in air quality modeling to determine potential impacts of offshore sources to onshore areas. A 2011 Gulfwide emissions inventory study has just started to address the new Environmental Protection Agency (EPA) standards, to coordinate the offshore with the onshore inventories, to aid the operators with reporting to EPA under EPA's Mandatory Greenhouse Gas Reporting Rule, and to aid in BOEM's future NEPA documents. This study will build upon past emissions studies. Once it is completed in 2013, this emissions inventory will be used for air quality modeling to determine potential impacts of offshore sources to onshore areas. A follow-up Gulfwide emissions inventory study is planned for FY 2013.

The study, *Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling*, has completed its first year of fieldwork. Based on the initial findings, additional fieldwork for the winter season was approved. It is anticipated that a draft final report will be available in late 2012 or early 2013. A study to enhance the capability of a new meteorological model to examine dispersion over water is proposed for FY 2013.

#### 1.4.3 Fates and Effects

In the mid-1970s, 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 1980s 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. However, before the DWH spill, debate over the objectives and methodology of such a study resulted in its postponement. One example of a debated component of the study is whether to compare relatively 'pristine' Eastern GOM locations with previously drilled Central GOM locations, despite natural differences in samples from these locations, or to apply new techniques and methodologies to compare original sampling results to current conditions at the same locations. To better target the most efficient approach of such a study and to sum up the current known baseline of the GOM, we propose a multi-day workshop for FY 2013 in which BOEM will solicit expert advice from a diverse group of scientists on the best ways to utilize past GOM studies, current DWH-related studies, and develop the request for the next study to further build upon this framework. Special consideration should be given to new tools and techniques that might be applied to past data or future research.

*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). Thus BOEM is interested in studying the interactions of oil and sediment particles in a deepwater and to explore sedimentation of the oil. The DWH oil spill is 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. Thus, BOEM is also interested in gleaning more information about the interaction of dispersed oil with sediments in a deepwater environment. 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. This study will be pursued as a cooperative agreement this fiscal year with a researcher involved with the Gulf Research Initiative analyzing oil/sediment interactions.

The DWH spill response is the first time that dispersants have been injected near the seafloor for remediation purposes. The use of dispersants in addition to the unplanned release of oil and natural gas, both carbon sources, into the deepwater environment led to concerns as to whether dissolved oxygen levels in the GOM would drop drastically as a result of microbial degradation. In 2005, BOEM (then MMS) released a report titled "Understanding the Processes that Maintain the Oxygen Levels in the Deep Gulf of Mexico" (Jochens et al, 2005). Though the study gleaned much information on the oxygen budget for the GOM, it noted that "the mechanisms that transport oxygen-rich water masses from the Yucatan Channel into the Gulf interior at depths greater than ~1,000 m are not well-understood, and a study to determine these Gulfwide processes would be useful for studies of pollutant transports at depth."

#### 1.4.4 Biology

The management needs of BOEM continue to demand information on all aspects of ecology in every habitat of U.S. waters. 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. In addition to these GOM needs, interest in the Atlantic coast requires BOEM to collect and update information on Atlantic ecosystems.

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.

Identification of any long-term effects of oil and gas activities on the OCS is beneficial to assess the effectiveness of BOEM protection of the coastal, marine, and human environments in the GOM.

Deepwater exploration and production continues to expand in the GOM. Continued studies will be needed to better understand the ecology of sensitive deepwater habitats in the GOM. As oil and gas activities move to within 125 miles of the west coast of Florida, further investigations of habitats along the West Florida Escarpment may be needed. However, shallow waters along the Gulf coast such as estuaries and on the continental shelf also continue to require updated information. New studies for FY 2013 and 2014 propose to map and model deepwater corals and benthic habitats, examine Florida manatee movement and habitat use, conduct comprehensive avian surveys, and characterize *Sargassum* algae distribution and movement.

BOEM has environmental stewardship over seabirds, and must mitigate any serious impacts to populations. Practically no data are available on the distribution and abundance of populations except for anecdotal observations, data collected on research cruises not primarily focusing on seabirds, and locations of colonies of seabirds on the Gulf coast. Serious population declines can come from many sources including climate change, oil spills, and West Nile virus. BOEM is responsible for mitigating any potential oil and gas impacts that would exacerbate such declines. Impacts that are most serious are oil spills, but large oil spills are infrequent. The exact size of a spill is not a good measure of relative impacts on seabirds; rather oil spill impacts are contingent on context. BOEM needs information on Atlantic coast seabird populations to evaluate their vulnerability to potential oil and gas impacts. New avian studies propose to examine: Black Skimmers, avian species composition in relation to offshore oil platforms, and potential interactions between various species and OCS activities.

#### 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* (SWSS), additional cetacean studies have followed. These include the *Sperm Whale Acoustic Prey Study* (SWAPS) (GM-09-05) and *Sperm Whales and Bottlenose Dolphins in the GOM* (GM-11-03). Sea turtles in the GOM are also the focus of BOEM research in *The Movement and Habitat Associations of Sea Turtles in the Northern Gulf of Mexico* (GM-10-04). New potential protected species studies could include research on Florida manatees, as well as passive acoustic monitoring of cetaceans in the northern GOM.

#### 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 Advisory Committee reviews, CMI proposals have not been provided in this document even though they address a wide range of critical information needs related to such topics as oil spill impacts, industry strategy, localized socioeconomic effects, infrastructure use, environmental justice, and assessment methodology.

#### 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 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 completed CMI study is testing 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 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. Another study completed in 2011 expanded our knowledge of shipwrecks that were lost in the GOM by conducting research in a rich, previously untapped, resource—the New Orleans Notarial Archives.

Current information needs include understanding how to apply National Register criteria to Atlantic shipwrecks, their appearance in the remote sensing record, and the extent and condition

of sites in the Atlantic environment. In order to further this understanding BOEM archaeologists are at present joining with our benthic biologists and the National Oceanic and Atmospheric Administration/Office of Ocean Exploration and Research (NOAA/OER) to conduct a study off the Virginia coast similar in scope to the award winning collaborations *Deepwater Program: The Archaeological and Biological Analysis of World War II Shipwrecks in the Gulf of Mexico: A Pilot Study of the Artificial Reef Effect in Deepwater* and *Lophelia II*. BOEM is also joining with NOAA's U.S.S. Monitor National Marine Sanctuary to continue the study, *Battle of the Atlantic*, investigating World War II losses off the coast of North Carolina. The first season of this study won the Department of the Interior's Cooperative Conservation Award in 2009.

Future needs focus on the impacts of the DWH oil spill and subsequent spill response activities on submerged cultural resources. One new study procured in 2012 intends to investigate and record impacts to offshore sand resources and shipwrecks discovered as a result of dredging activities associated with the oil spill response. Dredging activities on the OCS are by far the most damaging to submerged cultural resources. A study proposed for FY 2013 intends to investigate impacts to shipwreck sites and their associated biota from exposure to oil and chemical dispersants. Another study seeks to investigate impacts to coastal prehistoric sites from the oil spill as well as the associated clean-up activities. Impacts to archaeological resources are not addressed as part of the Natural Resources Damage Assessment process; therefore, these studies will fill significant information gaps for the bureau and future NEPA analyses.

### 1.5 New Starts for FY 2012 and Ongoing Studies Table

Table 1 lists new studies planned to start in FY 2012 and ongoing studies categorized by discipline. Profiles for these studies can be found at: <http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Gulf-of-Mexico-Region/Gulf-of-Mexico-Environmental-Ongoing-Studies.aspx>.

**Table 1.** BOEM Gulf of Mexico Region New Starts for FY 2012 and Ongoing Studies

NSL #	Study Title	Planning Area (s)	Start FY	Partners
<b>New Starts</b>				
<b>Air Quality</b>				
GM-11-13	Oil/Dispersed Oil-Sediment Interactions in Deepwater Environments	C	2012	
<b>Habitat &amp; Ecology</b>				
GM-12-02	Remote Sensing Assessment of Surface Oil Transport and Fate During Spills in the Gulf of Mexico	GW	2012	
GM-12-03	Eastern Brown Pelicans: Dispersal, Seasonal Movements, and Monitoring of PAHs and Other Oil Contaminants among Breeding Colonies in the Northern Gulf of Mexico	C & W	2012	

GM-12-x10	Abundance and Distribution of Commercially Important Estuarine Dependent Species Populations within the Gulf of Mexico – Implications of an Oil Spill on Spawning, Recruitment, Settlement and Vitality	C & E	2012	
<b>Information Management</b>				
GM-12-06	Information Transfer Meetings and Other Workshops	GW	2012	
GM-09-01-01	LSU CMI (FY 2009 - 2013)	GW	2012	LSU
<b>Social &amp; Economic Sciences</b>				
GM-11-08	Assessing Vulnerability of Sectors and Regions to OCS Oil and Gas Industry Volatility	GW	2012	
GM-12-04	Analyzing the Potential Impacts to Cultural and Sand Resources at Recently Utilized Sand Borrow Sites	C	2012	
GM-12-05	Environmental Studies Program (ESP) Gulf of Mexico Region (GOMR 1974-2010): Program Evaluation to Establish Outcomes and Trends	GW	2012	
GM-12-x11	Social Impacts of Deepwater Horizon along the Gulf Coast	GW	2012	
<b>*Note: The procurement of any study is contingent upon availability of funding</b>				
<b>Ongoing Studies</b>				
<b>Air Quality</b>				
<a href="#">GM-06-x14</a>	Operations of the BOEM's Radar Wind Profiler/at the Houston Coastal Center	C & W	2006	
<a href="#">GM-92-42-138</a>	Deployment and Operational of Radar Profiler	C & W	2007	LSU
<a href="#">GM-08-04</a>	Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling	GW	2008	
<a href="#">GM-10-02</a>	Year 2011 Gulfwide Emissions Inventory Study	GW	2010	
<b>Fates &amp; Effects</b>				
<a href="#">GM-92-42-129</a>	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
<a href="#">GM-09-11</a>	Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the OCS	GW	2010	

<b>Habitat &amp; Ecology</b>				
<a href="#">GM-92-42-104</a>	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
<a href="#">GM-92-42-105</a>	Assessing Trophic Linkages Between Platforms and Pelagic Fishes Using Ultrasonic Telemetry and Active Acoustics	C	2003	LSU
<a href="#">GM-92-42-117</a>	Determining the Geographic Distribution, Maximum Depth, and Genetic Affinities of Corals on Offshore Platforms, Northern Gulf of Mexico	C & W	2004	LSU
<a href="#">GM-92-42-118</a>	Digital Conversion and Selected Analysis of Dive Video From Fifteen Dive Seasons	C & W	2004	LSU
<a href="#">GM-05-03</a>	Investigations of Chemosynthetic Communities on the Lower Continental Slope of the Gulf of Mexico	C & W	2005	
<a href="#">GM-92-42-126</a>	Deep-Water Coral Distribution and Abundance on Active Offshore Oil and Gas Platforms and Decommissioned "Rigs-to-Reefs" Platforms	C & W	2006	LSU
<a href="#">GM-92-42-128</a>	Platform Recruited Reef Fish, Phase II: Do Platforms Provide Habitat that Increases the Survival of Reef Fishes?	GW	2006	LSU
<a href="#">GM-92-42-133</a>	Gulf SERPENT: Establishing a Deepwater Plankton Observation System Using Industrial ROVs	GW	2007	LSU
<a href="#">GM-92-42-140</a>	Digitization and Reanalysis of Northern Gulf of Mexico Continental Slope Study Seafloor Photographs	GW	2008	LSU
<a href="#">GM-08-03</a>	Exploration and Research of Northern Gulf of Mexico Deepwater Natural and Artificial Hard Bottom Habitats with Emphasis on Coral Communities: Reefs, Rigs and Wrecks	C & W	2008	
<a href="#">GM-09-02</a>	Long-Term Monitoring at the East and West Flower Garden Banks (2011-2014)	C	2009	
<a href="#">GM-09-01-07</a>	New Invasive Marine Species Colonizing Oil/Gas Platforms in the northern Gulf of Mexico: Verification and Examination of Spread	C	2010	
<a href="#">GM-09-01-08</a>	Biomass and Mass-Balance Isotope Content of Seep Populations on the Upper Slope Gulf of Mexico Determined from Archived Samples	C	2010	LSU

<a href="#">GM-09-11</a>	Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the OCS	GW	2010	
<a href="#">GM-10-01</a>	Forcing Functions Governing Salt Transport Processes in OCS Navigation Canals and the Surrounding Wetland Landscape Utilizing Houma Navigation Canal (HNC) as a Surrogate Canal	C	2010	
<a href="#">GM-11-01a</a>	Deep-Water Reconnaissance of Potentially Sensitive Biological Features (PSBF's) Surrounding Shelf-Edge Topographic Banks in the Northern Gulf of Mexico	C & W	2011	
<a href="#">GM-11-01b</a>	Deep-Water Reconnaissance of Potentially Sensitive Biological Features (PSBF's) Surrounding Shelf-Edge Topographic Banks in the Northern Gulf of Mexico	C & W	2011	
<b>Information Management</b>				
<a href="#">GM-04-04</a>	Literature Search and Data Synthesis of Biological Information for use in Management Decisions Concerning Decommissioning	C & W	2005	
GM-04-03	Information Transfer Meetings and Other Workshops	GW	2006	
<a href="#">GM-08-x13</a>	EcoSpatial Information Database – U.S. Atlantic Region	AW	2009	
<a href="#">GM-09-x21</a>	South Atlantic Information Resources: Data Search and Literature Synthesis	S-ATL	2009	
<a href="#">GM-09-01-01</a>	Administration of the LSU Coastal Marine Institute (2009-2013)	GW	2010	LSU
<b>Marine Mammals &amp; Protected Species</b>				
<a href="#">GM-08-02</a>	Seismic Survey Mitigation Measures and Marine Mammal Observer Reports	GW	2008	
<a href="#">GM-09-05</a>	Sperm Whale Acoustic Prey Study (SWAPS)	GW	2009	
<a href="#">GM-09-x20</a>	Marine Mammal and Sea Turtle Literature Search and Data Synthesis Including Strandings and Nesting Sites	ATL	2009	
<a href="#">GM-10-04</a>	The Movement and Habitat Associations of Sea Turtles in the Gulf of Mexico	GW	2010	
<a href="#">AT-10-x11</a>	Atlantic Marine Assessment Program for Protected Species (AMAPPS)	GW	2010	
<a href="#">GM-11-03</a>	Sperm Whales and Bottlenose Dolphins in the Gulf of Mexico	GW	2011	

<b>Physical Oceanography</b>				
<a href="#">GM-92-42-94</a>	Wave-Bottom Interaction and Bottom Boundary Layer Dynamics in Evaluating Sand Mining at Sabine Bank for Coastal Restoration, Southwest Louisiana	C & W	2002	LSU
<a href="#">GM-92-42-119</a>	New Wave Current Information System (WAVCIS) Ocean Observing Station on Ship Shoal	C	2005	LSU
<a href="#">GM-92-42-127</a>	Effects of Loop Current and Loop Current Eddies - Analysis Using the Real-time BOEM ADCPs from Oil Platforms	GW	2006	LSU
<a href="#">GM-07-x14</a>	Integrated Bio-Physical Modeling of the Louisiana-Texas (LATEX) Shelf	C & W	2007	NOAA
<a href="#">GM-07-05</a>	Ultra-Deepwater Circulation Processes in the Gulf of Mexico	GW	2008	
<a href="#">GM-08-01</a>	Dynamics of the Loop Current in U.S. Waters	E	2008	
<a href="#">GM-09-07</a>	Current Measurements in the Yucatan-Campeche Area in Support of Loop Current Dynamics Study	E	2009	CICESE
<a href="#">GM-10-03</a>	Lagrangian Study of the Deep Circulation in the Gulf of Mexico	GW	2010	
<a href="#">GM-10-05</a>	Current-Topography Interaction and Its Influence on Water Quality and Contaminant Transport Over Shelf-Edge Banks	W	2010	NRL
<a href="#">GM-11-02</a>	Simulation Modeling of Ocean Circulation and Oil Spills in the Gulf of Mexico	GW	2011	
<b>Social &amp; Economic Sciences</b>				
<a href="#">GM-92-42-80</a>	The Relationship of Crime to Oil Development in the Coastal Regions of Louisiana	C	2000	LSU
<a href="#">GM-92-42-106</a>	Environmental Justice: A Comparative Perspective in Louisiana	C	2003	LSU
<a href="#">GM-92-42-110</a>	Social Capital and Offshore Oil Development in St. Mary Parish	GW	2004	LSU
<a href="#">GM-92-42-122</a>	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
<a href="#">GM-06-03</a>	Gulf Coast Communities and the Fabrication and Shipbuilding Industry: A Comparative Community Study	GW	2006	
<a href="#">GM-92-42-125</a>	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

<a href="#">GM-92-42-131</a>	Gulf Coast Subsidence and Wetland Loss: A Synthesis of Recent Research	GW	2006	LSU
<a href="#">GM-07-08</a>	State and Local-Level Fiscal Effects of the Offshore Petroleum Industry	GW	2007	
<a href="#">GM-07-x12</a>	Assessing Impacts of OCS Activities on Public Infrastructure, Services, and Population in Coastal Communities Following Hurricanes Rita and Katrina	GW	2007	
<a href="#">GM-92-42-134</a>	Forecasting Service Vessel and Helicopter Trips Related to OCS Development	GW	2007	LSU
<a href="#">GM-92-42-135</a>	Structural Shifts and Concentration of Regional Economic Activity Supporting GOM Offshore Oil and Gas Activities	C & W	2007	LSU
<a href="#">GM-92-42-137</a>	Socio-Economic Responses to Coastal Land Loss and Hurricanes: Measuring Resilience among Outer Continental Shelf Related Coastal Communities in Louisiana	C & W	2007	LSU
<a href="#">GM-92-42-139</a>	Understanding Current and Projected Gulf OCS Labor and Port Infrastructure Needs	GW	2007	LSU
<a href="#">GM-08-x14</a>	Energy Market and Infrastructure Information for Evaluating Alternative Energy Projects for OCS Atlantic and Pacific Regions	ATL & PAC	2008	
<a href="#">GM-08-07</a>	History of Gulf of Mexico Offshore Petroleum Industry, Phase III: Deepwater Developments	GW	2008	
<a href="#">GM-92-42-141</a>	The Offshore Drilling Industry and Rig Construction Market in the Gulf of Mexico	C & W	2008	LSU
<a href="#">GM-92-42-142</a>	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
<a href="#">GM-09-01-02</a>	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
<a href="#">GM-09-01-03</a>	Developing Indicators to Measure Socioeconomic Impacts of OCS Activities: A Temporal Analysis of Counties within the Gulf of Mexico Region	GW	2009	LSU
<a href="#">GM-09-01-04</a>	Geographic Units for Socioeconomic Impact Analysis in the Gulf of Mexico Region	GW	2009	LSU
<a href="#">GM-09-01-05</a>	Improving Capacity for Institutional Analysis of the Oil and Gas Industry for the Gulf of Mexico Region	GW	2009	LSU



<a href="#">GM-08-08</a>	MAG-PLAN Modification: New Gulf of Mexico Data Collection, Testing and Streamlining of OCS Economic Impact Model	GW	2009	
<a href="#">GM-09-08</a>	Oil and Gas Infrastructure in the Mid-Atlantic Region	M-ATL	2009	
<a href="#">GM-09-01-06</a>	A Prospectus for Historical Social and Economic Analysis of the Oil and Gas Industry for the Gulf of Mexico Region	GW	2010	
<a href="#">GM-08-05</a>	Ethnic Groups and Enclaves Affected by OCS Activities	GW	2010	
<a href="#">GM-11-06</a>	Examination of the Relationship between Tourism and OCS Oil and Gas Activities in the Gulf of Mexico	GW	2011	
<a href="#">GM-09-01-09</a>	Subsistence in Coastal Louisiana: An Exploratory Study	C	2011	LSU
<b>Social &amp; Economic Sciences (Marine Archaeology)</b>				
<a href="#">GM-92-42-136</a>	Examining and Testing Potential Prehistoric Archaeological Features on the Gulf of Mexico, Offshore Continental Shelf	C & W	2007	LSU
<a href="#">GM-08-10</a>	Evaluation of Visual Impacts on Historic Properties	AW	2008	
<a href="#">GM-09-04</a>	Archaeological Analysis of Submerged Sites on the Gulf of Mexico Outer Continental Shelf	C & W	2009	
<a href="#">GM-09-10</a>	Inventory and Analysis of Archaeological Site Occurrence on the Atlantic OCS	AW	2009	
<a href="#">AT-10-04</a>	Battle of the Atlantic Expedition 2010-2015	M-ATL	2010	NOAA
<b>Planning Area Codes</b>				
Central = C		Mid Atlantic = M-ATL		
Eastern = E		North Atlantic = N-ATL		
Western = W		South Atlantic = S-ATL		
Gulfwide = GW		Straits of Florida = SF		
Nationwide = N		Atlantic Wide = AW		
<b>Partner Codes</b>				
CICESE = Centro de Investigación Científica y Educación Superior de Ensenada				
LSU = Louisiana State University				
NOAA = National Oceanic and Atmospheric Administration				
NRL = Naval Research Laboratory				

## SECTION 2 PROPOSED STUDY PROFILES

### 2.1 Introduction

A blowout, explosion, and fire occurred on April 20, 2010 aboard the Transocean-owned *Deepwater Horizon* (DWH) Mobile Offshore Drilling Unit during cementing of the well more than 50 miles offshore, located at a depth of 5,000 feet, and operated by the BP Corporation. The DWH rig sank on April 22, 2010 causing damage to the well riser and a massive oil spill that spewed millions of gallons of crude oil into the Gulf of Mexico.

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.), damages from the DWH spill may exceed those of all previous spills in U.S. waters. Since the spill, 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 studies may not address particular resources and their impacts from the oil spill.

The FY 2013-2015 Studies Development Plan includes profiles for new studies within the disciplines of air quality, habitat and ecology, marine mammals and protected species, physical oceanography, fates and effects, information management, social sciences, and marine archaeology. 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 spill. Several proposed studies represent multiyear, multidisciplinary efforts aimed at studying a variety of resources that may be impacted by an oil spill. Some studies also envision 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 2013 and beyond. However, most of the 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 2013 NSL

**Table 2.** BOEM Gulf of Mexico Region Studies Proposed for the Fiscal Year 2013 NSL

Page #	Discipline	Title	Rank #
21	AQ	NAAQS Exemption Level Study	1
23	MM	(BSEE) Pressure Wave and Acoustic Properties Generated by the Explosive Removal of Offshore Structures: Potential Effects on Protected Species	2
25	SS	A Comparative Analysis of an Oil Spill on Biota Inhabiting Several Gulf of Mexico Shipwrecks Spanning the 19 <sup>th</sup> to 20 <sup>th</sup> Centuries	3
29	AQ	Year 2014 Gulfwide Emissions Inventory Study	4
31	SS	Environmental Justice and OCS Petroleum: A geo-spatial analysis	5
35	IM	Workshop on Future Directions in Understanding Physical-Biological Oceanographic Interactions in Mid- to Deep Waters of the Gulf of Mexico	6
37	SS	An Analysis of the Impacts of the <i>Deepwater Horizon</i> on the Seafood Industry	7
39	HE	Pelagic <i>Sargassum</i> Algae Distribution and Movement in the Gulf of Mexico	8
41	SS	Testing and Assessment of the Effects of an Oil Spill on Coastal Archaeological Sites	9
43	HE	Deepwater Coral Atlas and Modeling Program: Gulf of Mexico	10
45	MM	Florida Manatee Movement and Habitat Use in the Northern Gulf of Mexico	11
47	PO	Coral Reef Ocean Acidification Sentinel Site in the Flower Garden Banks National Marine Sanctuary	12
49	AQ	Enhancing the Capability of a New Meteorological Model for Air Quality and Other BOEM Applications in the Gulf of Mexico	13
51	SS	An Analysis of the Fiscal Impacts of the OCS Industry in the Gulf of Mexico	14
53	SS	The Demographic Consequences of the Gulf of Mexico Offshore Petroleum Industry	15
57	SS	(BSEE) Analyzing Impacts to Cultural Resources as a Result of Oil and Gas Activities in Deepwater (<500-10,000)	16
61	IM	Workshop on Monitoring the Long-term Effects of Offshore Oil and Gas Activities in the Gulf of Mexico	17
65	FE	Managing Dredging Environmental Impacts by Optimizing the Use of Sand Resources	18
67	SS	Coastal Land Loss and Oil & Gas Infrastructure	19

AQ = Air Quality	FE = Fates & Effects	HE = Habitat & Ecology
IM = Information Management	MM = Marine Mammals & Protected Species	
PO = Physical Oceanography	SS = Social Sciences & Marine Archaeology	

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Gulf of Mexico

**Planning Area(s):** Western and Central

**Title:** NAAQS Exemption Level Study

**BOEM Information Need(s) to be Addressed:** Will study the exemption level used in the plan's process of the air quality review to determine if the exemption level needs to be updated due to newer NAAQS regulations.

**Cost Range:** (in thousands) \$80-\$120

**Period of Performance:** FY 2013-2014

### **Description:**

Background: The Clean Air Act, which was last amended in 1990, requires the EPA to set National Ambient Air Quality Standards (NAAQS) for wide-spread pollutants considered harmful to public health and the environment. The EPA has set NAAQS for six principal pollutants, which are called "criteria" pollutants including carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter (PM), and sulfur dioxide (SO<sub>2</sub>). Recently, the EPA issued new NAAQS for the 8-hour ozone of 75 parts per billion (ppb) effective May 27, 2008, for the 1-hour NO<sub>x</sub> of 100 ppb effective January 22, 2010, and for 1-hour SO<sub>x</sub> of 75 ppb effective June 2, 2010.

BOEM is required under the Outer Continental Shelf Lands Act 1334(a)(8) to comply with the NAAQS to the extent that OCS offshore oil and gas exploration, development, and production sources do not significantly affect the onshore air quality of any State. Industry must submit plans to BOEM before conducting exploratory drilling or production. These plans include data which estimates air emissions as required under 30 CFR 250.218 (30 CFR 550.218) and 30 CFR 250.249 (30 CFR 550.249). Spreadsheets were created by BOEM, where industry reports all the emissions sources under the proposed plan, the horsepower (hp) ratings of those sources, and the timeframe of those sources operating. Using EPA formulas and emissions factors, emissions are calculated for that proposed plan in maximum pounds per hour and tons per year.

These estimates of emissions must be compared to an exemption level to determine if the plan has impacts to onshore air quality and is therefore approved or denied. This exemption level must assure that this plan's emissions would have no impact to onshore NAAQS standards. In the existing regulations 30 CFR 250.302 to 250.304 (30 CFR 550.302 to 550.304) and used by the GOMR, the exemption level is based on distance to shoreline and was calculated using the OCD model and older annual NAAQS standards. The exemption level was determined to be 33.3 times the distance to shoreline (D) expressed in miles. Therefore, if a plan's emissions are under that exemption level (33.3xD), the plan is approved.

Due to the newer NAAQS and the more stringent ozone standard, this exemption level needs be re-analyzed to ensure that OCS sources do not impact onshore air quality.

Objectives: The purpose of this study is to verify that the existing exemption level remains adequate or to determine a new exemption level if necessary for the GOMR air quality spreadsheets used by BOEM to review plans to ensure that sources do not impact the onshore air quality.

Methods: The contractor should perform several computer modeling episodes using an approved EPA model from 40 CFR Part 51 Appendix W (Guideline on Air Quality Models) to review and calculate a new exemption level in the Gulf (if necessary) based on distance to shoreline. Several hypothetical oil producing and exploration drilling sources should be placed in several different meteorological regimes in the Western and Central Gulf of Mexico to determine at what level oil and gas source impacts onshore air quality.

At this time, the model and methodology is unknown. Methodology will depend on most recent model development. For example, AERMOD-COARE is the preferred model but it may not be available by EPA for use when this study gets awarded. If AERMOD-COARE is unavailable, then OCD or CALPUFF would need to be used. Additionally, the OCD model should be updated so that it is compatible with Windows 7.

The contractor should use emissions from the most recent GOADS emission inventory or review several air quality spreadsheets to determine typical or maximum platform emissions including support vessels, pipeline installation, facility installation and production.

The contractor should offer new ideas to determine an exemption formula. All NAAQS (short term and annual) need to be included. And, the most recent 5 years of meteorological data should be included. Currently, the meteorological data is for 2000-2004.

**Revised Date:** May 3, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Western and Central

**Title:** Pressure Wave and Acoustic Properties Generated by the Explosive Removal of Offshore Structures: Potential Effects on Protected Species

**BSEE Information Need(s) to be Addressed:** The potential effects of anthropogenic noise on marine mammals and sea turtles are a high profile and environmentally sensitive issue. Currently, there is inadequate data available on the pressure wave and acoustic properties generated by the explosive removal of offshore structures for management decision-making relative to the protection of marine mammals and sea turtles. New Rulemaking on decommissioning is required in 2013. Due to the results of data collected to date, NMFS has accepted the projected levels of the Applied Research Associates (ARA) underwater explosive shockwave simulation model for determining harassment of protected species. With more data points, BSEE will be able to update the ARA model to more accurately reflect projected levels of underwater shock waves. Therefore, more data concerning the physical properties of explosive detonations, as conducted by industry, would greatly facilitate the development of flexible and suitable mitigations for this activity and can be used in forthcoming BSEE rulemaking.

**Cost Range:** (in thousands) \$480-\$720

**Period of Performance:** FY 2013-2014

### **Description:**

Background: Approximately 4000 oil and gas platforms exist on the OCS. Within one year of lease termination, the BSEE requires that platforms be removed from the OCS. The most common method for removing platforms is severing them below the water line using explosives. However, the pressure wave and acoustic impacts created by underwater explosions can kill or harm protected marine mammals and sea turtles that may be in proximity to the detonation site.

As a Federal agency, BSEE is required to comply with the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). Mitigation procedures exist to minimize impacts to protected species. The mitigation measures are legally applicable for structure removals performed on the continental shelf (underwater lands that are landward of the 656 ft isobath). However, these mitigation measures are only practical for structures that occur in waters less than 180 ft in depth, and not for deeper waters where industry has placed and is presently removing offshore structures with explosives. NMFS has adopted the dual criteria of 12 psi and 180 dB re 1 Pa for “take” harassment zones. These original harassment zones were based on tests of explosives that were detonated in open water. However, BSEE requires that offshore structures be severed 15 feet below the mudline. A model was developed in 2003 by ARA to take into account the supposed attenuation of explosives beneath the mudline. With no supporting data for the ARA model, NMFS used the more conservative harassment zones for open water detonations.

Data collected by Sonalysts, Inc. from four structure removals indicate that the structure and surrounding sediments do absorb and dampen the pressure wave and acoustic properties of an explosive used to sever the legs and conductors of an offshore structure. Based on these data

points, NMFS revised the harassment zones during the 2007 Rulemaking using the ARA model pending more data. BSEE needs additional data to confirm the results and to determine the pressure wave and acoustic properties of explosives used to remove offshore structures so that the reputed dampening effects may be accurately measured and demonstrated to the NMFS for rulemaking that will be re-initiated in 2013. These data can then be used to update the ARA underwater acoustic model and more accurately calculate the “take” harassment zones for marine mammals and sea turtles specific to structure removals. The data will also be used during the ESA consultation process in conjunction with MMPA Rulemaking.

Objectives: The objectives of this study are to:

- Quantitatively measure the underwater pressure waves and acoustic properties generated by the detonation of explosives used for offshore structure removals.
- Investigate the reputed dampening effects of the structure and surrounding sediments.
- Provide BSEE with scientifically valid data to update the ARA model so that the “take” harassment impact zones of protected species may be more accurately calculated.

Methods: Sonalysts, Inc. has developed a method to determine the underwater shock pressure pulse parameters of peak overpressure, specific impulse, and energy flux density resulting from explosive cutting of the piling legs and well conductors of offshore platforms. Their equipment and methods are tested in the field and are accepted by NMFS. The same contractors and methods will be used to collect all data.

Written and digital reports containing a pressure wave and acoustic data set, critique of data sets, analyses of data sets and updates to the existing ARA underwater acoustic model, calculations of a more accurate “take” harassment zones, and recommendations.

The data collected to date indicates that sediments and the structure itself attenuate the acoustic shockwave of explosives detonated within a well conductor or piling below the mudline. However, more data is needed. This information will be used as soon as it is available to update the ARA underwater calculator and to develop reasonable and prudent mitigation measures through Rulemaking in 2013 to protect marine mammals and sea turtles while performing explosive removals of offshore structures.

**Revised Date:** May 3, 2012



## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Gulf of Mexico

**Planning Area(s):** Central

**Title:** A Comparative Analysis of an Oil Spill on Biota Inhabiting Several Gulf of Mexico Shipwrecks Spanning the 19<sup>th</sup> to 20<sup>th</sup> Centuries

**BOEM Information Need(s) to be Addressed:** This study will support EIS development and decision-making by providing documentation and analysis of a major oil spill's prospective lasting effects on shipwrecks, which have been demonstrated in previous BOEM studies to serve as deepwater artificial reefs for various biota. Section 106 of the National Historic Preservation Act requires Federal agencies to consider the potential effects of their permitted activities on cultural resources before issuing such permits but impacts to shipwrecks from oil spills such as the DWH spill of 2010 are unknown. Archaeological investigations conducted after the Exxon Valdez oil spill in Alaska focused on terrestrial sites even though post-spill surveys identified submerged cultural resources within the affected area. Additionally, damages to cultural resources are not addressed by the Natural Resource Damage Assessment process, and no other studies are currently analyzing these potential impacts. General questions to be addressed in the proposed study include whether and how oil, dispersed oil, and chemical dispersants used to manage the oil spill interact with and are integrated within the shipwreck remains and surrounding seafloor. This study will also analyze each chosen vessel's current state of preservation, its site formation processes over time, the degradation of its respective metal and/or wooden hull structure, and associated material remains. Microbial action and resident biota at each test site will also be systematically analyzed to determine if exposure to hydrocarbons and dispersant-based chemicals cause any long term impacts. Baseline data collected at selected sites before the 2010 DWH spill will be used for comparative purposes.

**Cost Range:** (in thousands) \$1,600-\$2,400 **Period of Performance:** FY 2013-2016

### **Description:**

**Background:** As amply demonstrated in BOEM's award winning 2004 study entitled *Archaeological and Biological Analysis of World War II Shipwrecks in the Gulf of Mexico* (Church et al., 2007), such archaeological sites serve as an ideal sample because they are located at random throughout the study area and have a diverse array of organisms, both macro and micro that inhabit each of these sites. The 2004 study collected baseline data providing information on the environment at each site, a determination of the physical and biological modification of sediments in the immediate area of each site, limited sampling of the fauna attached to hard substrate for taxonomic studies, and an analysis of hundreds of hours of video imagery and sample collection to address spatial heterogeneity of the fouling community and motile fish and invertebrate association with the wrecks. In addition, archaeological assessments and site plans were created for each of the study shipwrecks along with an analysis of the structural integrity and current state of preservation to understand the individual formation processes occurring at each site. Limited, bio-chemical analyses were conducted to identify microbial metabolic potential at each site and to determine if decay (rust formation) was accelerating at any or all of the mid-20<sup>th</sup> century shipwrecks assessed. This critical analysis was

key to understanding the decay processes occurring at each site and for determining if any of these sites' hulls would eventually become compromised and potentially release contaminants and/or hazardous materials contained within the vessels at the time of their sinking. Most of these sites have not been visited since the conclusion of this pilot study in 2004, and this study did not include wooden shipwreck sites or sites on the continental shelf. Considering the overall lack of archaeological survey and environmental data among the Gulf of Mexico's shipwreck sites, the site-formation processes and possible negative impacts associated with a large-scale oil spill over time are unknown.

Post-spill investigations of several deepwater coral colonies in 2010 have, to date, identified one colony to the southwest of the Macondo well that exhibited stress from possible exposure to oil (White et al., 2012). Using gas chromatography and other analyses, researchers concluded that the corals had indeed been exposed to oil, likely from the DWH spill. Investigations such as these, however, have not collected wood or metal samples from any shipwrecks to determine whether the sites were exposed to oil and, if so, how exposure to hydrocarbons may affect site formation processes, state of preservation, and rates of degradation.

Objectives: This follow-up study will complete a detailed comparative analysis of data collected during the 2004 study and other pre-spill shipwreck investigations to assess the current physical and environmental condition of each selected site and determine if the site was exposed to oil. In addition, a comprehensive assessment of biota associated with each site will evaluate temporal changes over time as well as any changes related to the oil spill which occurred in the vicinity of some of the selected shipwreck sites. The study will additionally conduct a detailed analysis of the environmental, macro and micro biological and archaeological conditions of several wooden shipwreck sites that have been previously investigated during complementary efforts and are located in the area of the oil spill to determine if the sites were exposed to oil and if such exposure has affected their state of preservation. The techniques that will be employed will be complementary to the previous 2004 work, but will incorporate sophisticated investigation of intact microbial populations, select environmentally relevant groups, and their metabolic potential in shipwreck degradation. The totality of data from the proposed work will inform BOEM about the rate of changes occurring at these sites. They will also address questions related to the preservation of archeological sites in the GOM, and identify if the release of hydrocarbons and chemical dispersants have impacted shipwrecks. For comparative purposes, assessments will be made of select shipwreck sites on the continental shelf in shallower waters that are outside of the area impacted by the oil spill.

Methods: This study is proposed as an Interagency Agreement (IA) with the United States Naval Research Laboratory (NRL) and a cooperative agreement with George Mason University (GMU), who will provide expertise in microbial analysis. Methods employed for this study will include a reassessment and comparison of the local environment at each site using video transects. The video transects will help to identify visual physical and biological modification of sediments in the immediate area of the site. Video imagery from the proposed study will be compared to the previous work on comparable sites. Samples of flora and fauna attached to hard substrates will be collected in order to identify and enumerate taxa and to determine the degree of impact that hydrocarbons and other chemical contaminants may have had on microbial communities and reef associated biota. Sampling of any fouling communities, motile fish, and invertebrate species associated with the sites will also be used for before/after spill comparisons.

In addition to new shipwreck sites that will be surveyed, follow-up archaeological assessments and site plans will be completed and analyzed to indicate whether there have been changes to the sites studied in 2004 since their initial investigations before the DWH spill. Additional bio-battery coupons will be placed at each study site to track *in situ* rust formation rates. Material samples (wood, metal, sediment, etc.) from each location will be collected and analyzed for identification of associated microbial communities and experimental studies to attempt to understand the impact of hydrocarbons and chemical dispersants on such materials. Using methods such as mass spectrometry and/or other appropriate techniques, a comparative analysis of exposed wood and organic material samples as well as complementary buried samples will provide insight regarding exposure to spill-related contaminants and the impact of contamination. Microbial metabolic rate measurements will also be utilized. All methodological surveying and sampling tasks involved in this study will be performed systematically and will be repeated every 3 to 5 years (whichever is more feasible) over a total period of approximately 15 years (this is an arbitrary figure and will be adjusted appropriately). This will aid in the development of a shipwreck site-formation database for the Gulf of Mexico region. The end products of this study will also include a report detailing the comparison and analysis with the earlier data collected from the 2004 study and other site investigations, detailed maps of each site along with any identified changes, and results of laboratory analyses.

A public outreach component including but not limited to posters and booklets detailing the history of the project and lessons learned are central to this proposed study. The proposed collaboration with BOEM, NRL, GMU, and other partners as appropriate will allow for the integration of research into education activities and provide training and research experience for two doctoral, one undergraduate, and one K-12 student, through a mentorship program at Thomas Jefferson High School of Science and Technology or the NRL Science and Engineering Apprentice Program. The activities proposed here will have a significant and visible impact on an array of collaborative student-faculty-and government scientist research opportunities. The study PIs will coordinate two sessions, one at the American Geophysical Union Annual meeting and one at the Society for Historical Archeology conference to highlight results by participants of the study. This will bring high visibility to the project within two scientific communities.

**Revised Date:** May 9, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Western and Central

**Title:** Year 2014 Gulfwide Emissions Inventory Study

**BOEM Information Need(s) to be Addressed:** First, the collection and compilation of an air emissions inventory is one of the tasks that BOEM conducts to assure coordination of air pollution control regulations between OCS offshore sources and state's sources onshore. Secondly, this emissions inventory will be useful for compliance with EPA's Greenhouse Gas Reporting Rule. Finally, BOEM will also use the 2014 emissions inventory to support the NEPA process when preparing EIS's and EA's, and for emissions trends and impacts analysis.

**Cost Range:** (in thousands) \$300-\$350

**Period of Performance:** FY 2013-2016

### **Description:**

Background: The 1990 Clean Air Act Amendments (CAAA) requires the EPA to set the National Ambient Air Quality Standards (NAAQS) for widespread pollutants from numerous and diverse sources considered harmful to public health and the environment. The law also requires the EPA to periodically review the standards to ensure that they provide adequate health and environmental protection, and to update those standards as necessary. The EPA has set standards for six primary pollutants and has recently lowered the ozone 8-hour standard and added 1-hour nitrogen dioxide (NO<sub>2</sub>) and 1-hour sulfur dioxide (SO<sub>2</sub>) standards.

Because of the continuing needs of addressing these standards, regulations may require state agencies to perform air quality photochemical modeling for use in their State Implementation Plans (SIPs). In order to conduct this modeling, emission inventories must be generated as inputs to the models. The 2014 Gulfwide emissions inventory will be available to assist states in conducting modeling for additional SIP demonstrations to meet the changing requirements. The collection and compilation of an air emissions inventory is one of the tasks that BOEM conducts to assure coordination of air pollution control regulations between OCS offshore sources and State's sources onshore (as per Section 328(b) of the 1990 CAAA).

The CAAA specify that states are to prepare emission inventories every three years, starting in 1996. The proposed 2014 Gulfwide emissions inventory will correspond with the next EPA onshore periodic emissions inventory. By conducting a 2014 Gulfwide emissions inventory, BOEM is working concurrently with EPA's routine, 3-year reporting cycle.

EPA has also issued the Final Mandatory Reporting of Greenhouse Gases Rule due to the FY 2008 Consolidated Appropriations Act (October 30, 2009). OCS facilities that emit 25,000 metric tons or more per year or greenhouse gases emissions in a CO<sub>2</sub> equivalent must submit annual reports to the EPA for carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O). The proposed 2014 inventory will include these greenhouse gases emissions that will assist the OCS operators with their mandatory reporting of greenhouse gases to EPA. Operators can use Gulf-wide Offshore Activity Data System (GOADS) greenhouse gas emissions to report to EPA, according to Subpart W.

Lastly, the inventory will be used to enhance the BOEM NEPA process by providing an accurate inventory to compute emission trends and to perform necessary air quality impact assessments. Because of newer 1-hour standards, BOEM needs to conduct an air quality impact assessment studying our potential impacts of air pollutant emissions from offshore OCS oil and gas exploration, development, and production sources to onshore states. This would address most of the EPA comments received on our last EIS.

Objectives: The purpose of this study is to develop a year 2014 Gulfwide air emissions inventory of OCS sources (platform and non-platform), including estimates of carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), hydrocarbons (VOC), carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxides (N<sub>2</sub>O) to support states in writing their SIPs, to support operators in their mandating reporting of greenhouse gases to the EPA, and to support BOEM in their NEPA process and impact assessments.

Methods: The contractor will collect and compile emissions activity data from BOEM-regulated OCS facilities and vessels. Facilities include all installations (e.g., production platforms) or devices having the potential to emit any air pollutant, as above. The platform activity data will be collected using the BOEM emissions activity software, GOADS. In addition, emissions from vessels used to support facilities (non-platform sources) will be collected using surveys or other appropriate sources. The contractor will quality control and assure all data collected, including making sure the vessels data collected in BOEM federal waters is consistent with the vessels data in states waters. The Contractor will calculate a total emissions inventory, by pollutant, using the existing Database Management System, which multiplies the activity data contained in GOADS times the appropriate emissions factors. The contractor will generate emissions inventory databases that will comply with EPA current formats and will be approved by BOEM.

**Revised date:** May 3, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** Environmental Justice and OCS Petroleum: A geo-spatial analysis

**BOEM Information Need(s) to be Addressed:** The potential for negative impacts to environmental justice is an important consideration in BOEM environmental impact assessments in the Gulf of Mexico Region. The EPA recommends that agencies use a geo-spatial approach to the analysis of environmental justice. To date, BOEM has sponsored two studies to develop a geo-spatial methodology designed to address the environmental justice concerns raised by the onshore consequences of OCS leasing actions. The first of these studies developed, for St. Mary Parish, a “risked environment” around various categories of OCS-related infrastructure and compared this distribution to those of low income and minority populations. The second study further refined the approach by applying it to three parishes and to comparing the relative risks of onshore petroleum production, offshore production, and refining. The second study, in particular, also examined the role of coastal geography and past population movements in establishing the current environmental justice conditions.

Important practical and methodological issues remain for the application of this approach in GOMR environmental assessments, such as how to operationalize distinctions between current baseline conditions and the new consequences of a sale, or between the environmental consequences of normal operations versus those from accidental operations, or the consequences of up-stream activities from down-stream ones. Since the completion of this research, the 2005 hurricane season and the DWH oil spill have raised additional concerns regarding environmental justice and the BOEM geo-spatial methodology. The Katrina and Rita hurricanes (and DWH to a lesser degree) significantly changed the geographic distributions of at risk human populations, thus changing baseline conditions. The DWH spill underscored issues underemphasized by the earlier work, particularly regarding the collection, transportation and disposal of OCS waste materials. Both the hurricanes and DWH raised environmental justice concerns regarding impacts affecting resources geographically distant from the people using them.

An important aspect of GOMR environmental assessments is the consideration of potential negative impacts to environmental justice. Information from this study will be used to update baselines, impact, and cumulative sections of GOMR EISs and to support BOEM environmental justice policies within the Department of the Interior. This effort will also support interactions among BOEM, USGS, and other federal and state entities.

**Cost Range:** (in thousands) \$280-\$420

**Period of Performance:** FY 2013-2014

### **Description:**

**Background:** In environmental assessments conducted under NEPA by the GOMR, the consideration of possible impacts to environmental justice is an important element of the overall assessment of possible OCS-related socioeconomic impacts. 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 essentially geo-spatial analyses—that the income and ethnic distributions within a population that may be affected by an action be compared with those distributions within a larger surrounding population to determine whether or not the impacted population is disproportionately low income or minority.

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 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 using it to compare types of petroleum development (e.g., onshore vs. off), 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 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.

Since the completion of this research, the 2005 hurricane season and the DWH oil spill have raised additional concerns regarding environmental justice and the BOEM geo-spatial methodology. The Katrina and Rita hurricanes (and DWH to a lesser degree) significantly changed the geographic distributions of at risk human populations, thus changing baseline conditions. The DWH had significant socioeconomic impacts across the Gulf Coast and highlighted issues that were not emphasized by the earlier work, particularly some associated with the disposal of oil spill cleanup wastes. Both the hurricanes and DWH highlighted environmental justice concerns associated with certain coastal and near-coastal communities and their use of natural resources, in some cases resources geographically distant from the people using them.

Other BOEM socioeconomic research has or will generate additional information relevant to environmental justice including several studies that address community resiliency, the distribution of OCS-related onshore activities, and a study of ethnic groups and enclaves that includes a component that assessed socioeconomic impacts in the immediate aftermath of DWH. A GIS system is a particularly applicable tool for organizing and analyzing much of this information which is geo-spatial in nature, and similar information that has been collected by other Federal agencies, such as USGS, in response to DWH.

Other federal and state institutions are—or will—also collect such data. For example, the “USGS Biology Long-Term Science Response to *Deepwater Horizon* Spill Study Plan” (still under development) includes at least three such possibilities: (1) “Social-ecological resilience of coastal Louisiana: The impacts of the *Deepwater Horizon* oil spill on natural resource dependent communities” will explore how resource-dependent communities in coastal Louisiana will adapt to short- and long-term declines in harvests and loss of economic viability of the ecosystem; (2) “Fishing in the Gulf: Adapting Identities in Response to the *Deepwater Horizon* Spill” will survey how effects on harvesting activities impact the personal and cultural identities of fishermen and women in impacted areas; and, (3) “Informing the Public: Perception, Trust, and the Communication Process in coastal Louisiana communities after the *Deepwater Horizon* Oil



Spill” will track how the long-term communication process builds and/or erodes trust and credibility of different groups residing in the impacted area including the Cajun community, the United Houma Nation, and Vietnamese-Americans. This holistic USGS approach will provide a wide range of geo-spatial data.

Efforts by BOEM, USGS, and others will collect geo-spatial data relevant to environmental justice consequences of the oil spill. There is a need to collect, systematize, and analyze these data generated by multiple sources.

Objectives: The overall goal is to further GOMR environmental assessment by developing a robust analysis of potential OCS-related impacts to environmental justice in the GOMR.

Methods: The DWH and its aftermath raised significant new environmental justice-related questions (e.g., regarding waste disposal) and substantially altered baseline conditions (e.g., changing population distributions in Plaquemines Parish). The research team will conduct an environmental justice analysis on the effects of the DWH and its aftermath, building on the methodologies developed in the two previous BOEM studies and incorporating relevant information from publically available government, NGO, and industry reports on recent hurricanes, DWH and socioeconomic conditions in the GOMR. This effort will be used to evaluate approaches to assessing 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 environmental justice. As part of these efforts, the research team will develop a geo-spatial database that supports the analysis of environmental justice-related questions 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:** May 3, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** Workshop on Future Directions in Understanding Physical-Biological 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 physical-biological oceanographic studies in the Gulf of Mexico. 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.

**Cost Range:** (in thousands) \$200-\$300

**Period of Performance:** FY 2013-2014

### **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 physical/biological oceanographic interaction workshop for the DeSoto 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 Gulf of Mexico, 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 DeSoto 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 physical-biological interactions and ecological/mathematical modeling in mid- to deep waters of the Gulf of Mexico (>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, biological-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:** May 3, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** An Analysis of the Impacts of the *Deepwater Horizon* on the Seafood Industry

**BOEM Information Need(s) to be Addressed:** The commercial seafood industry experienced a number of impacts from the DWH oil spill. The most obvious effects were the loss of fishermen's income, the decreases in seafood supply due to the fishing closures that were instituted in response to the spill, and the declines in the demand for Gulf seafood due to concerns regarding contamination and safety. Less obvious effects were manifested as well, some almost immediately and some still unfolding. For example, fish closures and lost income led to financing problems for boat owners. In some cases, it led to investments in alternative fisheries, in others to individuals leaving that industry for other employment. In some cases, money earned from the oil spill cleanup was used to pay off a boat or buy new gear while in other cases it was not. All of these effects led to changes in the organization of the commercial fishing industry. Similar effects played out in the seafood supply chain due to fluctuations in supply, demand, and price. In the short run, the spill's effects on supply and demand impacted the entire seafood supply chain negatively, but some enterprises were more negatively impacted than were others. In addition, while some businesses closed, others may have done well in the longer run. Some consequences are uncertain, such as how many enterprises who had to find alternative suppliers after the spill did not return to using GOM sources. Clearly, the spill had substantial, short-term negative impacts on the seafood industry. However, the extent to which these translated into longer-term impacts on the industry is less clear. It is essential for BOEM to gain a clearer understanding of possible longer-term effects, particularly as it relates to BOEM's responsibilities under NEPA. In particular, BOEM needs to know how the baseline environment for the seafood industry may have changed, as well as how the effects of the DWH add to our understanding of the impacts of any potential future spills.

**Cost Range:** (in thousands) \$ 240-\$360

**Period of Performance:** FY 2013-2014

### **Description:**

**Background:** The DWH oil spill had a number of effects on the seafood industry. Most directly, commercial fishing was banned in a number of areas for substantial periods of time subsequent to the spill. This directly and indirectly impacted commercial fisherman, as well as various firms along the seafood supply chain. The immediate impacts on harvest opportunities, product demand, labor availability, and income sources may have had longer term effects on the organization of the fishing industry—for example, the size and capitalization of the fleet. The spill also may have had broader longer term impacts on consumers and firms with less direct links to the GOM. For example, in the face of fishing closures, some seafood processors and restaurants that depend on Gulf seafood faced the problem of finding alternative supply sources as well as those associated with price fluctuations and changes in demand.

Objectives: The objective of this study is to enhance our understanding of the possible impacts of oil spills on the seafood industry in the GOM in general, as well as to understand the specific effects of the DWH spill.

Methods: This study has descriptive and analytical tasks. The former include the description and careful documentation of the short- and long-term responses to the spill and its aftermath that the various parts of the commercial seafood industry (e.g., shrimpers, oystermen, bluewater fishermen, shrimp processors, oyster houses, etc.) experienced, and to describe any long-term structural changes that have occurred due to the DWH spill and its aftermath. The analytical tasks include the examination and documentation of the causes of any identified changes (e.g., possible long-term changes in supply due to changes in the capitalization of fishing enterprises or changes in the supply-chain due to lost market-share), and the development of a set of “lessons learned” from the DWH in order to better understand the likely impacts of future oil spills and their aftermath (e.g., an examination of changes in price and quantities sold of various seafood-related products might provide insights into the relative vulnerability of various products to spills). All tasks will build on a synthesis of existing information sources regarding characteristics of the commercial fisheries and their supply chain in the GOM, as well as sources on the impacts of the spill (including information about the response and remediation activities that occurred). All of the tasks will also build on information gleaned from subject matter experts and participants in the affected fisheries and supply chain. To the extent possible, these tasks will distinguish impacts specific to each fishery (e.g., shrimping, blue water and coastal fishing, crabbing, oystering). To the extent possible, the analytical tasks will also incorporate more formal approaches such as illustration and confirmation of findings by identifying, acquiring and analyzing relevant datasets. For example, the study may include extensive data-gathering regarding prices and quantities sold at various stages of the seafood supply-chain as well as local-level employment data in various seafood-related markets. The study may also apply more formal analysis to document and explain these consequences, for example, by using mathematical methods to determine which markets were most impacted by the spill and to analyze trends prior to the spill and after the spill in order to determine the changes in market-structure that have arisen due to the oil spill.

**Revised Date:** May 3, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide, South Atlantic

**Title:** Pelagic *Sargassum* Algae Distribution and Movement in the Gulf of Mexico and Atlantic

**BOEM Information Need(s) to be Addressed:** BOEM needs to characterize the occurrence and movement of pelagic *Sargassum* algae in the GOM and western Atlantic to support assessment of oil spill risks and mitigation of potential impacts to this vulnerable habitat.

**Cost Range:** (in thousands): \$450-\$670      **Period of Performance:** FY 2013-2016

### **Description:**

Background: Pelagic *Sargassum* algae comprises a unique ecosystem that merits thorough consideration in BOEM efforts to protect the marine environment from potential impacts of oil and gas activities and renewable energy activities. It is considered essential fish habitat (EFH) and is designated as a habitat area of particular concern (HAPC). *Sargassum* is regulated in the southwest Atlantic by a fishery management plan. Use of the habitat by post-hatchling sea turtles is well documented. It is utilized as habitat by dolphin, wahoo, snapper, grouper, coastal migratory pelagic fish, and a variety of endemic species that are specially adapted to the habitat. Most offshore habitats are protected from the effects of oil spills because their depth under the water separates them from potential oil spills that would float at the surface. The *Sargassum* community is particularly vulnerable to contamination from spills because it floats at the surface of the sea. This is relevant to BOEM because the pelagic *Sargassum* ecosystem shares the offshore waters with permitted activities.

Recent work analyzing satellite imagery suggests that the traditional view of *Sargassum* originating in the western Atlantic is erroneous. Initial analyses of satellite observations reveal that *Sargassum* biomass in the GOM is greater than previously estimated and suggests that the algae is entrained in the GOM Loop current to feed into the Gulf Stream current, thus traveling up the east coast and into the Atlantic gyre. This theory bears further investigation and ground-truthing studies.

The ability to detect *Sargassum* via satellite was recently achieved by several Canadian researchers (Gower et al., 2006; Gower and King, 2008). Their research is based on images from satellites launched in 1997, 1999, and 2002. Relevant images of varying resolutions are available as far back as 1997, with the better data in the more recent images.

Objectives: This study will characterize the occurrence and movement of pelagic *Sargassum* algae in the Gulf of Mexico and western Atlantic.

Methods: A variety of methods will be employed to characterize the occurrence and movement of pelagic *Sargassum* algae. Methods should include field sampling to estimate the standing biomass of *Sargassum*. The project will also solicit coordination with other BOEM scientists

and scientists from other institutions with overlapping interests to consider possible combined efforts. The project will use appropriate methods to accomplish the following tasks.

1. Use satellite imagery to identify the seasonal distribution of *Sargassum* across all years with appropriate available data.
2. Use satellite imagery to track the seasonal movement of *Sargassum* across all years with appropriate available data.
3. Use methods such as deployment of satellite-tracked drifter buoys to confirm the movements of *Sargassum*.
4. Conduct field surveys to ground-truth satellite information to insure accurate characterization of *Sargassum* distribution and movement. This may be some combination of aerial photography and ship cruises.
5. Conduct field sampling to estimate the standing biomass of *Sargassum*.
6. Correlate results with appropriate physical factors such as water currents, sea surface temperature, nutrient levels, storm events, and climate.
7. Cooperate with other researchers having overlapping interests to maximize resources and promote additional research. This cooperation shall include supporting opportunistic sampling for other programs as appropriate.
8. Integrate study results into BOEM's new *EcoSpatial Information Database* (ESID, pronounced "ee-sid"). This requires delivery of all data files, imagery, GIS files, metadata files, an annotated bibliography of background research, and copies of background documents.

**Revised Date:** May 3, 2012



## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**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:** More than a year 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.

**Cost Range:** (in thousands) \$220-\$330

**Period of Performance:** FY 2013-2015

### **Description:**

Background: As a result of the cultural resources investigations conducted during the Macondo 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 Macondo 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. However, one of the recommendations to come from that experience is that it is critical to begin damage assessment studies within the first year after the event (Bittner, 1996: 817). Assessment studies relating to the Alaska spill suffered from multiyear delays, insufficient funding, and shifting priorities such that many basic questions remain unanswered. 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 and to obtain information on long-term human-environmental and cultural relationships in the coastal zone during the Late Woodland and Mississippi periods (ca. A.D. 700-1700). Archaeological components dating from this time are primarily known as coastal variants of Coles Creek and Plaquemine cultures. Evidence for Mississippian culture or cultural contacts along the Gulf Coast to the east, expressed mostly in ceramics, appears around A.D. 1400. 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.

Method: 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. 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. Extra-regional cultural contacts will be investigated through the identification of non-local ceramic vessels (styles and pastes), as well as lithics and other non-local resources. Field methods will consist of systematic surface collection, mechanized and hand-operated coring and augering, and excavation of 1-by-1-meter test units 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.

**Revised Date:** May 3, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

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

**BOEM Information Need(s) to be Addressed:** BOEM needs to characterize the known distribution of deepwater corals and predict their occurrence in the Gulf of Mexico. This achievement will promote accurate environmental descriptions in National Environmental Policy Act documents and support our ability to protect deepwater coral habitats from potential oil and gas impacts.

**Cost Range:** (in thousands) \$360-\$540

**Period of Performance:** FY 2013-2017

### **Description:**

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

A significant amount of information for chemo and coral communities in the GOM exists in a variety of formats and in scattered repositories. While the BOEM has conducted major studies, so have numerous other entities including academic and Federal institutions. A more accurate and useful understanding of the available information could be produced if the information were collated, analyzed, and organized for ease of access.

A major benefit of collating data of GOM chemo and coral communities would be the ability to produce better models for predicting their occurrence. Many locations with significant areas of hard bottom in the deep GOM are associated with faulting above the tops of salt diapirs. These areas are well represented in 3D seismic surface amplitude anomaly data. Surface seismic data and underlying geologic structures have been synthesized for a more complete interpretation. Recent BOEM analysis of industry 3D seismic seabed amplitude anomaly data has revealed over 16,000 separate features that likely represent exposed carbonate hard bottom. The collection and analysis of GOM data of chemo and coral communities in deep water will allow development of better predictive models. Deepwater coral habitats are internationally recognized for their value as unique fish habitat, high biodiversity, and even as sources for discoveries of compounds with

biotechnology potential. Of particular significance is determining the probability of where high-density coral communities will be found on exposed hard bottom substrate.

Objectives: The objective of this project is to (1) collate and organize ecological information for deepwater chemosynthetic and coral communities in the northern Gulf of Mexico into a geodatabase and (2) model ecological parameters to predict community occurrence and character.

Methods: This project will be conducted as a collaboration among research groups who have performed deepwater habitat research in the GOM. An interagency agreement will be created with the NOAA National Centers for Coastal Ocean Science (NCCOS), Biogeography Branch. The NCCOS is building the database for NOAA's National Inventory of Deep Coral Distribution ([http://ccma.nos.noaa.gov/ecosystems/coralreef/coral\\_dist\\_dev.aspx](http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_dist_dev.aspx)), and as such, will be collating information from numerous sources for GOM deepwater communities for this effort. The Biogeography Branch and other NCCOS offices will handle the bulk of the work, coordinating with BOEM, USGS, several other NOAA offices and numerous research institutions.

Data will be extracted from a variety of formats. These include sources such as video from manned submersibles and remotely operated vehicles (ROV), sonar and imagery from automated underwater vehicles (AUV), 3D seismic data, cruise reports, maps, museum records, and even old deepsea trawl data. The data targeted will be information that provides the locations and other ecological information for any structure-forming habitats in the deep GOM. This will specifically include not only any type of deep coral habitats but also chemosynthetic communities, sponge communities, and relevant deep artificial reef information.

The information will be processed for the objectives of the project. It will be collated and formatted into a usable database system. Data will be analyzed and used to support predictive modeling for the location and character of sensitive GOM deepwater benthic communities.

**Revised Date:** April 17, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** Florida Manatee Movement and Habitat Use in the Northern GOM

**BOEM Information Need(s) to be Addressed:** Florida manatees are expanding their range from the Eastern GOM westward. Data from telemetry studies and strandings documents movements to the west as far as Texas. While they are primarily a near shore species, they inhabit areas that are being used by offshore supply vessels that support industry activities in federal waters. Expansion of their range may increase the likelihood of impacts to manatees from BOEM activities.

**Cost Range:** (in thousands) \$800-\$1,200

**Period of Performance:** FY 2013-2015

### **Description:**

Background: Florida manatees (*Trichechus manatus latirostris*) are federally protected under the Endangered Species Act (ESA) and are listed as “endangered” throughout their range. Florida manatees are found in shallow coastal waters along the entire northern GOM from Florida to Texas (Fertl et al., 2005). However little is known about manatee habitat use west of the Suwannee River in Florida. Vessel strikes are the most common cause of human-induced mortality for manatees (Florida Fish and Wildlife Commission, 2010). Service and support vessels traveling through coastal areas to and from oil and gas structures have the potential to impact manatees by vessel collisions. In 1995, an oil crew workboat struck and killed a manatee in a canal near coastal Louisiana (Fertl et al., 2005). Inadequate hearing sensitivity at low frequencies (Gerstein et al., 1999), slow movement, and use of shallow and surface waters are contributing factors to their vulnerability to vessel strike impacts.

Objectives: The goal of this study will be to determine manatee movements/spatial distribution and habitat used as well as assess overall health in the northern GOM, specifically in areas west of the Suwannee River, Florida.

Methods: Over the course of a 3-year period, up to 20 manatees a year (N=60) will be outfitted with satellite tags to monitor movements and habitat use in the northern GOM. These tags transmit data via the Argos satellite system and may contain sensors for recording of depth, light-level, and temperature. In addition to obtaining Argos locations, GPS locations, tag operational parameters and environmental sensor data will be transmitted within standard Argos messages. The on-board GPS provides very precise spatial positioning data and tracking of animal movements through time. Habitats used by manatees will be characterized using standard methodologies and compared with previously collected data from the Big Bend area. When manatees are captured for tagging, each animal will have a health assessment conducted. Data collected may include gender, blood and urine samples, fat thickness (using ultrasound), scar photographs, and skin samples for genetic analyses.

**Revised Date:** May 3, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Western and Central

**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 assessments required by NEPA. Coral reef communities are expected to be uniquely impacted by climate change stressors and ocean acidification (OA). This study will assess OA variability in the Flower Garden Banks National Marine Sanctuary (FGBNMS) and will eventually help understand the implication of regional OA changes.

**Cost Range:** (in thousands) \$500-\$700

**Period of Performance:** FY 2013-2018

### **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-18<sup>th</sup> century have resulted in an increase of atmospheric CO<sub>2</sub> concentrations, with the ocean absorbing a significant fraction of this CO<sub>2</sub>. However, when CO<sub>2</sub> 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 1990s have suggested that declining levels of calcification will occur with increasing ocean acidification. BOEM and its predecessors have studied the Flower Garden Banks for several decades (since the 1970s), making this coral reef ecosystem a sensible choice for establishment of an OA sentinel site in GOM offshore waters. It also compliments 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 explore establishment of an OA sentinel site at the FGBNMS and integration 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 carbon chemistry conditions at the site.

Methods: Initial discussions with NOAA scientists at the Atlantic Oceanographic Meteorological Laboratory have commenced and collaborations with NOAA will be further

explored as partners in this research. 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  $p\text{CO}_2$ , pH,  $\text{O}_2$ , 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 OA parameters 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 carbon chemistry conditions in this region. 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 GOM.

**Revised Date:** May 3, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** Enhancing the Capability of a New Meteorological Model for Air Quality and Other BOEM Applications in the Gulf of Mexico

**BOEM Information Need(s) to be Addressed:** The National Center for Atmospheric Research (NCAR) has been developing an advanced meteorological model (The Weather Research and Forecasting Model (WRF)), a community meteorological model widely used in the world. The WRF model is a modeling tool that is required in the air quality modeling for assessing the impact of air quality from the OCS emission sources on the onshore environment. Recently, EPA has promulgated new ozone and 1-hour NO<sub>x</sub> and SO<sub>x</sub> standards. In addition, to understand the atmosphere boundary processes and structure in the coastal areas and its interaction with cloud, aerosols, chemistry, and mesoscale processes, and to address air quality issues, BOEM needs to develop an improved meteorological model to realistically modeling the meteorological phenomena such as sea breeze and cloud formation and to produce the better mesoscale wind, temperature, and moisture fields as well as mixing height in the coastal areas for air quality and other BOEM applications such as alternative energy, oil spill, and climate change. Therefore, it is an urgent need to develop an improved meteorological model for air quality applications in offshore and coastal regions.

**Cost Range:** (in thousands) \$400-\$600

**Period of Performance:** FY 2013-2015

### **Description:**

**Background:** Recently, the Bureau of Ocean Energy Management (BOEM) has funded a number of studies including air quality modeling and the atmospheric boundary layer study (ABL) in the Gulf of Mexico, including an ongoing study for wind-wave measurements and the new studies for collecting the air emission activities data from the OCS sources; the main purpose of this data collection is for air quality modeling. The information and results obtained from these studies will be used to improve the WRF meteorological model for air quality applications and other applications such as oil spill, oil and gas platform design, alternative energy, sea breeze, cloud formation, and hurricane forecast etc. The meteorological model will also include the improved COARE Bulk Air-Sea Flux Algorithm. The improved meteorological model will be used to simulate the atmospheric circulations and generate the basic atmospheric parameters such as predicting the mixing high over water, sea breeze circulation, meso-scale meteorological phenomena or weather patterns in the coastal areas. The information is required in air quality modeling to be able to reliably predict the air quality from offshore to the onshore environment. The accurate air concentrations obtained from the air quality modeling are required to meet the National Ambient Air Quality Standards (NAAQS).

**Objectives:** The objectives of this study are to improve the capability of the WRF model for air quality model applications over the ocean in the Gulf of Mexico, to understand the atmospheric boundary layer structure and its interactions with clouds, aerosols, chemistry, and mesoscale

processes, and to leverage the state-of-science and up-to date modeling information developed by the scientific community, and to produce a better and improved working WRF model for the applications in the OCS, especially in the coastal areas which are covered by the Thermal Internal Boundary Layer (TIBL).

**Methods:** This study will utilize the information and results obtained from the atmospheric boundary layer study and other BOEM's studies, and leverage the NCAR studies for improving the meteorological model, improving the parameterization scheme for surface fluxes, providing better science in the areas of air-sea interaction and initial conditions, and performing three-dimensional data assimilation of thermodynamic profiles and wind profiles for the model. The WRF model, including the improved COARE Algorithm for the applications in the coastal areas, will be used for this study. The BOEM-funded observational data will be used for model sensitivity study and model validation.

BOEM will work with NCAR, NOAA, and WRF working committee to develop the modules, especially the air-sea interaction module (COARE), and focus on WRF-VAR for data assimilations by including wind and thermodynamic variables; it is important that the model has the capabilities (or skills) of reliably predicting the meso-scale meteorological phenomena such as sea breeze and assimilating the water vapor profiles into the model.

**Revised Date:** May 3, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**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 OCS leasing program exists because of its fiscal contribution to Federal and State governments. This contribution, including the issue of equitable sharing, is a key part of the analysis of the BOEM 5-Year Programmatic EIS and associated decisionmaking documents. These effects are important in themselves; in socioeconomic impact analysis they are also often an important source of indirect 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 a major program benefit to the affected counties/parishes and states while the public expenditures which the program requires are an important burden. The long-term trends and variable nature of OCS activity also have important fiscal implications. The program's direct and indirect fiscal effects at state and local levels are important in themselves, and possibly as the source of other more indirect effects. For a number of reasons the GOMR currently lacks an approach for the systematic analysis of them—their fungibility, the complexity and variability of regional funding mechanisms, etc. However, the GOMR is strengthening its regional-level economic impact analysis. To date, this ongoing effort includes a redefinition of geographic impact areas based on OCS-industry distributions and the definition of focal areas for analysis based on their participation in, and sensitivity to, OCS-industry activities. This analysis of regional-level fiscal impacts is intended to provide a tool for linking economic impacts to other socioeconomic impacts within these focal areas.

**Cost Range:** (in thousands): \$280-\$420

**Period of Performance:** FY 2013-2014

### **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. Four years ago, 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 being closed. It has provided useful data that can be applied to future research but it has completed little analysis.

Objectives: The objectives of this study are to strengthen BOEM estimates of the overall economic fiscal contribution of the OCS leasing program to affected Gulf States and, more importantly, to provide the understanding and tools needed to assess regional-level fiscal impacts for selected focal areas.

Methods: The study will identify and define direct mechanisms (if any) by which OCS-related funds are distributed to states and their political subdivisions. It will develop allocation methodologies to estimate the distribution of revenues which do not have direct mechanisms. It will estimate the various indirect revenue impacts which accrue to the state and its political subdivisions and, to the extent possible, identify the linkages between these and OCS activity and estimate the distribution of these revenues among the state and its political subdivisions. 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. To accomplish these, the study will employ, but will not be limited to, 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 Louisiana.
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, public works).

**Revised Date:** May 3, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

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

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

**Cost Range:** (in thousands) \$240-\$360

**Period of Performance:** FY 2013-2014

### **Description:**

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

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

well integrated part of the Gulf's economy. Projects are familiar, local labor is poised to meet the demand, and each project blends into the next. These effects are from the routine operations of varied oil-related enterprises rather than from the concentrated activities of the construction trades.

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

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

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

relationships between the Gulf Region oil industry and offshore petroleum development and its demographic consequences. The goal is to select and answer a set of research questions that, together, will provide a better understanding of the demographic consequences, through time, of Gulf of Mexico petroleum development. The study shall address effects at least three levels of aggregation: GOMR, state, and BOEM-defined impact areas. While some effort will be directed toward data at the higher levels of aggregation, such approaches have not proven out in the past. Here, the strategy will be to emphasize regional (local) level analyses, to explore multiple approaches, and to construct the more general estimates based on an evaluation of them all.

**Revised Date:** May 3, 2012





## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Central

**Title:** Analyzing Impacts to Cultural Resources as a Result of Oil and Gas Activities in Deepwater (<500-10,000 fsw)

**BSEE Information Need(s) to be Addressed:** BSEE and BOEM are both required under Section 106 of the National Historic Preservation Act (NHPA) to consider the effects of their permitted actions on significant historic properties. Unfortunately, activities permitted by BOEM have, in the past, caused impacts to significant historic properties in deepwater. These impacts include anchoring cables slicing through wooden-hulled vessels, anchors and anchor chain caught on sites during anchor recovery operations, a pipeline laid on shipwreck sites, and other impact-producing factors associated with offshore oil and gas operations. This study will provide BSEE with baseline information on the location, preservation, site size, and the size of debris fields associated with known submerged cultural resources that were impacted by offshore oil and gas activities. The results of this study will have broader-scale implications for BSEE's Environmental Enforcement Division by providing information on the continued degradation and/or stabilization of sites that have been impacted because of these activities. Information obtained will also assist BSEE with complying with its Section 106 responsibilities under the NHPA by providing data about the current condition of these sites and what changes have occurred since the initial impact-producing factor occurred. In addition, these data will provide BSEE information about appropriate mitigation measures for future archaeological sites in these water depths and provide baseline data regarding the long term remediation to these types of sites when impacts occur.

**Cost Range:** (in thousands) \$1,280-\$1,920      **Period of Performance:** FY 2013-2016

### **Description:**

Background: In 2011, the BSEE was created with the express intent of promoting safety, protecting the environment, and conserving resources offshore through vigorous regulatory oversight and enforcement. The Environmental Enforcement Division, an arm of the larger BSEE program, is responsible for aggressively, but fairly ensuring environmental compliance during offshore development. Over the years, as industry has moved into ever increasing water depths, impacts to non-renewable submerged cultural resources have occurred. In the past, if an impact occurred to a submerged cultural resource, the common practice was to assess the damage and move forward with the proposed action. In some instances, impacts to submerged cultural resources occurred because industry was not required to conduct high-resolution surveys of the seafloor. However, on a few occasions, the oil and gas industry was found responsible and limited remediation efforts were made to address these impacts. In an effort to better understand the extent and long lasting effects these impacts may have on deepwater submerged cultural resources, this study will acquire data that will aid in understanding either the continued degradation and/or stabilization of these unique archaeological sites. Data will also be acquired to provide BSEE information about improving and appropriate mitigation measures for these

types of sites as well as the level of impact (if any) that has occurred. In addition, geophysical and geological data regarding the character and quality of sediments in the vicinity of the submerged cultural resource will also be acquired to better understand how the impacted environment has affected the condition and continued degradation and/or stabilization of this resource.

Objectives: The objectives of the study are twofold: 1). to identify and examine the long term impacts that have occurred as a result of permitted industry activity on submerged cultural resources in deepwater. 2). to understand how better to mitigate and reduce/eliminate these impacts by providing baseline information on appropriate remediation measures, stronger mitigations to prevent such impacts, and developing tools that will improve how BSEE conducts impact assessments of these types of impacts to submerged cultural resources.

Methods: The study will investigate the physical remains of up to ten shipwreck sites in water depths ranging between 500 to 10,000 feet that have known impacts from oil and gas activities. Each site will be evaluated to positively identify and assess the size, distribution, and characteristic of the shipwreck remains and debris fields associated with the impacts identified. Data will be used from previous Remotely Operated Vehicle (ROV) and Autonomous Underwater Vehicle (AUV) investigations of shipwreck sites that have been impacted by oil and gas activities. Extensive investigations will be conducted at each site using ROVs equipped with laser scales and tied into Long Baseline Arrays. The ROV investigation of each site will include visual surveys, mapping, and potentially dredging and probing in order to determine the extent of the impact as well as the age, cultural affiliation, and nationality of each identified shipwreck. Test units may be excavated in areas determined from both the remote sensing data as well as visual surveys (should conditions allow) as a means to identify intact areas of the site or secondary deposits made as a result of impact-producing factors. The project will also conduct extensive photographic documentation and mapping of each site. Limited artifact collection for identification purposes is also expected and all artifacts collected during the investigation are to undergo conservation and curation in conjunction with State of Louisiana protocols. Additionally, other analyses such as wood analysis will be conducted to provide further information about these sites. During these investigations, sampling and coring of the sediments in the vicinity of these shipwreck sites will be collected in an effort to define the character of the sediment resource to better understand if impacts to the surrounding environment have had an effect on the continued degradation/stabilization of the shipwreck sites. The study will provide an archaeological assessment of each site including site maps, site descriptions, impact analysis and damage assessments, and eligibility determinations to the National Register of Historic Places. Analysis of the archaeological data will be augmented by additional historic research of primary and secondary sources to provide as much information as possible for these sites.

The end product of this study will include a final report with an assessment of current mitigation measures placed on submerged cultural resources, recommendations on improvements to these mitigation measures, a series of baseline protocols for conducting impact assessments of these resources, a determination if long term degradation and/or stabilization occurs in these water depths, an assessment of nearby sediments to understand if impacts to the sediments exacerbates degradation of these sites, recommendations on appropriate remediation efforts, eligibility

determinations to the National Register of Historic Places, and a public outreach component including posters and booklets detailing the project's history, impacts of these types of operations on historic resources, and discoveries made that showcase the Gulf of Mexico's rich maritime heritage and highlight BSEE's commitment to preserving these non-renewable resources.

**Revised Date:** May 3, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** Workshop on Monitoring the Long-term Effects of Offshore Oil and Gas Activities in the Gulf of Mexico

**BOEM Information Need(s) to be Addressed:** BOEM has sponsored an extensive amount of studies on the Gulf of Mexico (GOM). Baseline studies in the 1970s and 1980s evolved into focused ecosystem studies in both continental shelf depths, but also extending to the full depths of the Gulf of Mexico. 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-1970s becoming annual in 1988. In accordance with the Outer Continental Shelf Lands Act (OCLA; SEC. 20. ENVIRONMENTAL STUDIES (b)\*) and BOEM's mission, BOEM should periodically revisit the results of these 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. BOEM must also consider if any new baseline data needs to be collected. Special consideration should 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 Deepwater Horizon (DWH) oil spill and any new results from DWH-related studies are a significant consideration (e.g., White et al., 2012).

**Cost Range:** (in thousands) \$200-\$300

**Period of Performance:** FY 2013-2014

### **Description:**

Background: The oil and gas industry has been operating in the GOM since the 1940s 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 1970s the OCS Environmental Studies Program (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://.data.boem.gov//\\_center///.asp?=](http://.data.boem.gov//_center///.asp?=). Included among these reports are bibliographies of

relevant literature such as “Effects of Oil and Gas Development: A Current Awareness Bibliography 2000-2004” (Conover and Duhon, 2005). Also, a number of large interdisciplinary/interagency studies on deep-water corals and chemosynthetic communities have recently been completed.

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 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.

It is anticipated that with consideration of both shallower continental shelf depths together with deepwater habitats of the GOM in a single workshop (in consideration of overlap of some components and cost savings), there will be two breakout themes to the workshop addressing these divergent environments between plenary issues at the beginning and end of the workshop.

Objectives: The purpose of this proposal is to hold a 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. 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,
- (3) Evaluate what offshore sites should be (re)examined including consideration of new exploration,
- (4) Evaluate what new techniques or instrumentation should be used to collect new data or analyze previously collected data, and
- (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.

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, 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 (re)visited including possible sampling schemes,
- (5) Advise BOEM on what type of samples should be taken and types of data that should be collected,
- (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 effects such as state oil and gas development, the fishing industry, onshore industries, oil seeps, river or atmospheric inputs etc...

The proposed budget will cover the cost for event planning and execution, facilities and needed equipment rental, and preparation of the workshop recommendations.

#### References

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\*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:** May 3, 2012





## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide and Atlantic

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

**BOEM Information Need(s) to be Addressed:** The persistence of environmental effects from recurrent dredging of the same sand resource is a common concern of environmental resource managers. For example, 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 thereby reduce potential impacts to benthic and essential fish habitat, benthic communities, and federally-managed fisheries. One way that individual project and cumulative effects can be managed is by optimizing the use of sand resources. This entails advanced planning using a systematic framework that incorporates long-term project design, engineering, and economic requirements with sand resource availability and impact minimizing strategies. This untested planning process, would constrain where and when the effects that could contribute to persistent impacts would occur. This strategic approach would focus NEPA analysis, Essential Fish Habitat consultation, and NHPA Section 106 coordination and drive better environmental and stewardship outcomes. A suitable planning methodology needs to be developed and then tested.

**Cost Range:** (in thousands) \$280-\$420

**Period of Performance:** FY 2013-2014

### **Description:**

**Background:** The typical beach nourishment and/or coastal restoration program involves an initial larger-scale construction phase followed by smaller-scale, regularly spaced 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/or multiple use conflicts are common, a single borrow area may 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, environmental windows, and dredge plant availability typically drive when dredging occurs.

Each dredging event diminishes not only the availability of sand resources, but the profile of the sand body or sheet, potentially affecting local and residual hydrodynamics, substrate composition, or the morphologic response of the sand body, *etc.* This series of coupled changes, magnified in the scenario of multiple dredging events, may disturb the ecosystem function of sensitive biological habitat and resources in the vicinity of the borrow area. Such physical process changes may also cause unanticipated indirect impacts to 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. BOEM cannot accurately estimate dredging intensity without this information, however dredge monitoring data is actually collected during or across construction cycles and could be used to constrain and validate such estimates.

The management of OCS sand resources is often a multifaceted challenge because of different engineering and design requirements, economic and environmental considerations, and stakeholder views that must be balanced. Consistent with the tenets of coastal and marine spatial planning, the preparation of a coupled impact management - use optimization plan is suggested to frame BOEM's resource management responsibility. Use optimization starts 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, persistent effects, and 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). Monitoring data and lessons learned from iterative project implementation provide an opportunity to further refine the resource optimization and impact management plan (Michel et al., 2004).

Objectives: The objectives of the study are to:

- Develop the methodology for sand resource use optimization planning.
- Demonstrate this planning process by developing a draft optimization plan for two 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 literature review and synthesis, comparative analysis, and stakeholder coordination. Historical sand resource and environmental resource information for existing OCS borrow area(s) selected for the study will be compiled and analyzed to prepare the draft borrow area management plan(s). Additional data collection may be warranted to fill important data gaps. Preparation of the draft borrow area management plan may require cost effectiveness analysis, multi-criteria decisional analysis or equivalent statistical/econometric analysis.

**Revised Date:** May 3, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Central

**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 EISs. 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 adequately prepared for the 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.

**Cost Range:** (in thousands) \$160-\$240

**Period of Performance:** FY 2013-2014

### **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 (mi<sup>2</sup>) 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 land loss is imposing on industrial infrastructure. While the Scott & 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). 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:

- effects coastal land loss and storm surges are having on coastal industry infrastructure and operations, particularly on OCS-related industry
- strategies and objectives to mitigate land loss impacts as well as identify industry trends 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 and 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 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, FEMA flood program policy) covering the oil and gas and other industries and those reliant on the coastal system for current operations.

Field reports, monthly progress reports, coordination meeting reports, data bases and maps, annotated bibliographies, transcribed discussions, and a final report will be submitted.

**Revised Date:** May 3, 2012

### 2.3 Profiles of Studies Proposed for the Fiscal Year 2014 NSL

**Table 3.** BOEM Gulf of Mexico Region Studies Proposed for the Fiscal Year 2014 NSL

Page #	Discipline	Title
71	SS	An Assessment of Transportation Infrastructure Usage by the OCS Oil and Gas Industry
73	HE	Artificial Reef Effects of Oil and Gas Pipelines on the Outer Continental Shelf of the Gulf of Mexico
75	HE	Black Skimmers: Inter- and Intra-Annual Movements, Home Range Size, Fidelity, Dispersal, and Nesting Ecology in the Northern Gulf of Mexico
77	HE	Characterization of Seagrass in Waters of the U.S. Outer Continental Shelf: Florida Big Bend Area
79	HE	Comprehensive Nearshore and Offshore Avian Surveys in the Gulf of Mexico (CASGOM)
83	SS	Effects of the OCS Industry on Tourism in the Gulf of Mexico: Extensions of Previous Research
85	SS	Impacts to Wooden Shipwreck Remains from Exposure to Crude Oils, Chemical Dispersants, and Oil-Eating Bacteria
87	HE	Offshore Platforms, Produced Water, and Seabirds: Avian Species Composition, Distribution, and Abundance
91	MM	Passive Acoustic Monitoring Program for the Northern Gulf of Mexico
95	MM	Potential for Interactions Between Endangered and Threatened Bat Species with OCS Activities within the Gulf of Mexico
97	SS	Public Outreach Through Development of Web-Based 3D Modeling of Shipwreck Sites
99	SS	Social Impacts of the <i>Deepwater Horizon</i> Oil Spill on Coastal Communities Along the U.S. Gulf of Mexico (Phase II)
101	SS	Subsistence Activities and Use in Coastal and Near Coastal Areas of the Gulf of Mexico
103	PO	Testing Chang and Oey's (2011) Gulf of Mexico Oscillator Hypothesis: A Field Program
AQ = Air Quality		FE = Fates & Effects
IM = Information Management		HE = Habitat & Ecology
PO = Physical Oceanography		MM = Marine Mammals & Protected Species
		SS = Social Sciences



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Central and Western

**Title:** An Assessment of Transportation Infrastructure Usage by the OCS Oil and Gas Industry

**BOEM Information Need(s) to be Addressed:** BOEM has documented and mapped major types of OCS onshore support infrastructure (e.g., ports, fabrication, ship and pipeyards, heliports, refineries, etc.) to facilitate assessment and monitoring of the onshore effects of offshore petroleum. BOEM has also described the many of the industry sectors associated with these infrastructures as well as the types and scale of support activities conducted by these sectors. Transportation to and from the OCS is intermodal, it moves from onshore forms such as trucks, railroads, and barges, to offshore forms such as supply boats and helicopters. In terms of traffic, infrastructure use, or economics, the onshore portion of this transportation system is huge, not well documented, and has been an expressed concern of affected Gulf States. This study will fill this important information gap. As it becomes available, information from this study on the onshore transportation web (roads, railroads, and waterways) will be incorporated into baseline, impact, and cumulative sections of GOMR environmental assessments and into the BOEM GIS system and it may be applied to future BOEM economic projections.

**Cost Range:** (in thousands): \$230-\$350

**Period of Performance:** FY 2014-2015

### **Description:**

**Background:** The inshore transportation system supports OCS activities by allowing the movement of products among intermediate consumers (e.g., from a factory to platform fabricator) and to the final consumers. Because of the substantial demand for goods generated by OCS-related activities, inshore OCS-related transportation sectors, most notably the trucking sector, are also large. As a group, offshore workers commute long distances to work, which generates additional demands on transportation infrastructures. Much of this OCS-related activity is “intermodal;” equipment, materials, supplies, and people are brought to coastal areas by road, railroad, or waterway and then, are moved offshore after being transferred to a different mode of transportation at ports and heliports or transformed into vessels and platforms in fabrication and shipyards. As part of its mandate to manage OCS mineral resources, BOEM has addressed the physical and biological effects of the ocean side of this intermodal system. However, as the discussions on Port Fourchon and LA 1 suggest, the onshore side of this system raises assessment issues as well. Some of these relate simply to the scale of the demand and of the use of infrastructure such as roads. Others relate to the intermodal and focused character of much of it. Beyond the socioeconomic consequences of heavy traffic, this concentrated activity can create transportation choke points. Such problems may become more pressing as deepwater developments continue to concentrate support-related activities into fewer and fewer ports.

While OCS activities occur offshore, its social and economic consequences occur onshore. Many of these are associated with onshore infrastructure used to support offshore petroleum

exploration, development and use. BOEM has documented and mapped major types of OCS onshore support infrastructure (e.g., ports, fabrication, ship and pipeyards, heliports, refineries, etc.) to facilitate assessment and monitoring of the onshore effects of offshore petroleum. BOEM has also described the many of the industries, types of activities, and scale of activities associated with these infrastructures as well as the types and scale of support activities conducted by these sectors. BOEM continues to update and refine this documentation and mapping. While these efforts encompass transportation systems that link shore to the OCS, they have not systematically addressed the onshore transportation web, the roads, railroads and waterways used in support of OCS-related activities. These systems, too, are critical to OCS activities, and the associated support sectors and activities (particularly trucking) are substantial inputs to the social and economic consequences of the Leasing Program. This new study will incorporate the onshore transportation web (roads, railroads, and waterways) and associated OCS-related industry sectors and activities into BOEM assessments including its GIS-based assessment and monitoring system.

Objectives: This study will enhance GOMR understanding of the role of the entire onshore transportation network in support of OCS-related activities--rail, roadway, and waterway.

Methods: The study will be based on literature review and analysis of available data 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). When appropriate, it will estimate levels of use for components of the systems. This study will also describe the OCS-related users of these systems, for example, typical characteristics of the trucking companies, and the aggregate size of this economic sector. When appropriate, it will describe the range and amounts of products delivered.

**Date Revised:** May 3, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Central and Western

**Title:** Artificial Reef Effects of Oil and Gas Pipelines on the Outer Continental Shelf of the Gulf of Mexico

**BOEM Information Need(s) to be Addressed:** BOEM needs a better understanding of the ecological effects of offshore oil and gas structures, including pipelines. This understanding is needed to respond to concerns about the potential loss of artificial habitat due to future decommissioning (50% more structure removals than installations over the next 40 years). Understanding is also needed to address concerns over the role of oil and gas structures as vectors for the establishment of exotic species. Pipelines could be considered corridors for immigration.

**Cost Range:** (in thousands): \$440-\$660

**Period of Performance:** FY 2013-2016

### **Description:**

Background: Over the next 40 years, approximately twice as many platforms are expected to be removed from the GOM as are expected to be installed. This raises public concern over loss of the fish habitat created by these structures. Many associated pipelines will also be decommissioned but these are typically abandoned in place. Since the first platform was installed in marine waters of the GOM in 1942, industry has created a tremendous network of pipelines to connect relevant offshore points with onshore facilities. Since the pipelines are usually abandoned in place, ecosystem services they may provide as artificial reefs also continue. In waters less than 200 ft (61 m) deep, pipelines are required to be buried a minimum of 3 ft (1 m) below the sediment upon installation. Pipelines in shallow waters are sometimes uncovered by water currents and storm action but most exposed pipelines are found in over 200 ft (61 m) of water depth.

The ecological effect of this vast network of steel on the seafloor has gone relatively unstudied. Modern concerns about the loss of platform structures as artificial habitat and concerns over exotic species increase the importance of the role of pipelines and their ecological effect. This network of pipelines could serve as significant artificial hard bottom habitat. It may provide corridors for the movement of fish and invertebrates across vast areas of otherwise featureless soft bottom. This could be seen as a positive effect; however, it could also be seen as an enabling network for the immigration of exotic species. Growing concern over invasive species (exotic species with detrimental effects) suggests that future attention on the role of oil and gas structures as vectors will intensify.

The BOEM needs to evaluate the ecological value of pipelines to understand their artificial reef effect. We need a full understanding of both the positive and negative aspects of the ecological role of pipelines to answer growing public concerns.

Objectives: This study will characterize the ecological community associated with oil and gas pipelines on the outer continental shelf.

Methods: Representative pipelines will be selected for examination in all regions of the Gulf of Mexico. This will include sites in federal waters from south Texas to Alabama, both nearshore and offshore to the extent of the outer continental shelf. The study will compare pipeline communities with those of natural habitats and other artificial habitats. Native and exotic species will be identified and quantified. Invertebrate and fish communities will be characterized.

The primary technique for quantification of pipeline communities will be video sampling. This will be done with small ROV's and with divers . Diver surveys will only be possible where exposed pipelines are identified in shallow waters. Though pipelines are initially buried in waters less than 200 ft deep, some become exposed due to movement of sediments by water currents and storm action. The method employed will depend on the water depth and conditions at a site. Physical samples of algae, invertebrates, and possibly fish will be taken for purposes of identification, as needed. Samples will be forwarded to taxonomic specialists as needed for identification.

Results of the pipeline community sampling will be compared with natural communities. During pipeline community sampling, observations and possibly some sampling of the surrounding benthic community will be taken for comparison. The results of pipeline community sampling will also be compared with relevant natural hard bank communities and other artificial reef communities to determine their similarity.

Water quality parameters will be measured at all sampling sites. Particular attention will be given to bottom waters. Factors such as dissolved oxygen concentration, salinity, temperature, turbidity, and Photosynthetically Active Radiation (PAR) will be measured. Bottom currents will also be measured at all sites.

This will be an excellent opportunity to observe the interaction of pipelines with the natural environment. General observations will be recorded and catalogued.

**Revised Date:** April 17, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** Black Skimmers: Inter- and Intra-annual Movements, Home Range Size, Fidelity, Dispersal, and Nesting Ecology within and among Nesting Sites in the Northern Gulf of Mexico

**BOEM Information Need(s) to be Addressed:** Additional information is needed to address information gaps for the population of black skimmers breeding in the northern Gulf of Mexico. It is estimated that ~35% of the southeastern population of black skimmers breed within the northern Gulf of Mexico (Hunter et al. 2006). Though this species is currently not listed under ESA, it is protected under the Migratory Bird Treaty Act and is considered a Bird of Conservation Concern by the U.S. Fish and Wildlife Service for BCRs 27 and 37 (USFWS 2008). This species is also considered a state species of conservation concern in 3 (FL, LA, and MS) of the 5 Gulf Coast states. In addition to documenting within and among year variation in movements, fidelity and dispersal, this study would provide information on within and among site differences in metrics of reproductive success. Information from this study would provide valuable information for use in OSRA models and for use in NEPA analyses, EPs, DOCDs, and would greatly support the agency in meeting obligations under the Memorandum of Understanding with the FWS (USDOJ 2009).

**Cost Range:** (in thousands) \$1,235-\$1,482      **Period of Performance:** FY 2014-2017

### **Description:**

**Background:** Presently, the 3 BCRs (Bird Conservation Regions) including the Southeastern Coastal Plain (BCR 27), Peninsular Florida (BCR 31), and Gulf Coast Prairie (BCR 37) supports roughly 12,000 breeding pairs, well below the objective of 25,000 pairs for these 3 BCRs (Hunter et al., 2006). The interaction of habitat loss (private and commercial development of beach-front property), degradation (hurricanes and sea-level rise), human disturbance, and apparently increasing diversity and numbers of predators continue to negatively impact breeding populations of this species (Gochfeld and Burger 1994). These habitat types (i.e., beaches, islands, sand bars, dredge piles) are extremely important breeding habitats for numerous species of waterbirds, as well as wintering habitats for numerous species of shorebirds, and these habitats are extremely vulnerable to anthropogenic habitat loss and degradation (Withers 2002, LeDee et al., 2008). Presently, habitat protection for known nesting areas in conjunction with habitat restoration or creation of high quality nesting sites (e.g., deposited dredge material; Erwin et al. 1995, Erwin 1996, Mallach and Leberg 1999) remain as conservation priorities for this species.

The northern GOM is recognized for its importance to a diverse and abundant assemblage of breeding beach-nesting waterbirds and shorebirds (Hunter et al. 2002, 2006). The stretch of coastline from the Mississippi Delta of Louisiana east to the Florida panhandle supports a disproportionately high number of beach-nesting species (USFWS 2010). As of 12 May 2011, the FWS had collected 253 black skimmers of which 55 were visibly oiled (22% oiling rate).

This species was the 5<sup>th</sup> most impacted species based on the number of individuals collected. The American Bird Conservancy determined that the black skimmer was vulnerable to 4 out of 4 oil-spill related threats including direct oiling, loss or contamination of food, contamination of nesting habitat, and habitat destruction during clean-up (ABC 2010). This species is generally restricted to the nearshore environment to fulfill its life-history requirements. It nests on beaches, barrier islands, flats, dunes, bars, dredge piles/islands, and other similar nearshore habitats. The combination of its habitat use, diet (small fish near the surface), and behavior make this species particularly vulnerable to oil spills. The black skimmer is a tactile forager gliding over the surface of the water with its lower mandible extending under the water's surface, dipping its head slightly, as the upper mandible secures its prey. Though Gochfeld and Burger (1994) identified the GOM as an important geographic area for research due to the large number of black skimmers breeding in this area, there remains limited information for this species and the potential effects of offshore oil and gas impact producing factors (including spilled oil) on its habitat, food resources, nesting ecology, and behavior.

Objectives: The proposed study will: (1) document inter- and intra-annual movements, home range size, fidelity, and dispersal for marked individuals among several known breeding colonies, as well as determining average foraging distances and identification of important foraging areas, (2) determine spatial and temporal variation in such reproductive parameters as nest density, clutch size, nest success, hatching success, and fledging success, and (3) document nesting behavior and information related to diets and provisioning.

Methods: Researchers will capture and mark 10-20 adult female black skimmers/nesting island along the northern GOM coast at 5-10 different sites located from roughly Corpus Christi, TX east to Cedar Key, FL. Females will be captured either during the pre-incubation stage or during incubation. VHF transmitters (n = 300; 3.5-4.5g) will be placed on individual adult females weighing  $\geq 252$ g. In addition, researchers will also mark nestling black skimmers (40-80/yr x 3yrs) with USFWS aluminum leg-bands and color leg-bands. Both transmittered and leg-banded individuals will provide information on important foraging areas, inter- and intra-annual movements, home range size, fidelity, and dispersal. Additional effort each nesting season will include remote camera monitoring of 50 nests/yr with cameras allocated roughly uniformly among sites. Cameras will be used to document incubation behavior, foraging intervals, food habits, and other information related to provisioning of nestlings. Reproductive parameters including nest density, clutch size, nest success, hatching success, and fledging success will also be monitored among sites. To our knowledge, this study represents one of the largest marking and monitoring efforts ever conducted for black skimmers. This project will potentially involve the FWS, USGS, several state agencies, and NGOs.

**Revised Date:** May 3, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Gulf of Mexico

**Planning Area(s):** Eastern

**Title:** Characterization of Seagrass in Waters of the U.S. Outer Continental Shelf: Florida Big Bend Area

**BOEM Information Need(s) to be Addressed:** Recent mandates to offer offshore leases up to 125 miles from the west coast of Florida prompt the need for BOEM to update seagrass information for the Big Bend region. Seagrasses are rapidly declining worldwide. The Big Bend region of Florida is one of the most favorable seagrass habitats in the U.S., with seagrass extending well into Federal waters. It has relatively low pollution, a gently sloping shelf, and a low-energy wave regime. It is little studied and in need of updated characterization. The BOEM needs information about the status of seagrass in the region to support ecosystem-based management of this sensitive resource.

**Cost Range:** (in thousands) \$600-\$900

**Period of Performance:** FY 2014-2017

### **Description:**

Background: Wave energy in the Big Bend area of Florida is relatively low due to the shallow and gently sloping nature of the sea bottom. The general decline of seagrasses in the Big Bend region has been attributed to increases of both coastal development and accompanying turbidity and contaminants. Dredge-and-fill projects seem to have the greatest adverse impacts upon submerged vegetation (SAIC, 1997; Sargent et al., 1995; Wolfe et al., 1988). Localized areas of seagrass loss are associated with the mouths of coastal rivers. Elevated nutrients in rivers affect seagrass growth and productivity by increasing phytoplankton abundance in the water column, thus decreasing light availability at the seafloor (Hale et al., 2004). Despite this, the Big Bend region is considered as relatively undisturbed with high water quality.

Some seagrass beds in the Big Bend area of Florida extend into Federal waters, which begin 16.7 km (10.3 mi) offshore. Sargent et al. (1995) reported dense seagrass beds up to about 26 km (16.1 mi) offshore. Both *H. decipiens* and *H. engelmannii* were seen growing to depths > 25 m (82 ft) in the Florida Big Bend area (Continental Shelf Associates, 1988). *Halophila engelmannii* has been reported from depths of 90 m (295 ft) off the Dry Tortugas Bank (Zieman, 1982) and *H. decipiens* has been reported growing down to a depth of 42 m (138 ft) off St. Croix (Wiginton and McMillan, 1979). Recent work indicates the presence of extensive, seasonal, deep-water *Halophila* beds, which may exceed four hundred thousand hectares (one million acres) (Dawes et al., 2004). Benthic green algae and drift algae are major components of Big Bend seagrass beds. In some locales, biomass of algae exceeds that of seagrass and constitutes a significant resource (Mattson, 2000).

Due to the gentle slope of the seafloor in the Big Bend region, small declines in water clarity can cause a large shoreward retreat of dense seagrass stands into shallower waters. The result can be

the loss of thousands of hectares (acres) of seagrass. Hale et al. (2004) reported changes in seagrass species distributions across the depth gradient.

Few studies of seagrass have surveyed the Big Bend region. Recent studies in the Big Bend region identified species distributions but did not measure quantities or density of grassbeds. Historic studies need to be updated to provide the current status of seagrasses in the Federal waters of the Big Bend region. New directives and incentives are in place for oil and gas exploration within 125 miles (200 km) of the Florida coast. These pressures dictate that the BOEM renew its information base for sensitive habitats on the Florida shelf. Seagrasses of the Big Bend area are a valuable resource that the BOEM must protect. Knowledge of the status of seagrass is important for the BOEM to protect the ecosystem.

Community composition data will be integrated into Geographic Information System (GIS) layers to both display the results and to provide access to the data through a geospatial interface. Deliverables will include GIS layers depicting the spatial distribution of seagrass species. The geospatially linked data will be used to define habitat zones based on statistical analysis of community composition. In addition, the GIS layers will integrate other data and analyses for the seagrass beds. This is to be done in coordination with another study (GM-08-x13) that is gathering existing data into a GIS interface.

**Objectives:** The objective of this study is to characterize seagrass habitat in Federal waters of the Florida Big Bend region and compare results with historical information.

**Methods:** The study will employ typical survey methods for quantitative analysis of seagrass and algae beds. Likely methods include transects across the shelf depth gradient with more intensive sampling at select sites. Transect methods could employ scuba divers, drop cameras, camera sleds, video, and/or still transects. Appropriate methods will accomplish the following tasks.

1. Define the distribution of seagrass by species.
2. Define the distribution of major algal components by species.
3. Quantify the seagrass communities (e.g., shoot density, standing crop, root biomass, productivity, etc.).
4. Quantify algal communities.
5. Log and analyze water quality parameters at all sites (e.g., turbidity, Secchi, PAR, nutrients, etc.). Measure light incidence at the surface and at the seagrass bed.
6. Compare results with historical information.
7. Integrate study results into BOEM's new *EcoSpatial Information Database* (ESID, pronounced "ee-sid"). This requires delivery of all data files, imagery, GIS files, metadata files, an annotated bibliography of background research, and copies of background documents.

**Revised Date:** April 19, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** Comprehensive Nearshore and Offshore Avian Surveys in the Gulf of Mexico (CASGOM)

**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. Multiple studies are being conducted in the north and central Atlantic Ocean that can be used to make informed management decisions in the future relative to offshore oil and gas activities, sand and gravel extraction, and renewable energy (Energy Policy Act 2005). However, in the GOM, very limited information is available for 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 1980s. Much has changed to the environment in the intervening 30+ years. Clearly, additional research is warranted to better address questions related to spatiotemporal aspects of avian distribution and abundance. This study would provide valuable information for use in NEPA analyses, EPs, DOCDs, oil spill risk assessment, and would greatly assist the agency in meeting obligations under the Memorandum of Understanding with the FWS (USDOJ 2009).

**Cost Range:** (in thousands) \$5,000-6,500

**Period of Performance:** FY 2014-2018

### **Description:**

**Background:** It has been well documented that seabirds represent reasonable, if not reliable, indicators of ecosystem health (Furness and Camphuysen, 1997). This is probably due to a combination of life-history characteristics and behavior whereby various species of seabirds sample different types of foods at various trophic levels over a large geographic area, and individuals of many species can be very long-lived. Similarly, because seabirds tend to show ecological responses to changes in environmental conditions, as well as to changes in distribution and abundance of preferred food items and thus monitoring their reproductive success or populations through time may be an indicator of spatio-temporal changes to the ocean ecosystem (Mallory et al., 2010).

Though the GOM has a long history of anthropogenic stressors on the ocean ecosystem (e.g., offshore oil and gas activities) there remains rather limited information relative to potential impacts to avian resources in this Region, particularly in the offshore environment. Early survey efforts in the 1980s and 1990s provided reasonably reliable information about specific locations of coastal marsh- and waterbird colonies, as well as some information on species-specific counts or population estimates (e.g., Portnoy 1978, 1981; Clapp et al. 1982, 1983). Information in the offshore environment is even more limited (Duncan and Havard, 1980). Overall, there are limits on the value of this earlier work because much of the effort was restricted to only the breeding season with little to sampling during the spring, fall, and winter periods. Additionally, there was little effort to correct for methodological issues particularly with respect to detectability

(detection bias) which can vary as a function of species, observer (among-observer differences in experience), habitat, time-of-year, time-of-day, habitat, weather conditions, etc. Probably, more importantly, is that much of the nearshore habitats have changed dramatically since these earlier studies likely as a function of both natural (i.e., subsidence and hurricanes) and anthropogenic processes (i.e., channelization and other modifications to the Mississippi River, coastal development, oil and gas development) (Gosselink et al., 1998) such that the working baseline is no longer applicable. Also, much improvement has been made in the areas of avian survey methodologies, analytical procedures, and population estimation procedures and modeling (Williams et al., 2002; Royle and Dorazio, 2008).

An assessment of potential direct and indirect impacts to avian resources from offshore oil and gas activities in the Gulf of Mexico remains one of the biggest knowledge gaps. At the same time, detailed information on the potentially affected resources will be required for appropriate analysis and mitigation of any of the activities or impact producing factors. BOEM has responsibilities for protection and conservation of avian resources under NEPA, Migratory Bird Protection Act, and the Memorandum of Understanding between the MMS (now BOEM) and the Fish and Wildlife Service (USDOJ, 2009) signed on 4 June 2009. 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.

Objectives: Using AMAPPS (AT-10-x11) and the Compendium of Avian Information and GIS Geodatabase (NT-08-03) as successful planning models, the proposed study will: (1) collect broadscale geographic information on distribution, abundance (density contours), and species-composition of birds in the nearshore and offshore environments, (2) collect finer spatial scale information on distribution, abundance (density contours), and species-composition of birds in the nearshore environment that may be particularly relevant to the FWS and Louisiana Department of Wildlife and Fisheries, (3) determine spatial and temporal variation in these same parameters, (4) determine how these parameters vary with respect to distance from shore, water depth, distance to platforms, distance to Shelf break, distance to cyclonic and anticyclonic eddies, and other environmental features such as surface temperature and salinity, chlorophyll A, density and diversity of zooplankton and micronekton, Sargassum lines (Haney 1986a, 1986b, 1986c; Ribic et al. 1997), and (5) develop geospatial models of bird distribution and abundance relative to the various potential anthropogenic and environmental factors influencing these metrics in an effort to determine bird distribution hotspots or density contours (Begg et al. 1997). These models could potentially be used during the offshore oil and gas siting decisions, as well to predict avian mortality risk associated with potential oil spills (e.g., Wilhelm et al. 2007).

Methods: A combination of nearshore and offshore vessel-based will be employed. In addition, FWS or contract aircraft will be utilized for conducting 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 (e.g., Laguna Madre, Sabine NWR, Delta and Breton NWRs, Gulf Islands National Seashore, Lower Suwanee and Cedar Keys NWRs). 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 Gulf of Mexico (see Tasker et al. 1984; Spear et al. 2004; Hyrenbach et al. 2007). For seabird surveys conducted from NOAA vessels, surveys should be



continued at least to the Shelf break and in some cases to the EEZ. Data obtained from this study will be instrumental in addressing a major information gap and could result in possible mitigations or stipulations specific to avian resources in the offshore environment. Specific details regarding methodologies, timing, location, and type of surveys will be determined at a later date, but should roughly follow the approach taken for AMAPPS. This project will potentially involve the NOAA-NMFS SEFSC, FWS, USGS, and several state agencies.

**Revised Date:** May 3, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**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 event, 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 fishing, recreational resources, and economic issues.

**Cost Range:** (in thousands): \$160-\$240

**Period of Performance:** FY 2014-2015

### **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 event 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.

Objectives: The overall goal of this study is to support assessments of the potential effects of the OCS leasing program on recreation and tourism in the GOMR, particularly with regard to potential future oil spills.

Methods: This study will update and extend the tools BOEM uses to estimate the scale of the tourism and recreation economies in the coastal zone of the GOM and the potential impacts of OCS activities on them; it will update and extend descriptions of the current Gulf Coast tourism and recreation industries in light of ongoing economic change, as well as in light of the DWH; and it will to examine aspects of the direct and indirect impacts of the DWH on tourism and recreation in order to better understand the potential impacts of possible future oil spills. In particular, this project will build off of the work of “An Examination of the Relationship between Tourism and Offshore 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. This would also entail presenting the results of the study in a formal report so as to allow for distribution of the statistical results.
2. By 2013, BOEM will likely have clarified the economic units it will use in its socioeconomic impact analysis. Therefore, the analysis of GM-11-06 will likely have to be expanded to include all regions within BOEM's new economic impact areas. This will primarily entail creating statistical measures of the scale of the tourism industry in particular counties.

**Revised Date:** May 3, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Regions:** Gulf of Mexico

**Planning Area:** Gulfwide

**Title:** Impacts to Wooden Shipwreck Remains from Exposure to Crude Oils, Chemical Dispersants, and Oil-Eating Bacteria

**BOEM Information Needs to be Addressed:** To date, no studies have been conducted on the impact of oil spills on 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 (Mobley et al. 1990). 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 oil-eating bacteria on the longevity of wooden shipwreck remains. We know that a significant portion of the oil expelled into the northern GOM from the Macondo well did not rise to the surface but rather, oil was emulsified at the well head due to turbulent mixing, reduced buoyancy at depth, and the addition of Corexit 9500 dispersant (Fodrie and Heck, 2011).

Section 106 of the National Historic Preservation Act of 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. Further, these results could assist other Interior Agencies in their approaches to the care and management of archaeological sites.

**Cost Range:** (in thousands) \$200-\$300      **Period of Performance:** FY 2014-2017

### **Description:**

**Background:** The stewardship of the OCS's archaeological heritage is a well-established policy and function of BOEM. The Bureau has paid special attention to archaeological resources on submerged lands due to the effects that Bureau-permitted activities may have 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 is 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" (Chang et al. 2002). During long-term exposure to submerged conditions, all wooden artifacts (including the ship hull itself) 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 decreases its structural stability (Hamilton, 1999). 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 shape of the wood (Jordan, 2001). 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 (Jordan, 2003). 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 was accelerated (Ejechi, 2003). 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. There is a possibility that 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 introduction of oil eating bacteria, crude oil, or chemical dispersants has the potential to alter shipwrecks' environmental conditions, which may rapidly accelerate the degradation of wooden artifacts. The proposed laboratory experiments would allow researchers to test the hypothesis that exposure to oil in the submerged environment negatively impacts the preservation of wooden artifacts and hull remains, accelerating their natural breakdown.

Objectives: The objectives of this study are to document through laboratory experiments, the results of short-to-midterm exposures to high levels of crude oil, chemical dispersants, and oil-eating bacteria on waterlogged wooden shipwreck remains. The basic initial question should determine if bacteria like *Alcanivorax borkumensis* will migrate from the consumption crude oils into the natural oils found in wooden shipwreck remains. Second, the laboratory will determine what effects, if any, the sudden introduction chemical dispersants like Corexit 9500 has on the stability of waterlogged archaeological wood. The laboratory will mimic as closely as possible Macondo's crude oil type, dispersant types used, and the range of bacterial activity found following oil spills in the GOM. It would be premature to try to completely replicate the exact environmental factors of the DWH oil spill. The re-creation of more complex and demanding region-specific environmental factors like pressure and dissolved oxygen levels at various depths should wait until this study determines if there is a significantly negative impact from exposure, or for that matter, any impact at all. Results would easily be integrated into future NEPA analyses of proposed oil and gas activities on the GOM OCS and bolster areas of weakness in impact determinations.

Methods: The study will develop and recreate potential spill-impact scenarios in the laboratory. Chemists, microbiologists, and archaeologists familiar with working in the marine environment will develop impact metrics and laboratory tests to assess oiling effects on shipwreck remains. There are a number of facilities that store water-logged archaeological wood that has yet to have undergone preservation. For example, the State of Florida's Conservation Laboratory houses a variety of remains, the University of West Florida has ample access to 16<sup>th</sup> century Spanish shipwreck remains and continues to excavate two period wrecks, Texas A&M has elements of the 17<sup>th</sup> century French vessel *La Belle* which could likely be used. This is, of course, only a sampling of materials originating from the GOM that could be used for these purposes.

Laboratory tests will introduce oil, dispersants (in isolation and in combination) and strains of hydrocarbonoclastic bacteria found in the GOM (such as *Alcanivorax borkumensis*) to waterlogged archaeological samples and modern waterlogged wood under laboratory conditions. There are a number of laboratories that house and produce these bacteria and should pose little difficulty in obtaining samples that can be cultured in large quantities. The lab will be using water similar to that found in the GOM. 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.

Both professional and public outreach at various stages of this study should be conducted by presenting method, designs, and results at conferences as well as groups which may have a more avocational interest. This topic may also be of interest to Graduate Student researchers and could possibly make for excellent thesis topics in the fields of Marine Archaeology, Chemistry, Marine/Microbiology. The results of this study should be published in variety scientific and public forums.

**Revised Date:** May 3, 2012





## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Western and Central

**Title:** Offshore Platforms, Produced Water, and Seabirds: Avian Species Composition, Distribution, and Abundance in Relation to Platform Activity Level, Distance from Platform, and Frequency and Volume of Produced Water

**BOEM Information Need(s) to be Addressed:** Additional information is needed to address information gaps relative to the potential impacts of produced water on seabirds in the Gulf of Mexico. Recently, during informal consultations, the FWS recommended the agency conduct a study to address this information gap. Produced water including its constituent pollutants is the largest waste stream associated with oil and gas production (Veil et al., 2004; Welch and Rychel, 2004). From 2000-2009, an estimated 489.0-648.2 million bbls of fluids were discharged into the GOM from offshore platforms. The attraction of seabirds to large offshore structures is well documented, so the overlap for potential interactions between seabirds and produced water exists. Clearly, additional information is needed to better understand the interaction between platforms, seabirds, and produced water. This study would provide valuable information for use in NEPA analyses, EPs, DOCs, and would greatly assist the agency in meeting obligations under the Memorandum of Understanding with the FWS (USDOJ, 2009).

**Cost Range:** (in thousands) \$2,710-\$3,523      **Period of Performance:** FY 2014-2017

### **Description:**

**Background:** Pollutants discharged into navigable waters of the U.S. are regulated by the EPA under the Clean Water Act of 1972 and subsequent provisions (33 U.S.C. §1251 et seq.). Specifically, a National Pollutant Discharge Elimination System (NPDES) permit must be obtained from the EPA under Sections 301(h) and 403 (45 FR 65953, Oct. 3, 1980) of the Clean Water Act. The volume of produced water is not constant over time and increases over the life of an individual well (Veil et al., 2004). It has been estimated that U.S. wells produce 7 bbl of produced water for every barrel of oil, and may comprise as much as 98% of the material brought to the surface for wells nearing the end of productivity (Veil et al., 2004). Produced water is comprised of a number of different substances including trace heavy metals, radionuclides, sulfates, treatment chemicals, produced solids and hydrocarbons (see Veil et al., 2004:table 2-1 for complete list of substances and amounts from GOM wells). For produced waters from offshore platforms in the GOM irrespective of Planning Area, the daily and monthly maximum hydrocarbon concentrations are set at 49 mg/L and 29 mg/L, respectively. There remains a fair amount of uncertainty relative to the potential effects of operational discharges on seabirds in the offshore environment, as well as several untested, implicit assumptions (Fraser et al., 2006:152-153). Produced water including its constituent pollutants is the largest waste stream associated with oil and gas production (Veil et al., 2004; Welch and Rychel, 2004). From 2000-2009, an estimated 489.0-648.2 million bbls of fluids were discharged into the GOM from offshore platforms.

The effects and impacts from discharges, i.e., produced water, on avian resources can vary from short- to long term and from sublethal to lethal. This is an impact-producing factor that has previously received limited attention relative to potential effects to birds. There appears to be a number of untested, implicit assumptions related to routine, permitted discharges into the ocean. First, the regulatory limits established by the EPA eliminate or significantly reduce the potential for negative effects to birds. Second, produced water and its constituent pollutants will be diluted simply as a function of the dilution potential of the ocean, eliminating any harm to birds (Fraser et al., 2006:150). Third, oil sheens from produced water, which are poorly monitored, are assumed to do no harm to birds. Fourth, the EPA and BOEM rely on permit-holders to self-monitor and self-report relative to testing, monitoring, and quantifying the volume of produced water, and they are also supposed to report incidents in which oil sheens are observed. As part of the permitting process, hydrocarbon concentrations are monitored, but there are apparently no requirements to remove or monitor volatile organic compounds (VOCs) or semi-volatile organic compounds (SVOCs) as a standardized process within either the best practicable technology or best available technology (see Veil et al., 2004; Welch and Rychel, 2004). Recently, in their review letter of the WPA SEIS (dated 6 June 2011), the FWS recommended a study be funded by BOEM to determine potential effects of produced water on birds.

An assessment of potential impacts from produced water and other permitted discharges (and unpermitted events such as sheens) on seabirds in the vicinities of offshore oil and gas platforms represents one of the biggest knowledge gaps. At the same time, birds injured or killed from these activities represent a form of take under the Migratory Bird Treaty Act, and goes against the requirements, responsibilities, and integrity of the Memorandum of Understanding between the MMS (now BOEM) and the FWS (USDOJ, 2009) signed on 4 June 2009. Clearly, more research is needed to assess the potential impacts of produced waters and oil sheens on birds in the offshore environment (Fraser et al., 2006; O'Hara and Morandin, 2010).

Objectives: The proposed study will: (1) document distribution, abundance, density, and species-composition of seabirds in the vicinity of offshore oil and gas platforms, (2) determine spatial (distance from platform) and temporal (time-of-day and seasonal) variation in these same parameters, (3) determine how these parameters vary with respect to platform characteristics, e.g., size, # of personnel, activity level, distance from nearest platform, distance from shore, etc., and (4) document frequency, size, duration, and other characteristics associated with produced waters and sheens, if available, e.g., does it appear that birds are particularly attracted during discharge events.

Methods: A combination of simultaneous vessel-based and platform-based surveys will be necessary to assess seabird attraction to platforms (Wiese et al., 2001). Observers should be available 7d/week per visit and avian surveys should be conducted each month during a calendar year. In addition, observers should be available for roughly 2-3 month periods during the peak of spring (mid-March to mid-May) and fall (mid-Aug to early Nov) migration periods. This is not a repeat of the study conducted by Russell (2005) as this study more directly addresses questions related to interactions between platforms, discharges, and seabird distribution and abundance. Data obtained from this study will be instrumental in addressing a major information gap identified by the FWS and could result in possible mitigations or stipulations specific to avian resources in the offshore environment. 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. This project will potentially involve the FWS, USGS, several state agencies, and NGOs.

**Revised Date:** May 3, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

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

**BOEM Information Need(s) to be Addressed:** Data on the ambient noise environment in the GOM is extremely limited. Other than some short-term recordings associated with previous studies and recent PAM work done as part of the Natural Resource Damage Assessment for the DWH event, no data exist. BOEM is required to assess potential impacts to protected species, specifically under the MMPA, ESA, and NEPA. Noise impacts to protected species (primarily cetaceans) may occur as a result of our activities (e.g. seismic, decommissioning, drilling, vessel noise, etc.) however characterizing this is difficult without any “baseline” data about the current ambient noise environment in the GOM. A PAM program would provide a relative baseline with which to assess any future activities as well as provide additional information about cetacean presence/absence using vocalizations recorded on the PAM system.

**Cost Range:** (in thousands) \$1,600-\$2,400      **Period of Performance:** FY 2014-2019

### **Description:**

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

Objectives: This project will collect ambient noise data throughout the northern GOM to establish a “baseline” against which to judge potential future noise impacts from BOEM activities as well as characterize the sound budget from other kinds of noise already occurring in the GOM (e.g. shipping, drilling, etc.). The acoustic data will also provide both spatial and temporal information about cetacean species in the GOM (by recording their vocalizations).

Methods: Hydrophones will be deployed, maintained, and redeployed on a regular schedule throughout the GOM. The moored hydrophones will not be monitored in real-time, but rather replaced on a regular basis in order to retrieve the stored data. Deployment and retrieval

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

**Revised Date:** May 3, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** Potential for Interactions between Endangered and Threatened Bat Species with OCS Activities within the Gulf of Mexico

**BOEM Information Need(s) to be Addressed:** Development of offshore energy facilities, oil & gas or renewable, have the potential to impact bat species. Of particular concern is the potential for endangered or threatened species to be impacted by facilities with resultant population impacts. The information will be critical in the decision of placement or operation of these facilities.

**Cost Range:** (in thousands) \$120-\$180

**Period of Performance:** FY 2014-2016

### **Description:**

Background: On August 8, 2005, President Bush signed into law the Energy Policy Act of 2005 (EPAct). EPAct amended the OCS Lands Act to grant the Secretary of the Department of the Interior discretionary authority to issue leases, easements, or rights-of-way for previously unauthorized activities that: (i) produce or support production, transportation, or transmission of energy from sources other than oil and gas; or (ii) use, for energy-related or other authorized marine related purposes, facilities currently or previously used for activities authorized under the OCS Lands Act.

Of key concern is the potential for offshore facilities to impact endangered, threatened, or candidate species of bats that migrate within and along the Gulf of Mexico. White-nose syndrome, the disease that has killed millions of bats in eastern North America, has been confirmed in bats in Jackson County, Alabama. This disease is expanding and could further affect bat species in the GOMR.

This literature synthesis and associated baseline data will help in understanding these communities and in predicting how they will be able to respond to potential and existing OCS development. Any evaluation will need to address several key questions. First, do the bats actually fly offshore where they may be at risk or not. If they potentially do, could various weather conditions alter that risk? If there is a potential for bat strikes, an evaluation of the impacts of mortality on the population will need to be assessed as well as possible mitigations to lessen mortalities in the GOM.

Objectives: The objective of the study is to determine whether endangered, threatened, candidate or any species of bats are at risk from OCS facilities in the entire GOM.

Methods: The research will include evaluation of existing GOM data to determine key locations of the bat species of interest and potential areas of high use where risk may be increased. The data search and synthesis will be a comprehensive search and integration of existing environmental information for the region. Literature searches shall be conducted to identify,

acquire, review, and annotate all environmental literature (published and unpublished) for the entire GOM. Information acquisition shall be conducted through computer searches, telephone contacts, library visits, personal contacts, and other means as necessary. This shall be submitted as annotated references. Metadata for each geo-referenced data set shall be submitted. Period of performance is expected to be 24 months, with a deliverable report after 18 months.

**Revised Date:** May 3, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Central

**Title:** Public Outreach through Development of Web-based, Animated, and Interactive 3D Modeling of Archaeological Shipwreck Sites on the Gulf of Mexico OCS

**BOEM Information Need(s) to be Addressed:** Since 2010, both former Director Michael Bromwich and current Director Tommy Beaudreau have emphasized BOEM's renewed commitment to scientific research as an integral component of the agency's regulatory responsibilities towards oil and gas activities on the OCS. An aspect of BOEM-funded scientific research that has historically been overlooked or underfunded, however, is the presentation of completed research to the general public in a manner that is engaging and easily accessible. This study will provide BOEM with an addition to the agency's website that allows users to interactively view 3D animations of documented OCS archaeological shipwreck sites as they currently exist on the seafloor. This product will have the benefit of efficiently and creatively presenting extensive BOEM funded historical and archaeological research through historically accurate imagery of significant shipwreck sites. Through a combination of the agency website and public presentations this tool can be utilized by a wide range of the public including the scientific community, the sport diving community, industry representatives, interested laypersons, social media users, and classroom students.

**Cost Range:** (in thousands): \$80-\$120

**Period of Performance:** FY 2014-2016

### **Description:**

Background: In the past decade the GOMR Environmental Studies Program has funded numerous completed or ongoing studies that have discovered, identified, and documented historically and archaeologically significant shipwrecks including: nineteenth century merchant sailing vessels; a Civil War gunboat; a World War II German U-boat; several World War II American tanker casualties sunk by U-boats; a Spanish-American War-through-World War I-era U.S. Navy gunboat; and a possible War of 1812-era privateer. These sites range in water depth from less than 100 ft to over 4,000 ft. A single study of seven World War II shipwrecks also included an analysis of biological communities that have colonized and are currently utilizing these sites. Though the scientific reports resulting from these studies are available to the public, these documents are necessarily technical and targeted primarily to the professional archaeological and scientific communities. To date there has been little effort to synthesize the studies in a manner that effectively illustrates to the general public the significant scientific knowledge that was gained as a result, or why and how this knowledge benefits the public interest at large.

A by-product of these studies has been the acquisition of vast amounts of remote-sensing data, ROV imagery, ship construction plans, and measured archaeological site drawings. It is often impractical to include the majority of this data in the technical reports, and what imagery is

presented is limited to static two-dimensional images on the printed page. Recently, web-design contractors have begun to utilize these same sources of dimensionally-accurate data to create immersive 3D visualizations of shipwreck sites. These web-based visualizations can range from relatively simple pre-defined guided tours to more advanced applications built on video-gaming engines, which allow users to interactively simulate their own self-guided diver or ROV investigation of a modeled shipwreck site. Ideally, signposts linking to additional photographs, videos, or historical/ archaeological/biological information may also be embedded within the 3D model. This technology could be an important outreach component of future archaeological studies, and may further serve as an analytical tool for archaeologists and other scientists, particularly for any studies involving long-term monitoring of site formation processes. However, a benefit of the current study proposal is that it will create a tangible public outreach tool using data that is already collected and analyzed from previously completed studies, thus saving BOEM the time and expense of funding and conducting an as-yet undefined future archaeology study before such a product is possible.

Other Federal managers of marine resources, particularly at NOAA's Thunder Bay National Marine Sanctuary, have successfully used similar technology for the explicit goals of public outreach and education. This study seeks to replicate those goals and results.

Objectives: The objective of this study is to provide a public outreach and educational component that has been previously lacking from BOEM environmental studies. By creating interactive, web-based 3D shipwreck models, BOEM will have the ability to visually disseminate large amounts of scientific information to the public through a variety of pathways, including the agency website, conference presentations, and classroom lectures. This study will utilize existing data sets to create shipwreck visualizations of completed study results, and will further serve as a technological template for public outreach efforts on future studies.

Methods: This study will first identify a list of known shipwreck sites that have significant amounts of measureable data previously collected during completed or ongoing studies, and are optimal for accurate 3D modeling. These data will include, but not be limited to, remote-sensing data, photo and video imagery, construction plans, and site drawings. In instances where these types of imagery are known to exist but were not previously acquired, additional archival research trips will be necessary. The relevant information from these data will then be synthesized into a software application to create interactive 3D visualizations that simulate the current underwater structural and environmental conditions at each shipwreck site. In addition to simulated visualizations, these models will include embedded photographic and video imagery of significant features, as well as text blocks describing the historical and archaeological significance of the sites. Finally, these interactive models will be incorporated into the BOEM website and adapted as necessary for use in other public outreach venues.

**Revised Date:** May 3, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** Social Impacts of the *Deepwater Horizon* Oil Spill on Coastal Communities Along the U.S. Gulf of Mexico (Phase II)

**BOEM Information Need(s) Addressed:** This study will enhance our understanding of possible socioeconomic effects of potential oil spills that may occur due to OCS-related oil and gas activities. Large spills are uncommon in U.S. waters and each spill's environmental and socioeconomic consequences are largely determined by its characteristics, those of the environment in which it occurs, and those of the societies it affects. Hence, the impacts of one are poor predictors of the next. Recognizing the importance of capturing this event as it unfolded, within weeks of the event BOEM initiated a systematic effort to document and assess local-level effects of the spill and its aftermath first, by modifying an ongoing study, *Ethnic Groups and Enclaves Affected by OCS Activities* (GM-08-05), and then by funding research to follow spill effects over time. This is the second and final phase of this longer-term effort to document and analyze local/regional effects of the DWH on the people and communities in Gulf coastal areas. Study results detail wide ranging and variable mid- and long-term effects from the spill and subsequent response across a number of communities and enterprises. GOMR environmental assessments must analyze the possible socioeconomic effects of potential oil spills that may occur due to OCS-related oil and gas activity. The information provided by this study will be the primary source supporting this analysis. This information will also be invaluable in planning oil spill responses in the future.

**Cost Range:** (in thousands) \$250-\$370

**Period of Performance:** FY 2014-2016

### **Description:**

**Background:** The DWH oil spill occurred in Mississippi Canyon Block 252, the Macondo prospect, which is located at a depth of 4,993 feet. A blowout, explosion, and fire occurred on April 20, 2010. One hundred and fifteen workers were rescued from this disaster; eleven were lost. The DWH is a watershed event; while the spill has socioeconomic impacts, many more arise afterwards and in a much longer timeframe as consequences of cleanup and mitigation efforts and, then, as changes resulting from the spill in how coastal industries (e.g., fisheries, offshore oil, and tourism), States, communities, and families operate. For example, closures immediately impacted commercial fishing operations and communities and families dependent on them; the "midterm" impacts of the damage compensation process were less immediate but no less consequential; finally, the spill's longer-term socioeconomic impacts due to changes in capitalization, organization, and participation within the industry and distribution systems may be the most significant but are still unfolding. The same holds for the offshore oil industry; beyond the impacts of yesterday and today, the DWH continues to affect how it operates in the Gulf, how it is regulated and taxed, how it hires, and how it is viewed by coastal peoples long associated with it and by the general public. Since the livelihood of many Gulf Coast families depends on a mix of commercial fishing and petroleum industry jobs, they and their communities

are doubly exposed to DWH consequences. In sum, the spill's immediate and midterm impacts morph into longer-term consequences to commercial and recreational fisheries, land values, tourism, and other commercial and recreational uses of the Gulf's coast, waterways, and wetlands and to the ways of life of people dependent on them. Directly or indirectly, the spill will affect the economies, fiscal systems, and public services of communities and coastal states.

Objectives: The overall objective is to enhance the state of BOEM's knowledge of direct and indirect socioeconomic consequences of the DWH in the GOMR.

Methods: This effort would be the second and final follow-up study for the DWH component of the study, *Ethnic Groups and Enclaves Affected by OCS Activities*. The first of these follow-ups is planned to begin in late FY2012 and to end in early FY2014. This second follow-up will be launched only if the preceding research indicates that it is warranted by a continuing unfolding of DWH effects, and if it is launched, its research design will be based on current knowledge of the socioeconomic consequences of the DWH. This effort, like the earlier ones, will describe and analyze DWH socioeconomic effects with sufficient detail to address the spill's differential impacts on households, communities, and regions, with sufficient breadth to address the range of human endeavors and institutions that were affected and the range of effects as they unfold over time, and with sufficient evidence, documentation and care to serve as a reliable source of information and analysis in support BOEM assessment and decisionmaking, the of other Federal and State institutions and, more broadly, the general understanding of these uncommon and troubling events. As with the previous efforts, this one would employ a multi-method approach built on iterative interactions between and applied anthropological fieldwork team and applied demographic research team. This mix would be supplemented with the ongoing sharing of information and findings with other BOEM-supported research efforts. Due to the evolving nature of DWH socioeconomic effects and Agency needs for timely information and analysis, the research effort is divided into phases, each with a report deliverable.

**Revised Date:** May 3, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Gulf of Mexico

**Planning Area(s):** Central and Western

**Title:** Subsistence Activities and Use in Coastal and Near Coastal Areas of the Gulf of Mexico

**BOEM Information Need(s) to be Addressed:** The information and analyses provided by this research will support BOEM assessment and decisionmaking. The collection of information on subsistence behavior in coastal Louisiana is highly relevant to the agency's mission, particularly in the aftermath of the DWH oil spill. The commercial and domestic use of wild resources is a significant aspect of the area's economy and social system, and the interaction between subsistence activities and the petroleum industry's use of this environment has long been seen as unique and mostly positive. Very little is known about the subsistence portion of wild resource use on the Gulf Coast and documenting it will substantially improve BOEM's baseline descriptions and analyses. The aftermath the DWH incident has underscored the importance of subsistence to BOEM assessments of socioeconomic impacts and of environmental justice.

**Cost Range:** (in thousands) \$290-\$440

**Period of Performance:** FY 2014-2015

### **Description:**

Background: In northern North America, certain harvests and uses of wild resources are defined legally as subsistence. There, and in many rural areas of the world, economists, social scientists and others analyze certain harvests and uses of agricultural and wild products as subsistence. In coastal and near coastal areas of the GOM, certain practices important to people's lives and diets clearly fit this concept of subsistence. For example, wild foods—most notably, shrimp, fish and oysters—are unusually important people's diets; and they are harvested locally by people who view harvesting as their way of life; and, while much of this product goes to market, much is also distributed among local households in ways other than by buying and selling. For some households, such resources are an indispensable part of the family budget, a substitute for adequate income but for all these are preferred foods and their contribution to the overall quality of life of coastal residents is great. As elsewhere, GOM subsistence overlaps economic and social domains, on one side addressing the dietary needs of households and linking them in certain ways to the market economy and, on the other, expressing relationships among members of the family and community, values regarding human relationships, ways of life, the environment, the community, and the church. In all these things, subsistence is local, an expression of a specific place and people, an expression that is always looking to the past but moving into the future.

The presence of Gulf Coast subsistence is widely acknowledged but its characteristics are poorly documented. Everyone knows that many of these households consume large quantities of shrimp, fish and oysters, but no one is clear about how much is typical, or how much of the harvest is marketed and how much distributed locally in other ways, or the how and why of these other distributions. Its importance and the lack of information were both underscored by the

DWH oil spill. Damages were claimed for the loss of access to harvest wild foods but also for loss of wild foods normally received from others. Concerns about seafood safety grew because local consumption far exceeded the “normal” amounts assumed by the EPA in its determination that contaminant levels were safe.

The DWH spill heightened awareness generally about the importance of the area’s subsistence. For BOEM and its assessment of possible consequences of the OCS leasing program, this included an awareness of the need of more information on—and more understanding of—subsistence activities and uses in coastal and near coastal areas of the Gulf. In the face of the dearth of publically available information, BOEM and LSU launched “Subsistence in Coastal Louisiana: An exploratory study” to clarify issues to be addressed and approaches to them that might be productive. This study builds on the earlier effort.

Objectives: This study aims to understand the full range of substance activities in the Gulf of Mexico and its role in the social and economic lives of Gulf coast residents.

Methods: This study will describe the full 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, and the study will describe key dynamics in the overlapping activities of commercial harvesting, household consumption, gift exchange, barter, and small-scale informal sales from the harvest. To accomplish the study objectives, the research team will conduct literature review and synthesis of published works, grey literature and government reports, collect and synthesize formal expertise on Gulf subsistence from such sources as city, parish and state officials (including, for example, field and area officials with the Louisiana Department of Wildlife and Fisheries, and the local sheriffs’ offices who enforce limits on wild harvesting), regional ethnographers working on National Park Service-funded projects, and researchers in other fields whose work touches on wild harvesting, including biologists working at Sea Grant, LUMCON, and at Nicholls State University. The team will collect subsistence information from coastal residents using a community partnership approach and that employs such methods as focus groups and participant observation as well as ones such as collecting food diaries, freezer and pantry inventories, and hunting/fishing journals. The team will identify and develop case studies (such as households, individual life histories or work groups) that illustrate the range of subsistence activities, the dynamics between these and overlapping activities, and the role subsistence activities play in defining personal identity, relationships to the environment, kin, work and community. The team will design, and then administer to samples or defined subsets of subsistence producers or consumers, of one or more instruments to collect systematic information and data on subsistence activities, participation and production.

**Revised Date:** May 3, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Gulf of Mexico

**Planning Area(s):** Gulfwide

**Title:** Testing Chang and Oey's (2011) Gulf of Mexico Oscillator Hypothesis: A Field Program

**BOEM Information Need(s) to be Addressed:** The results of the study should help improve performance of numerical models of GOM circulation that in turn should lead to enhanced environmental assessment and spill risk analyses.

**Cost Range:** (in thousands) \$720-\$1,000      **Period of Performance:** FY 2014-2017

### **Description:**

Background: Many gaps still remain in our understanding of the GOM circulation. However, some recent advances from one of BOEM's studies were published in the peer-reviewed literature (Chang and Oey, 2010a,b; Chang and Oey, 2011). In the latter article, the authors proposed the idea that the Gulf's thermocline oscillates like a low frequency (time scales of 11 months) see-saw along an east-west line across the GOM in response to the Loop Current intrusions and an east-west mass transport across the 90°W longitude. Testing this hypothesis is important because it can shed light on the Loop Current intrusion and eddy shedding problems. Any advance on this front will have great repercussion on our understanding of the Gulf circulation and our ability to employ numerical circulation models to forecast the circulation.

Objective: The goal is to test the Gulf of Mexico Oscillator hypothesis of Chang and Oey (2011) by measuring the thermocline depth and correlating this with the zonal mass transport at 90°W below the thermocline.

Methods: This study will conduct analyses of existing data and other models to find preliminary evidence corroborating the Gulf's oscillatory hypothesis advanced recently in the scientific literature. Also, plans to deploy an array of pressure inverted eco-sounders and other needed instruments consisting of two orthogonal transects should be put forward. The east-west transect will run across the Gulf but confined to depths  $\geq 2,500$  m located initially along  $\approx$  latitude 27°N. The north-south transect will span the Gulf within water depths  $\geq 2,500$  m at 90°W. Because of our interest in low frequency processes, the array will be deployed for at least two oscillation cycles or  $\sim 24$  months. The final products will include Deep Gulf mass transport information and manuscripts for peer-review journals. Every effort will be made to leverage this effort with other Agencies interested in this experiment.

**Revised Date:** May 3, 2012





## **SECTION 3 TOPICAL AREAS FOR FY 2015 AND BEYOND**

The GOMR is expecting a continuation of offshore oil and gas activities; however, future activities in the Atlantic region are uncertain. With a new Administration and a draft proposed plan under review, 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**

Deepwater habitats including the mid-water pelagic realm are the least understood marine environments of the GOM. Three major deepwater studies are ongoing to broaden our limited knowledge base of deepwater benthic ecology. The results from these studies will lead to new areas for further investigation.

Recent congressional mandates require BOEM to lease areas in the GOM within 125 miles (200 km) of Florida. As oil and gas activities move closer to the west coast of Florida, BOEM will need to further investigate habitats along the West Florida Escarpment. In addition, ecosystems east of the escarpment, such as seagrass in Federal waters (up to 70 mi (110 km) offshore), low relief live bottoms, and topographic features (Sticky Mounds, Madison-Swanson, Steamboat Lumps, etc) will warrant future assessment.

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 wrecks with biological characterization of the organisms that have colonized them. A new study, proposed as an interagency agreement, 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 National Historic Preservation Act.

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 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 Gulf of Mexico 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**

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. 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 1980s, 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 through 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 Gulf of Mexico? 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 study, *Literature Synthesis for North and Central Atlantic*, was completed and is awaiting publication. Additionally, we have three ongoing studies: *South Atlantic Information Resources: Data Search and Literature Synthesis*; *EcoSpatial Information Database – U.S. Atlantic Region*; and *Mid-Atlantic Ocean Model Calculations*, all to be completed in 2012. 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. Much BOEM research taking this wider view was addressing industry responses to the falling and low oil prices of the 1980s-1990s. Given the pace of change in the industry and energy markets, as well as the new emphasis on energy security, this research may need updating.

The GOMR will continue efforts to define, describe, and measure OCS industry sectors that drive its onshore impacts. A study of the fabrication industry and port communities is near completion. BOEM needs fuller analyses of other sectors including the service boat, drilling, pipe-coating, pipe-laying, and workover industries. Complexity and changeability make these efforts iterative. Service ports are vectors for many industry impacts but have proven particularly difficult to address. Currently, BOEM is engaged in limited efforts to address this issue, but efforts include the annual purchase and analysis of GOM vessel movement data.

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. Past CMI studies have refined these aggregations to better reflect onshore industry distributions and activities. Much ongoing and planned efforts aim at analyzing the regional economies of the new areas and their linkages to the OCS industry. This effort will provide stronger support to BOEM economic modeling and SIA. This effort 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; this effort is planned to continue. 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 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 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 2013-2015  
Studies Development Plan  
Pacific OCS Region**

**U.S. Department of the Interior  
Bureau of Ocean Energy Management  
Pacific OCS Region  
Camarillo, CA  
2012**



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## ACRONYMS

AFB	Air Force Base
BAA	Broad Agency Announcement
BBLS	Barrels of Oil
BOEM	Bureau of Ocean Energy Management
CARE	California Artificial Reef Enhancement Program
CF	Cubic Feet of Gas
CFR	Code of Federal Regulations
DBMS	Database Management System
DOI	Department of the Interior
EIS	Environmental Impact Statement
EO	Executive Order
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
ESP	Environmental Studies Program (National Program)
FERC	Federal Energy Regulatory Commission
FY	Fiscal Year
GGARCH	Geophysical, Geological and Archaeological Guidelines
GIS	Geographic Information Systems
GLS	Global Location Service
GNOME	General NOAA Oil Modeling Environment
GPS	Global Positioning System
HECO	Hawaii Electric Energy Company
HIREP	Hawaii Interisland Renewable Energy Program
LNG	Liquefied Natural Gas
MHI	Main Hawaiian Islands
MMS	Minerals Management Service
MS	Microsoft
MW	Megawatt
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIS	Non-indigenous Species
NNMREC	Northwest National Marine Renewable Energy Center
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service

NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NSL	National Studies List
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OWET	Oregon Wave Energy Trust
PAH	Polycyclic Aromatic Hydrocarbon
POCSR	Pacific Outer Continental Shelf Region
SCCWRP	Southern California Coastal Water Research Project
SPUE	Sightings per Unit Effort
SST	Sea Surface Temperature
UHF	Ultra High Frequency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

## **SECTION 1.0 PROGRAMMATIC OVERVIEW**

### **1.1 Introduction to the Region**

The Environmental Studies Program (ESP) in the Pacific Outer Continental Shelf (OCS) Region (POCSR) started in 1973. The Program has evolved with change in the geographic areas of concern and study, in the emphasis of disciplines highlighted for research, with change in the status of the Region from a frontier to a mature oil and gas producing area (from prelease to postlease emphasis) and with change to a frontier area for renewable energy production. The Pacific OCS Region's responsibility now encompasses on-going oil and gas operations and potential renewable energy development utilizing both wave energy conversion and wind turbine generation in deepwater. The area of importance for the Pacific OCS Regions stretches from the United States-Mexico border to the U.S. border with Canada and extends westward to include the State of Hawaii. The Pacific ESP is evolving and expanding our area of study along with our new responsibilities for the OCS renewable energy program, and finally, with formation of Renewable Energy OCS Task Forces with the states of Oregon and Hawaii.

For the Fiscal Year 2013-2015 Study Development Plan, the Pacific Region reached out to over 30 major stakeholders for input. They included federal and state agencies and Tribal governments. The POCSR received 12 study ideas from external sources including the National Oceanic and Atmospheric Administration (NOAA), United States Geological Survey (USGS), National Park Service (NPS) and the states of Oregon, California and Hawaii. Several of these ideas formed the basis for study profiles included 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 over 24 million barrels (bbls) of oil and 47 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 plan reflects the Bureau of Ocean Energy Management (BOEM) Pacific OCS Region's need to continue to study environmental effects from on-going oil and gas production operations. The OCS activities section of this report discusses some of the projects occurring on producing leases.

This plan also explains the urgent need for information to regulate future renewable energy projects that may be proposed and implemented in the Pacific OCS 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 all along the Pacific Coast and offshore Hawaii. The interest for renewable energy along the Pacific is focused on wave energy conversion 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 the Pacific Region has received proposals for floating deepwater wind off Hawaii. Both states have expressed interest for offshore research leases. However interest for siting renewable energy is rapidly 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 platforms continue to be discussed. As the Region has matured, and as developed oil and gas field production has peaked and entered declines, new and innovative ideas for the use of traditional oil and gas platforms have emerged. For example, an international company is exploring options for the development of a grid-connected technology testing facility (“National Wave Energy Testing Center”) on the OCS close to Platform Irene offshore Central California. 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 OCS Region. It applies to the entire Region, which stretches from the United States-Mexico border to the U.S. border with Canada and extends westward to encompass the State of Hawaii.

For renewable energy studies, this plan focuses on all Pacific OCS Planning Areas offshore Washington, Oregon and California, and includes the Hawaii OCS that might experience renewable energy projects. Studies related to oil and gas in the Southern California Planning Area support decisions for activities on existing producing leases.

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

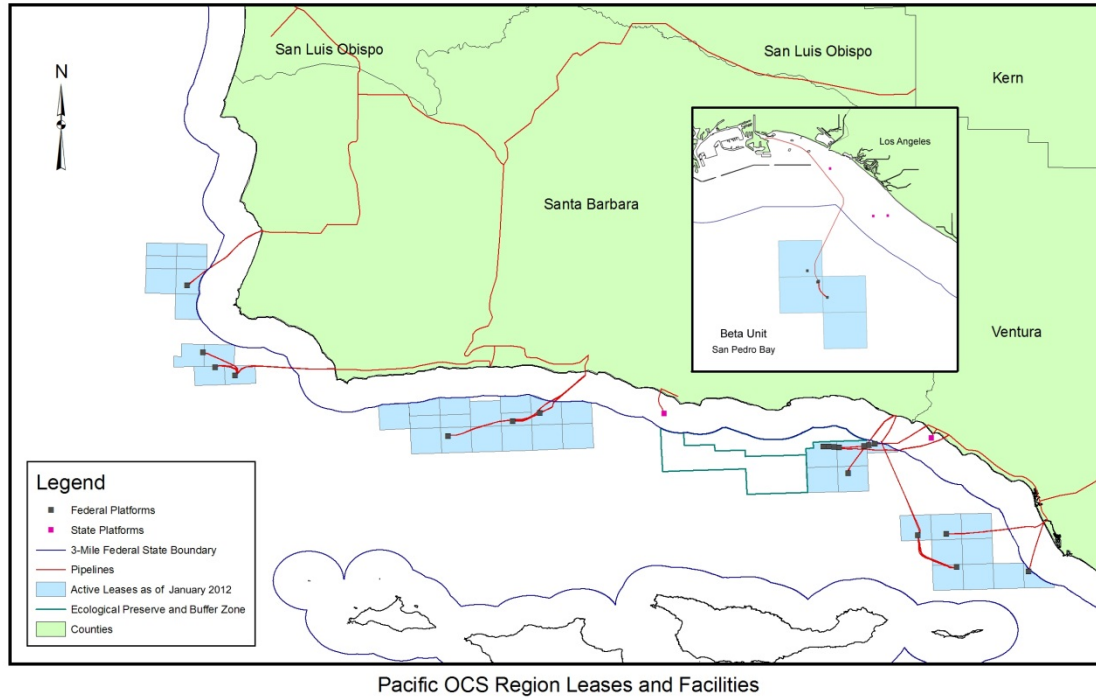
- The study provides significant new or additional information beyond what is already known.
- The identified study is within the time frames of the Offshore Program.
- The information provides insight into significant processes critical for understanding both natural and anthropogenic changes.
- The 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 OCS 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, Pacific OCS Region, at (805) 389-7820. You can also view the BOEM and Pacific OCS Region home pages at [www.boem.gov](http://www.boem.gov) and <http://www.boem.gov/About-BOEM/BOEM-Regions/Pacific-Region/Index.aspx>, respectively, for additional information.

## 1.2 Maps of the Pacific OCS Region—Active Leases and Resource Potential for Renewable Energy

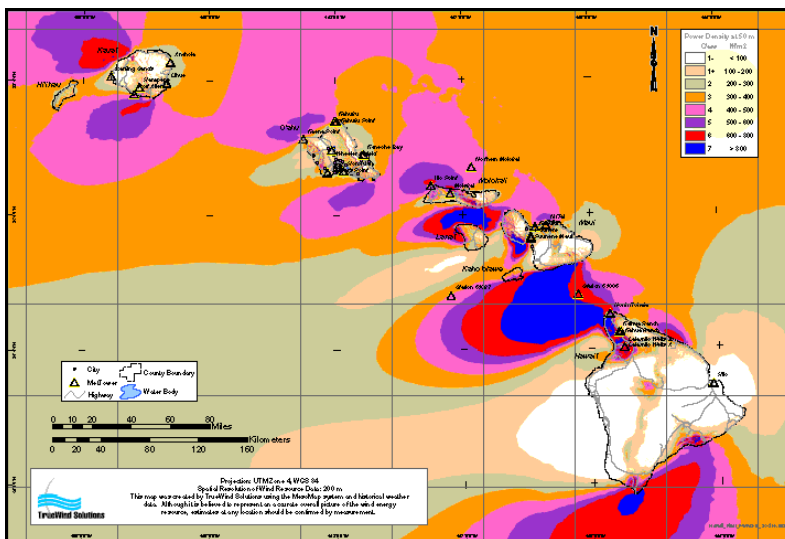
**Figure 1.** Active Oil and Gas Leases in Southern California



**Figure 2.** Resource Potential for Renewable Energy from Wave Power



**Figure 3. Resource Potential for Renewable Energy from Wind Power**



### **1.3 Projected OCS Activities**

The BOEM Environmental Studies Program supports BOEM decisions associated with leasing, exploration and development of oil and natural gas, marine minerals and renewable energy. Often, studies serves needs associated with all three programs.

#### **Renewable Energy Activities and Alternate Use of OCS Facilities**

The BOEM was delegated responsibility for implementing an OCS renewable energy program with the passage of the Energy Policy Act of 2005. Alternative use of existing OCS facilities is also authorized by this Act. Regulations implementing the Act were published in April 2009, and prospective developers of offshore deepwater wind and wave energy conversion devices have started to develop project proposals 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 Years 2011 and 2012.

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 will support and enhance 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. Secretary Salazar accepted the request on December 30, 2010. The Pacific Region finalized a charter outlining the purpose, membership and planned functions of the task force. Task Force meetings were held in March and August of 2011 and on April 12, 2012, in Portland, OR.

The BOEM Oregon Renewable Energy Task Force immediate focus is to discuss available information about energy and environmental resources and identify areas on the OCS with high renewable energy value and low use conflicts. The State of Oregon requested that BOEM hold a scientific marine renewable energy conference in 2012. The region is considering the meeting for November 2012 at Oregon State University in Corvallis. The Northwest National Marine Renewable Energy Center (NNMREC) at Oregon State University prepared a feasibility/suitability study for a grid-connected deepwater wave test facility offshore Oregon. The NNMREC has formed a consortium with Oregon Wave Energy Trust (OWET) and the National Renewable Energy Laboratory (NREL). Most of the sites under consideration are located on the OCS. The NNMREC completed the study in December 2011. The study indicates that all four sites under investigation are technically feasible for a wave energy test facility. The NNMREC began coastal community outreach in January 2012 in the vicinity of the four sites to assist their site selection process. An international company is conducting a feasibility study for a wave energy project offshore Camp Rilea (Warrenton, Oregon). The company feasibility study is expected to be completed by summer 2012. The potential project would support OCS wave energy devices that would



transmit up to 1-2 megawatts (MW) of electricity for use at Camp Rilea, an Armed Forces training facility maintained by the Oregon National Guard with U.S. Army involvement.

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. Secretary Salazar accepted the request on July 1, 2011. The Pacific Region has reached agreement with Hawaii on the draft charter, task force membership and planned functions of the task force. The first Task Force meeting was held on March 7, 2012, in Honolulu, HI.

Research leases are expected to be a significant focus of the initial BOEM-Hawaii Renewable Energy Task Force discussions. 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. The HECO is seeking proposals for an inter-island transmission cable system, interconnection facilities and other power transmission infrastructure to deliver power to Oahu. A Right-of-Way is required from BOEM for any portions of the cable in OCS waters outside of National Marine Sanctuaries. The BOEM is a Cooperating Agency in developing a programmatic environmental impact statement (EIS) for the "Hawaii Interisland Renewable Energy Program (HIREP): Wind" that includes analysis of a potential OCS subsea power cable for inter-island energy transmission. The HECO's draft request for renewable energy proposals is targeted was issued in March 2012 and specified that projects deliver renewable energy to the Oahu grid by the end of 2018. The BOEM Pacific Region received a draft unsolicited request for an OCS wind lease for a 400 MW floating wind project offshore Oahu on April 27, 2011. The Region provided review comments and met with the company. The company also met with Hawaii State official and is revising their request. A separate company informed the Pacific Region in January 2012 that they plan to file a formal request for an OCS commercial wind lease for a 400 MW offshore wind project offshore Oahu in the near future.

Offshore California, an international company is exploring options for the development of a grid-connected technology testing facility ("National Wave Energy Testing Center") on the OCS in the vicinity of federal Platform Irene offshore Central California. The company is coordinating with Sandia National Laboratories, Department of Energy, Department of Defense – Vandenberg Air Force Base (AFB), the Federal Energy Regulatory Commission (FERC), California Lt. Governor Gavin Newsom, the Electric Power Research Institute (EPRI) and the platform operator, Plains Exploration and Production, to develop a proposal. A meeting was held with the company, BOEM, Vandenberg AFB, Office of California Lt. Governor, the National Renewable Energy Laboratory and Sandia Laboratories on January 25, 2012, to discuss research lease requirements. A separate company has submitted an application for a wave project to FERC for a preliminary permit and intends to submit an OCS lease request. The project is proposed for 1 to 3.5 miles offshore Morro Bay, California (Central California). The City and County of San Francisco informed the Pacific Region on December 9, 2010, that they will submit a request for an OCS wave energy lease offshore San Francisco. 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 planning the

project and a preliminary technical design study is underway. They have a goal to generate 100 percent of the City's electricity from renewable sources by 2020.

## **Oil and Natural Gas**

Typically, the OCS oil and gas management program is addressed as prelease and postlease. Prelease activities include development of a 5-year program in which oil and gas lease sales are scheduled. The Pacific Region has not been included in a 5-Year Oil and Natural Gas Leasing Program since 1987 as a result of repeated moratoria. 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 OCS Region was not included for leasing in the Preliminary Revised Program for 2012-2017, which was announced by the President and the Secretary on March 31, 2010.

Postlease oil and gas activities are those associated with the development of the 43 producing leases in the Southern California Planning Area. Currently, 23 Federal oil and gas platforms produce over 24 million bbls of oil and 47 billion cf of natural gas per year. This rate could be sustained for the next several years, as Federal lessees continue to focus on the recovery of approximately 400 million barrels of oil in proven reserves. Studies identified in this regional plan highlight information gaps and are geared to allow BOEM to conduct analyses that support the BOEM mission of environmental review of new 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 and certainly eventual decommissioning 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.

## **Marine Minerals Other than Oil and Gas**

Opportunities to explore for and develop OCS mineral resources other than oil and gas become increasingly attractive to developers as economic conditions improve. In the future, there may be a need to collect and analyze information in support of potential leasing and development of a marine mining program on the Pacific OCS.

## 1.4 Identification of Information Needs

**The main areas of information needs for Fiscal Year (FY) 2013-2015 fall into the following categories and support potential renewable energy leasing and/or existing oil and gas production activities:**

### Social and Economic Sciences for Renewable Energy Leasing:

With increasing interest in renewable energy resource development, particularly in areas outside the geographic extent developed for oil and gas, additional information needs will have to be addressed. An inventory and analysis of submerged cultural resources is on-going for the Pacific coast. The study “Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence near the Main Hawaiian Islands” focuses on the State of Hawaii where there is pressing interest in floating deepwater wind power installations off the islands of Oahu and Hawaii. The purpose of this study is to provide baseline information on submerged and terrestrial archaeological resources and traditional cultural properties. This information will be needed for environmental assessment and mitigation of potential adverse effects to these resources. This is required under Section 106 of the National Historic Preservation Act and Executive Order 11593, which require that Federal agencies must apply the National Register Criteria to properties that may be affected by an undertaking.

### Biology and Habitat and Ecology for Renewable Energy Leasing and Existing Oil and Gas Production Activities:

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 U.S. 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 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.

Presently, there is increasing interest in research leases and commercial-scale projects offshore of Hawaii. Currently there is a lack of quantitative information that links distribution, movements and behaviors among seabirds with physical habitats in waters surrounding the main Hawaiian Islands. More information is needed by BOEM to evaluate potential environmental effects to seabirds and their oceanic habitats caused by installation of

new alternative energy infrastructure (i.e., hydrokinetic and wind-energy structures) within OCS waters off Hawaii. A recently approved FY12 Study Plan seeks to establish a ‘*Seabird Vulnerability Index*’ based on observations of seabirds at sea recorded from ships and archived in extensive historic databases. These data primarily are focused on the California Current and Eastern Tropical Pacific, and include much less information regarding seabirds in OCS waters off Hawaii. The USGS is currently acquiring behavioral data from seabirds in Hawaii and the California Current using sophisticated telemetry techniques that enable measurements of flight behaviors associated with ranging patterns, wind speed/direction and sea-state. Furthermore, USGS and collaborators have generated predictive models of fine-scale wind and wave fields for waters surrounding the main Hawaiian Islands. The study “Habitat Affinities and at-sea Ranging Behaviors among Main Hawaiian Island Seabirds” will provide additional detailed information linking abundant Hawaiian breeding seabirds with coastal and offshore habitat utilization surrounding the main Hawaiian Islands.

For the Southern California Planning Area, BOEM is responsible for plans involving ongoing operations and decommissioning of oil and gas facilities as well as future planning for renewable energy leasing. The BOEM’s planning efforts need to utilize information within the entire Southern California Planning Area for effective ecosystem management of seafloor fishes and invertebrates. Seafloor fish and invertebrate species form particular aggregations or communities that are known to indicate the relative health of an area. These aggregations change spatially and temporally with natural shifts in the environment and so geospatial integration of the entire region is necessary to understand how the aggregations near disturbed areas compare with undisturbed habitats. The BOEM does not have current information on seafloor communities and species abundances in the vicinity of existing Federal Platforms in the Pacific OCS because BOEM has not conducted or participated in ongoing southern California regional benthic assessments for over twenty years. However, this information is currently needed for environmental analysis of ongoing oil and gas operations. The study “Platform Impacts on Seafloor Communities in the Southern California Planning Area” will provide BOEM an understanding of the relative health of the seafloor communities near offshore oil and gas platforms at a regional scale, which is also useful to BOEM in light of future planning for global climate change, decommissioning and renewable energy leasing.

#### Interdisciplinary for Renewable Energy Leasing:

There are currently no marine renewable energy arrays operating on a commercial scale in United States waters. This compromises the ability to understand, predict, manage and mitigate potential impacts of proposed marine renewable energy projects. To perform timely environmental review, data from ongoing projects and activities (surrogates) with stressors and receptors similar to those expected from marine renewable energy projects can be analyzed to reduce the uncertainty in the range of outcomes and intensity of environmental consequences. The purpose of the study “Using On-going Activities as Surrogates to Predict Potential Ecological Impacts from Marine Renewable Energy” is to identify and analyze available data from ongoing projects or activities (surrogates) with stressors and receptors similar to those expected from marine renewable energy projects. Examples of unanalyzed data for stressor-receptor pairs that are known to exist and may be particularly useful to analyze from surrogates include (1) effects of electromagnetic fields from operating power

cables as impediments on migration of marine mammals and anadromous fishes (salmonids and green sturgeon) and (2) mooring configurations of offshore aquaculture facilities and oceanographic buoys as entanglement hazards for marine mammals. The BOEM will use results from this study for impact assessments contained within NEPA documents, and also in consultations required by the Endangered Species Act and the 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act.

#### Fates and Effects for Existing Oil and Gas Production Activities:

Artificial substrate in the marine environment may facilitate the establishment and spread of non-indigenous species (NIS) by providing novel habitats where native species fail to have a competitive advantage over recent arrivals. Some of these NIS may subsequently invade natural habitats and displace or change native biological communities. The BOEM requires information to elucidate the role that offshore platforms may have in affecting biological communities and to comply with the duties of Federal agencies that are outlined in Section 2 of Executive Order 13112 (Invasive Species). The purpose of the study “Understanding the Role of Offshore Structures in Managing Potential *Watersipora subtorquata* Invasions” is to describe the distribution, abundance and life history of the bryozoan *Watersipora subtorquata*, which is a NIS known to exist on offshore oil and gas platforms and has the potential to become invasive and affect native biological communities. Using these ecological data, this study will assess the effectiveness of potential mitigation measures to prevent further colonization on uninhabited substrate. The BOEM will use study results for environmental reviews concerning ongoing operations and decommissioning alternatives of offshore oil and gas platforms and potential marine renewable energy facilities.

#### Physical Oceanography for Renewable Energy Leasing and Existing Oil and Gas Production Activities:

To perform environmental analyses, BOEM requires information about the sensitivity and resilience of biological habitats to disturbance. Because little is known about how activities related to wave energy conversion devices on the outer continental shelf might affect nearshore habitats, numerous scientific reviews rank this information gap as a priority for future research. Some nearshore coastal marine communities are sensitive to wave energy, most notably kelp forests. The purpose of the study “Predicting the Consequences of Wave Energy Absorption from Marine Renewable Energy Facilities on Nearshore Ecosystems” is to develop a statistical model that predicts the potential effects of wave energy absorption from marine renewable energy facilities on nearshore ecosystems. The need for this information is to predict which siting alternatives of proposed wave energy facilities may generate detectable changes in nearshore ecosystems, especially kelp forests. BOEM will use results from this study for impact assessments contained within NEPA documents, and also in essential fish habitat coordination and consultation requirements established by the 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act.

The General NOAA Oil Modeling Environment (GNOME) that BOEM Pacific Region currently uses to conduct oil spill risk analyses are 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 study “Expansion of West Coast Oceanographic Modeling Capability” will allow BOEM analysts to conduct more accurate offshore oil and gas risk analyses.

#### Information Management for Renewable Energy Leasing:

There is increasing interest in the development of offshore renewable energy projects off the coast of the Main Hawaiian Islands (MHI). The University of Hawaii and the Natural Energy Laboratory of Hawaii have expressed interest in obtaining OCS research leases offshore Oahu and the Hawaii and BOEM has received unsolicited requests for wind leases offshore of Oahu. The BOEM needs baseline information on a variety of biological and physical resources offshore of the MHI to determine knowledge gaps, conduct environmental analyses and inform the decision making process for the review of offshore renewable energy project submittals. Biogeography is the study of the spatial and temporal distribution of organisms, their associated habitats, and the historical and biological factors that influence species’ distributions. The purpose of the study “A Biogeographic Assessment of the Main Hawaiian Islands” is to define biogeographic patterns throughout the MHI; an effective way to synthesize the known information about biological and physical resources off the MHI. A biogeographic assessment will compile and synthesize readily available georeferenced data describing the physical oceanography, and the distribution and abundance of benthic habitats, cetaceans, seals, seabirds and fish and corals on the OCS of the MHI. Collectively, these datasets (in a Geographic Information System (GIS) format) would be used by BOEM to better characterize the marine resources found within state and federal waters, and potentially support renewable energy siting and development in and around the MHI.

### **1.5 BOEM Pacific Region New Starts for FY 2012 and Ongoing Studies Table**

The following table contains the list of New Starts and Ongoing Studies managed by the Pacific OCS Region. Descriptions of Ongoing Studies may be found on the web at <http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Studies/Current-Environmental-Studies.aspx>. A list of significant completed studies by the Pacific OCS Region may be found at <http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Completed-Environmental-Studies.aspx> and a discussion of highlights and accomplishments of the Pacific Environmental Studies Program is available at <http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Studies-Highlights-and-Accomplishments.aspx>.

**Table 1.** Pacific Region New Starts for FY 2012 and Ongoing Studies

NSL #	Study Title	Planning Area (s)	Start FY	Partners
<b>New Starts</b>				
<b>Fates and Effects</b>				
PC-12-04	Nocturnal Surveys for Ashy Storm-Petrels and Xantus's Murrelets at Offshore Oil Production Platforms, Southern California	SC	2012	
<b>Habitat and Ecology</b>				
PC-12-02	Biological Productivity of Fish Associated with Offshore Oil and Gas Structures on the Pacific OCS	SC	2012	UCSB/CESU
PC-12-07	Analysis of Fish Populations at Platforms off Summerland California	SC	2012	UCSB/CESU
<b>Marine Mammals and Protected Species</b>				
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	2012	USGS/BRD
PC-12-06	Characterizing and Quantifying Sea Lion and Seal Use of Offshore Man-made Structures in California	SC	2012	NMFS
PC-12-x11	Oregon Marine Renewable Energy Science Conference	WA/OR/NC	2012	OSU/CESU
<i>*Note: The procurement of any study is contingent upon availability of funding</i>				
<b>Ongoing Studies</b>				
<b>Fates and Effects</b>				
PC-08-07	Investigation of PCB and PAH Contaminants in Samples of Platform Resident Fish	SC	2008	USGS/BRD
PC-11-03	Renewable Energy <i>in situ</i> Power Cable Observation	SC	2011	UCSB/CESU
<b>Habitat and Ecology</b>				
PC-10-01	Regional Importance of Manmade Structures as Rockfish Nurseries	SC	2010	USGS/BRD
PC-10-02	MMS MARINE – Multiagency Rocky Intertidal Network	NC/CC/SC	2010	UCSC
PC-10-03	Completion of Fish Assemblage Surveys around Manmade Structures and Natural Reefs off California	SC	2010	UCSB





**Partner Codes**

BAA/NOPP = Broad Agency Announcement/National Oceanographic Partnership Program

CESU = Cooperative Ecosystem Studies Unit

CSUCI = California State University Channel Islands

NMFS = National Marine Fisheries Service

NPS = National Park Service Channel Islands National Park

OSU = Oregon State University

UCSB = University of California Santa Barbara

UCSC = University of California Santa Cruz

USGS/BRD = U.S. Geological Survey/Biological Resources Division

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## SECTION 2.0 PROPOSED STUDY PROFILES

### 2.1 Introduction

A list of significant recently completed studies by the Pacific OCS Region may be found at <http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Studies/Completed-Studies.aspx> and a discussion of highlights and accomplishments of the Pacific Environmental Studies Program is available at <http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Studies-Highlights-and-Accomplishments.aspx>.

#### **Renewable Energy and Oil and Gas Operations Support Studies:**

Nine new studies supporting potential and ongoing activities are proposed for FY 2013. These studies are:

Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence near the Main Hawaiian Islands

Using Ongoing Activities as Surrogates to Predict Potential Ecological Impacts from Marine Renewable Energy

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

Understanding the Role of Offshore Structures in Managing Potential *Watersipora subtorquata* Invasions

Predicting the Consequences of Wave Energy Absorption from Marine Renewable Energy Facilities on Nearshore Ecosystems

Habitat Affinities and At-Sea Ranging Behaviors among Main Hawaiian Island Seabirds

A Biogeographic Assessment of the Main Hawaiian Islands

Expansion of West Coast Oceanographic Modeling Capability

Platform Impacts on Seafloor Communities in the Southern California Planning Area

## 2.2 FY 2013 Table

**Table 2.** BOEM Pacific OCS Region Studies Proposed for the Fiscal Year 2013 NSL

Page #	Discipline	Title	Rank
19	SE	Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence near the Main Hawaiian Islands	1
21	IN	Using Ongoing Activities as Surrogates to Predict Potential Ecological Impacts from Marine Renewable Energy	2
23	HE/MM	Data Synthesis and High-Resolution Predictive Modeling of Marine Bird Spatial Distributions on the Pacific OCS	3
25	FE	Understanding the Role of Offshore Structures in Managing Potential <i>Watersipora subtorquata</i> Invasions	4
27	PO	Predicting the Consequences of Wave Energy Absorption from Marine Renewable Energy Facilities on Nearshore Ecosystems	5
29	HE/MM	Habitat Affinities and At-Sea Ranging Behaviors among Main Hawaiian Island Seabirds	6
31	IM	A Biogeographic Assessment of the Main Hawaiian Islands	7
33	PO	Expansion of West Coast Oceanographic Modeling Capability	8
35	HE	Platform Impacts on Seafloor Communities in the Southern California Planning Area	9
AQ = Air Quality		FE = Fates and Effects	
HE = Habitat and Ecology		IM = Information Management	
IN = Interdisciplinary		MM = Marine Mammals and Protected Species	
PO = Physical Oceanography		SE = Social and Economic Sciences	

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Pacific Region

**Planning Area(s):** Hawaii

**Title:** Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence near the Main Hawaiian Islands

**BOEM Information Need(s) to be Addressed:** The State of Hawaii has mandated a goal of achieving 70% clean energy by 2030. In order to meet this goal, development of offshore renewable energy resources and construction of inter-island transmission cables will be necessary. With passage of the Energy Policy Act of 2005, BOEM has assumed jurisdiction for some types of renewable energy development on the OCS, and is required under multiple statutes (Outer Continental Shelf Lands Act (OCSLA), NEPA and National Historic Preservation Act (NHPA)) to take into consideration the impacts of OCS activities on cultural and archaeological resources and traditional cultural properties. To achieve compliance with these laws, BOEM has developed regulations and guidance documents directing lease and permit holders to avoid impacting any archaeological resources identified during the survey or development of their leases (e.g., BOEM Geophysical, Geological and Archaeological Guidelines (GGARCH) 21 April 2011). While it is possible to avoid impacting known cultural resources on the seafloor, it is not always possible to avoid visual impacts to coastal historic or traditional cultural properties. The purpose of this study is to provide baseline information on submerged and terrestrial archaeological resources and traditional cultural properties. This information is necessary under Section 106 of the NHPA, which requires that federal agencies must apply the National Register Criteria to properties that may be affected by a federal undertaking. The information will also be used to support reviews under NEPA and other federal laws.

**Cost Range:** (in thousands) \$720-\$1,080

**Period of Performance:** FY 2013-2015

### **Description:**

**Background:** The BOEM has completed, or is in the process of completing, baseline studies of known and reported submerged cultural and archaeological resources in each OCS Region off the contiguous U.S.; however, no such baseline study has ever been completed off the main Hawaiian Islands for any federal agency. As a result, there is very limited information currently available regarding potential submerged cultural resources off the main Hawaiian Islands.

While remote sensing surveys will be required of permittees for all offshore activities within areas of potential effect, an inventory of known and potential archaeological resources developed by the proposed study will help guide decision makers in developing appropriate mitigation strategies and best management strategies for targets located by remote sensing; the development of an effective survey strategy is contingent upon knowing the nature of these resources and where they most likely may be located.

The main Hawaiian Islands also contain numerous historic properties on land that could potentially be impacted visually by offshore siting. Determining whether a property may be adversely impacted is a requirement of Section 106 of the NHPA. The basis for making the determination of whether a property is adversely impacted depends upon the description within the property listing or the archaeological and historic assessment of the property. If, within the description, the rationale for listing the property or its potential eligibility includes the visual aspects of its surroundings, then the property may be adversely impacted by visual disruption. Native Hawaiian Organizations may also have ceremonial or religious ties to certain areas that could be impacted from offshore renewable energy development. An analysis of the potential for visual impacts from offshore energy development to coastal historic and traditional cultural properties that are either listed on, or eligible for listing on the National Register of Historic Places (NRHP) has never been conducted for the main Hawaiian Islands. These properties can include historic structures, historic archaeological sites, prehistoric archaeological sites, sacred sites and traditional use areas.

There is a critical need to complete a baseline study of historic properties and potential properties, develop a digital database of known and reported submerged cultural resources, conduct ethnographic interviews with Native Hawaiian Organizations, and develop a digital database of coastal historic properties and property types within the region of the main Hawaiian Islands. This information will provide valuable information for completing NHPA Section 106 reviews.

Objectives:

The primary objectives of this study are:

- Accumulate baseline information on submerged and terrestrial cultural and archaeological sites and site types;
- Develop a geo-referenced database of known, reported and potential historic shipwrecks on the Pacific OCS off the main Hawaiian Islands emphasizing the use of primary sources;
- Identify and develop a database of coastal historic properties and property types that could be adversely impacted by the alteration of the view of the ocean.

Methods: The proposed study will collect information from archival and secondary sources of known, reported and potential archaeological sites on the Pacific OCS off the main Hawaiian Islands and synthesize this information into a Microsoft Access database; collect information from archival and secondary sources to develop an MS Access database of coastal properties listed, and potentially eligible for listing, on the NRHP; collect ethnographic information from Native Hawaiian Organizations regarding traditional use and traditional cultural properties that could be impacted by offshore development; identify protocols for incorporating traditional knowledge into NHPA and NEPA analysis; and prepare a final report of findings that details the efforts to compile the databases and provides an historic context of site types that can be expected in the project area. Digital versions of predictive maps and uncertainty will be delivered in a format that is compatible with the BOEM Multipurpose Marine Cadastre and similar BOEM data sets.

**Revised Date:** April 9, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Pacific OCS Region

**Planning Area(s):** All

**Title:** Using Ongoing Activities as Surrogates to Predict Potential Ecological Impacts from Marine Renewable Energy

**BOEM Information Need(s) to be Addressed:** The purpose of this study is to identify and analyze available data from ongoing projects or activities (surrogates) with stressors and receptors similar to those expected from marine renewable energy projects. Stressor-receptor pairs that may be particularly useful to analyze from surrogates include: (1) electromagnetic fields from operating power cables as impediments to migration of marine mammals and anadromous fishes (salmonids and green sturgeon), and (2) mooring configurations of offshore aquaculture facilities and oceanographic buoys as entanglement hazards for marine mammals. Given that no current marine renewable energy facilities exist, and because BOEM may receive applications for renewable energy projects in the near future, analyzing data from surrogates will provide some of the best available and most timely information to make informed decisions regarding project permitting and guide future research efforts. BOEM will use results from this study for impact assessments contained within NEPA documents, and also in consultations required by the Endangered Species Act and the 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act.

**Cost Range:** (in thousands) \$240-\$360

**Period of Performance:** FY 2013-2014

### **Description:**

Background: There are currently no marine renewable energy arrays operating on a commercial scale in United States waters. This compromises the ability to understand, predict, manage and mitigate potential impacts of proposed marine renewable energy projects. To perform timely environmental review, data from ongoing projects and activities (surrogates) with stressors and receptors similar to those expected from marine renewable energy projects can be analyzed to reduce the uncertainty in the range of outcomes and intensity of environmental consequences. Stressor-receptor pairs that may be particularly useful to analyze from surrogates include: (1) electromagnetic fields from operating power cables as impediments to migration of marine mammals and anadromous fishes (salmonids and green sturgeon), and (2) mooring configurations of offshore aquaculture facilities and oceanographic buoys as entanglement hazards for marine mammals. Other useful stressor-receptor pairs from appropriate surrogates may be identified.

Objective: The objective of this study is to analyze existing data from surrogate projects to predict the ecological consequences of proposed marine renewable energy facilities.

Methods: To meet the study objective, a Broad Agency Announcement (BAA) will be used to solicit proposals with varying technical/scientific approaches (per 48 CFR 35.016(a)). One to three projects will be funded under this BAA, with each project receiving a maximum of

\$100,000 in funding. Given the need for timely review, each proposed project must complete the final report within one year of the initial financial award. No new data are to be collected as part of this study; proposed work shall analyze information already available.

**Revised date:** April 9, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Pacific OCS Region

**Planning Area(s):** California, Oregon and Washington

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

**BOEM Information Need(s) to be Addressed:** With the passage of the Energy Policy Act of 2005, BOEM acquired responsibilities for renewable energy activities on the OCS, including wind, wave and offshore current power development. As part of this responsibility, BOEM will conduct detailed environmental analyses of renewable energy projects proposed for development. The potential direct, indirect and cumulative impacts on the human, coastal and marine environments must be evaluated in order for BOEM to make environmentally sound decisions about managing renewable energy activities and developing mitigation measures to avoid or minimize impacts. 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.

**Cost Range:** (in thousands) \$440-\$660

**Period of Performance:** FY 2013-2015

### **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. This information is needed by BOEM in order to predict and evaluate potential environmental effects of management actions and project approvals (i.e., Liquefied Natural Gas (LNG) facilities, renewable energy structures) throughout the Pacific OCS.

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 U.S. Fish and Wildlife Service (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 (a.k.a. “hotspots”) that may be threatened by offshore wind energy development. Conversely, the identification of “coldspots” or areas where birds do not aggregate is equally important.

Sampling of the marine environment is inherently difficult due to weather and the logistics of access; and so approaches such as predictive population modeling have been recommended to provide guidance to agencies in assessing the potential impacts of development on wildlife.

Objectives: Increase BOEM's understanding of marine bird distribution on the Pacific OCS by: 1) collating existing data from surveys conducted over the last 50 years; 2) predictively modeling marine bird distribution on the Pacific OCS, taking into account all available data and relationships with environmental variables; and 3) mapping the predictive distribution of marine birds to identify areas of persistent aggregation and persistent avoidance ("hotspots" and "coldspots").

Methods: The proposed study will identify, collect and synthesize all available quantitative scientific seabird survey data for the Pacific OCS off California, Oregon and Washington 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. 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 application to the Pacific OCS.

Predictive modeling will produce continuous, high resolution (~1 kilometer (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

A final report will be produced and delivered that presents the predictive modeling methods and results. Digital versions of predictive maps and uncertainty will be delivered in a format that is compatible with the BOEM Multipurpose Marine Cadastre and similar BOEM data sets. Results from this study will be provided in scientific presentations and peer reviewed scientific papers.

**Revised Date:** April 9, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Pacific OCS Region

**Planning Area(s):** All

**Title:** Understanding the Role of Offshore Structures in Managing Potential *Watersipora subtorquata* Invasions

**BOEM Information Need(s) to be Addressed:** The purpose of this study is to describe the distribution, abundance and life history of the bryozoan *Watersipora subtorquata*, which is a non-indigenous species (NIS) known to exist on offshore oil and gas platforms and has the potential to negatively affect native biological communities. Using these ecological data, this study will assess the effectiveness of potential mitigation measures to prevent further colonization on uninhabited substrate. The need for this information is to elucidate the role that offshore artificial structures may have in affecting biological communities and to comply with the duties of federal agencies that are outlined in Section 2 of Executive Order (EO) 13112 (Invasive Species). The BOEM will use study results for environmental reviews concerning ongoing operations and decommissioning alternatives of offshore oil and gas platforms, and potential marine renewable energy facilities.

**Cost Range:** (in thousands) \$580-\$870

**Period of Performance:** FY 2013-2016

### **Description:**

**Background:** Artificial substrate in the marine environment may facilitate the establishment and spread of NIS by providing novel habitats where native species fail to have a competitive advantage over recent arrivals. Some of these NIS may subsequently invade natural habitats and displace or change native biological communities. In southern California, biologists documented the first appearance of the non-indigenous bryozoan *Watersipora subtorquata* in 1963 at an artificial oil island located in State waters. Carlton (2000) states that the origin of this species is offshore the Pacific coast of Asia. In the decades following its first appearance, *Watersipora* has successfully colonized many bays and harbors along the California coast and a few offshore oil and gas platforms and natural reefs located in the Southern California Bight, and it is now found as far north as Yaquina Bay, Oregon. Due to its resistance to copper-based anti-fouling paints, it is commonly found on ship hulls; marine vessel traffic acts as the primary vector for translocating this species to new habitat. In other biogeographic regimes, this bryozoan has been recorded in the waters off Hawaii and in various locations in the Gulf of Mexico and western Atlantic Ocean. Under certain conditions and water depths, *Watersipora* covers virtually 100% of the available substrate and therefore experts recognize that this species has the potential to become quite destructive to native communities. Because it has been found on some oil and gas platforms located in federal waters, a report released in 2010 by the California Ocean Science Trust identified NIS as a priority information gap needed to evaluate future rigs-to-reefs proposals.

In addition to providing BOEM with needed information and the ability to comply with Executive Order 13112, study findings will directly benefit state government agencies that have key roles in managing invasive species and those that evaluate or comment on OCS activities (including rigs-to-reefs proposals and marine renewable energy projects) such as the California Department of Fish and Game, State Lands Commission, Coastal Commission and Ocean Protection Council, and the Oregon Department of State Lands and Department of Fish and Wildlife.

Objective: The overall objective of this study is to understand the role of offshore structures in managing potential *Watersipora subtorquata* invasions, and to incorporate this information into environmental reviews regarding ongoing operations and decommissioning of oil and gas platforms and potential renewable energy facilities.

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

(1) *Quantify the existing distribution and abundance of Watersipora subtorquata.* Scuba divers shall use underwater transects and photographic samples to document the relative abundance and geographic and depth distribution of *Watersipora* and other prominent NIS on (a) oil and gas platforms, (b) marine vessels used to service oil and gas platforms, (c) harbors and moorings used by these service vessels, and (d) nearby natural reefs. Voucher specimens that enable species identification and future genetic analyses (if any) will be collected, preserved and archived.

(2) *Document the seasonality of Watersipora settlement at platforms and in harbors.* Over a two-year period, this study will use settlement plates to detail the reproductive seasonality of *Watersipora*. Along with published information on oceanographic currents and seafloor maps, information from tasks 1 and 2 will be used to generate a model of potential vector pathways to and from oil and gas platforms, and identify vulnerable steps in the bryozoan's life history that can be used to manage future colonization risk (see task 3).

(3) *Assess the effectiveness of mitigation measures that would prevent establishment of Watersipora in uncolonized habitats.* Once the biological data have been collected and synthesized with other available information, the study will evaluate a number of simple mitigation measures that may be employed to manage NIS. Such measures may include (a) adjusting the schedule of either marine vessel hull cleaning or platform maintenance operations that remove biofouling on submerged portions of the jacket so that they coincide with seasons not sensitive to NIS establishment, (b) growth abatement devices, and (c) vector management and other potential actions. If applicable, the study will propose a monitoring plan for early detection and response for high-risk areas. Finally, the study will determine if a partial removal option in a rigs-to reefs proposal affects the risk of NIS establishment to natural habitats.

Once completed, study results will be published as a BOEM OCS Study Report and in peer-reviewed journals.

**Revised date:** April 9, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Pacific OCS Region

**Planning Area(s):** All

**Title:** Predicting the Consequences of Wave Energy Absorption from Marine Renewable Energy Facilities on Nearshore Ecosystems

**BOEM Information Need(s) to be Addressed:** The purpose of this study is to develop a statistical model that predicts the potential effects of wave energy absorption from marine renewable energy facilities on nearshore ecosystems. The need for this information is to predict which siting alternatives of proposed wave energy facilities may generate detectable changes in nearshore ecosystems, especially kelp forests. The BOEM will use results from this study for impact assessments contained within NEPA documents, and also in essential fish habitat coordination and consultation requirements established by the 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act.

**Cost Range:** (in thousands) \$240-\$360

**Period of Performance:** FY 2013-2015

### **Description:**

Background: To perform environmental analyses, BOEM requires information about the sensitivity and resilience of biological habitats to disturbance. Because little is known about how activities related to wave energy conversion devices on the outer continental shelf might affect nearshore habitats, numerous scientific reviews rank this information gap as a priority for future research. Some nearshore coastal marine communities are sensitive to wave energy, most notably kelp forests. Kelp forests provide a number of important ecosystem services and have been identified as habitat areas of particular concern (a subset of essential fish habitat) by the Pacific Fisheries Management Council. Thus, it is important to assess how reductions in wave energy might affect these habitats.

Objective: The objective of this study is to use existing data to build a statistical model that describes how wave energy may structure nearshore communities, and to use this information to predict the ecological consequences of various siting options for proposed marine renewable energy facilities.

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

*(1) Determine the distribution of wave period and amplitude across the study region.* The Pacific Coast includes a number of very exposed and very protected locations, including offshore islands. Using historical buoy data and oceanographic wave models, data will be generated and developed through use of GIS to show the distribution of nearshore wave energy throughout the study region. The maps will indicate the natural variation in exposure experienced by nearshore communities, helping to put into context potential human alterations to wave dynamics. The maps will also provide inputs needed for building a model of how nearshore communities respond to variation in wave exposure. The Coastal Data

Information Program will provide algorithms that compute wave energy as a function of swell direction, amplitude and period for each point along the coastline of the study region. This program has been supported by BOEM and its oceanic swell data come from sensors on Pacific Platform Harvest. By parameterizing the algorithms with historical data from Harvest, monthly plots will be made for maximum, average, and cumulative wave heights for the duration of the available data. This will indicate annual, seasonal and spatial variation in wave exposure in the study region.

(2) *Determine how wave model predictions relate to empirical observations along a depth gradient.* Wave models are coarse in their predictions and not fine-tuned to smaller spatial scales where species interact, and they do not indicate wave energy at different depths. The physics of breaking waves leads to attenuation of force and turbulence with depth. To extrapolate wave model predictions to forces acting on specific subtidal sites in marine communities, one must measure wave energy in the field at different depths and compare this to model predictions. Real time wave energy sensors will be deployed in the field to sites with a known variation in wave exposure (e.g., Pt. Conception) to determine the relationship between buoy projections, depth and wave forces that create environmental disturbances such as displacing kelp. The resulting model will express wave disturbance as a function of depth and wave period and amplitude.

(3) *Determine how marine communities respond to variation in wave exposure.* Kelp forests are sensitive to wave exposure and we presume that they are adapted to average conditions in the region. Wave action could affect various ecological factors, such as recovery rates from disturbance, productivity and biodiversity. Examining the sensitivity of these factors to wave exposure requires a long data set where community time series can be analyzed at several different sites. These long-term data sets exist and are presently being organized and analyzed by the BOEM-funded *DOI Partnership: Distinguishing Between Human and Natural Causes of Changes in Kelp Forests Using Long-term Data from DOI Monitoring Programs*. Wave energy will vary both in time and space, and allow the creation of statistical models that express nearshore communities as a function of wave energy in time and space. In this case, wave energy will be estimated from wave models as in task 1, and adjusted according to site depth as in task 2. With such statistical models, it will be possible to estimate a change in community state that might result from a change in wave energy state. For instance, one could predict changes to the nearshore community that would result if a renewable energy facility reduced the average amplitude of waves on shore by 10%. Due to non-linearities in the response of communities to waves, these models could predict where renewable energy facilities would lead to significant changes and whether these changes were considered positive or negative in terms of ecosystem services. Generalized linear models will be used to express how wave disturbance, as identified in task 2, affects temporal and spatial variation in the biodiversity, productivity and resilience of nearshore ecosystems using data derived from the *DOI Partnership* study.

**Revised date:** April 9, 2012

## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015

**Region:** Pacific OCS Region

**Planning Area:** Hawaii

**Title:** Habitat Affinities and At-Sea Ranging Behaviors among Main Hawaiian Island Seabirds

**BOEM Information Need(s) to be Addressed:** The BOEM and the state of Hawaii likely will receive proposals to develop offshore renewable energy related projects within state and federal waters surrounding the main Hawaiian Islands (MHI) and both agencies are developing a renewable energy taskforce. Presently, there is increasing interest in research leases and commercial-scale projects offshore the MHI. For example, the state is planning an inter-island power cable to transmit electricity from renewable energy projects (wind) between the islands of Lanai and Molokai to load centers on Oahu and possibly Maui. In addition to future infrastructure, such cable-laying operations (especially lighted operations at sea), pose a ship-strike or grounding risk to free-ranging seabirds that are prone to light attraction. Such risk is expected to vary according to species, time of year and environmental conditions. Currently there is a lack of quantitative information that links distribution, movements and behaviors among seabirds with physical habitats in waters surrounding the MHI. More information is needed by BOEM to evaluate potential environmental effects to seabirds and their oceanic habitats caused by installation of new renewable energy infrastructure (i.e., hydrokinetic and wind-energy structures) within OCS waters off Hawaii. A recently approved FY12 Study Plan seeks to establish a ‘*Seabird Vulnerability Index*’ based on observations of seabirds at sea recorded from ships and archived in extensive historic databases. These data primarily are focused on the California Current and Eastern Tropical Pacific, and include much less information regarding seabirds in OCS waters off Hawaii. The USGS is currently acquiring behavioral data from seabirds in Hawaii and the California Current using sophisticated telemetry techniques that enable measurements of flight behaviors associated with ranging patterns, wind speed/direction and sea-state. Furthermore, USGS and collaborators have generated predictive models of fine-scale wind and wave fields for waters surrounding the MHI. This proposed study will provide additional detailed information linking abundant Hawaiian breeding seabirds with coastal and offshore habitat utilization surrounding the MHI and help link surface wind and wave direction data with proposed *in situ* seabird bird telemetry data.

**Cost Range:** (in thousands) \$720-\$1,080

**Period of Performance:** FY 2013-2015

### **Description:**

**Background:** The MHI and associated offshore islets (i.e., Mokumanu, Kaula, Lehua, Manana and Molokini) provide substantial breeding habitat for more than a dozen seabird species including shearwaters, albatrosses, petrels, frigatebirds, boobies, tropicbirds and terns. Two main island species, the Newell’s Shearwater and Hawaiian Petrel are listed under the Endangered Species Act (ESA) as threatened and endangered, respectively. Presently, very little is known about breeding population sizes and trends, breeding biology and foraging

ecology among MHI seabirds. The suite of seabirds that comprise the Hawaiian community are uniquely adapted to relatively low productivity waters and patchy prey resources. Several species co-depend on schooling predatory fishes and odontocete cetaceans to locate and make available important forage fishes and squids, and therefore, certain Hawaiian seabirds can be used to identify ocean regions of important community-level food-web interactions and trophic transfer of energy. Furthermore, certain Hawaiian seabirds have adapted ranging behaviors, morphologies and flight characteristics that capitalize on energy associated with predominant wind patterns and wave energy. Hawaiian seabirds face increasing threats at sea including competition with fisheries, pollution and marine climate change. Increasing interest in ocean-based renewable energy and certain activities associated with development of these energy resources pose additional risks for seabirds. For example, there is increasing documentation of seabird interactions with wind-turbine structures, lighted facilities, and elevated power lines on land and lighted ships at sea within OCS waters off Hawaii. Risk depends on seabird behavior at sea (e.g., time per area, soaring flight behavior associated with wind speed/direction and wave height/direction).

Objectives: Increase BOEM's understanding of at-sea habitat utilization and ranging behaviors for seabirds breeding within the MHI by: 1) Conducting multi-species and multi-scale quantifications of at-sea habitat utilization and ranging behaviors for seabirds breeding within the MHI; and 2) compiling and providing an analysis of remotely-sensed and model-derived habitat data (e.g., chlorophyll concentrations, sea surface temperature (SST), 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 maps.

Methods: 1) Existing recent USGS telemetry-based information on at-sea utilization and behavior (albatrosses, petrels) will be combined with new measurements of at-sea habitat utilization (Global Positioning System (GPS), Ultra High Frequency (UHF) and Global Location Service (GLS)-based telemetry and archival sensors) among the most abundant (and multi-species, seabird/tuna/dolphin-affiliated), near-island foraging species (e.g., Wedge-tailed Shearwater). For species that frequent MHI waters (e.g., Great Frigatebird), tracking deployments will be targeted at significant roosting areas (e.g., Molokini off Maui Nui); 2) spatially-explicit habitat modeling will be used to combine seabird utilization with oceanographic habitat to generate mapped species probability distributions and multi-species data will be combined to delineate community-level hotspot areas; and 3) numerical models will be generated that relate flight behavior with fine-scale (2-6 km) winds and waves to evaluate 3-dimensional risk

Results will include: 1) raster-based maps of species distributions within State and Federal waters adjacent to the MHI, and 2) a numerical model that relates 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 that will be delivered in a format that is compatible with the BOEM Multipurpose Marine Cadastre and similar BOEM data sets.

**Revised date:** April 9, 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013–2015**

**Region:** Pacific OCS

**Planning Area(s):** Hawaii

**Title:** A Biogeographic Assessment of the Main Hawaiian Islands

**BOEM Information Need(s) to be Addressed:** There is increasing interest in the development of offshore renewable energy projects off the coast of the main Hawaiian Islands (MHI). The University of Hawaii and the Natural Energy Laboratory of Hawaii have expressed interest in obtaining OCS research leases offshore Oahu and Hawaii, and BOEM has received unsolicited requests for wind leases offshore of Oahu. In addition, BOEM is developing a programmatic EIS for the “Hawaii Interisland Renewable Energy Program (HIREP): Wind” that includes analysis of a potential OCS subsea power cable for inter-island energy transmission. The BOEM needs baseline information on a variety of biological and physical resources offshore of the MHI to determine knowledge gaps, conduct environmental analyses and inform the decision making process for the review of offshore renewable energy project submittals. A biogeographic assessment of the MHI will expand BOEM’s assessment capabilities and contribute greatly toward ecosystem-based management of the marine resources of the MHI.

**Cost Range:** (in thousands) \$400-\$600

**Period of Performance:** FY 2013-2015

### **Description:**

**Background:** Defining biogeographic patterns throughout the MHI is an effective way to synthesize existing information about biological and physical resources off the MHI. Biogeography is the study of the spatial and temporal distribution of organisms, their associated habitats, and the historical and biological factors that influence species’ distributions. A biogeographic assessment will compile and synthesize readily available georeferenced data describing the physical oceanography, and the distribution and abundance of benthic habitats, cetaceans, seals, seabirds, fish and invertebrates (including corals) in the MHI. Collectively, these datasets (in a Geographic Information System [GIS] format) would be used by BOEM to better characterize the marine resources found within state and federal waters, and potentially support renewable energy siting and development in and around the MHI.

The study will include characterization of the physical and biological environments (e.g., oceanography and benthic habitats) that structure the spatial and temporal distribution of living marine resources off the coast of the MHI. Readily available information on the distribution of living marine resources, including key species of interest identified by BOEM staff, will be integrated with available biophysical information using various spatial analysis techniques. Where possible and readily available, the study will integrate existing human use information related to the MHI.

Objectives: Questions to be addressed in this study include:

- How are trophic groups, families and species distributed spatially & temporally in the MHI?
- Where are ecologically unique and productive habitats located in the MHI?
- How are ecologically important areas being utilized by living marine resources?
- Where can offshore renewable energy projects (e.g., wind farms) be located to maximize energy production and minimize potential impacts to the marine environment?
- What significant gaps exist in our knowledge about of the physical, biological and ecological characteristics of the MHI?

Methods: The specific tasks for this project include: 1) identification and acquisition of existing relevant, readily-available physical, biological and ecological datasets for the study area including information about benthic habitats, cetaceans, seals, seabirds, fish and invertebrates (including corals); 2) organization of data into a common spatial framework within GIS, and identification of information gaps in existing datasets and research activities; 3) synthesis of GIS data and development of maps depicting the spatial distribution of physical, biological and ecological data sets for the study area; 4) biogeographic analysis of available data to identify ecologically significant regions, based on species distributions, abundances, associated benthic habitats and other datasets if appropriate; and 5) preparation of a report summarizing methods and key findings, including relevant maps, figures, tables and appendices. Readily available data on physical, biological and ecological data sets will be obtained from groups actively working in the region (i.e., academic, government, consulting, nonprofit and other groups). Relevant datasets will be formatted and organized into a preliminary database management system (DBMS) to assess their quality and content. All data acquired and used for the assessment will be standardized into a common spatial projection within a GIS. With the DBMS and GIS in place, the extent and quality of data will be evaluated, important information gaps will be identified, and appropriate analytical techniques will be selected given the quality and spatial extent of the data collected and the desired products. Once the datasets have been formatted and organized, maps will be developed depicting the spatial distribution of the physical, biological and ecological data. If the data allows, species abundances will also be mapped. The GIS data used to create these maps will be delivered to BOEM, along with metadata describing source, derivation and limitations of each GIS data layer, when possible. The quality of the final maps will depend on the quality, quantity and availability of data for analysis. Key ecologically important areas will be identified based on the following criteria: 1) the availability, completeness and limitations associated with specific datasets; 2) maps denoting the distribution and abundance of specific species; and 3) the distribution of bio-physical habitats. All data will be integrated into a spatially-explicit index in an attempt to evaluate overall spatial patterns. A final report will be prepared describing key ecological patterns, linkages and locations highlighted by the project's quantitative and qualitative analyses. All data sets and GIS products will be delivered in a format that is compatible with the BOEM Multipurpose Marine Cadastre and similar BOEM data sets.

**Revised Date:** April 9, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Pacific OCS Region

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

**Title:** Expansion of West Coast Oceanographic Modeling Capability

**BOEM Information Need(s) to be Addressed:** 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.

**Cost Range:** (in thousands) \$160-\$240

**Period of Performance:** FY 2013-2015

### **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 United States 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 data sets; 2) A wave model would be forced by the wind model results and be validated through in situ measurements; 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; 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)

**Revised date:** April 30, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2013-2015**

**Region:** Pacific OCS Region

**Planning Area(s):** Southern California

**Title:** Platform Impacts on Seafloor Communities in the Southern California Planning Area

**BOEM Information Need(s) to be Addressed:** The BOEM's planning efforts need to be based on current scientific information. Plans involving Federal platforms need to consider the seafloor animals impacted by past and ongoing operations near these platforms. Information on seafloor invertebrate species and abundances in the vicinity of existing federal platforms in the Pacific OCS is outdated and was last collected over 17 years ago. The proposed study will collect seafloor invertebrates near platforms and analyze these data against an existing, extensive regional dataset. Results of this study will enable BOEM to evaluate the impact to seafloor communities exposed to very different types of platform discharges and use this information in all environmentally-based planning, from current platform level operations to regional level decommissioning decisions.

**Cost Range:** (in thousands) \$360-\$540

**Period of Performance:** FY 2013-2018

### **Description:**

Background: Benthic (seafloor) invertebrates are often used to assess sediment quality because they live in sediments and adapt to site-specific conditions. They integrate the biological effects of multiple co-occurring contaminants and multiple stressors over time. A well-established method for evaluating impacts from offshore drilling and mud cutting discharges is to conduct community-level analysis of the benthic invertebrates near and far from the discharge source. Studies have typically shown that the invertebrate community within one to two km of a platform (i.e., where the bulk of the discharge has landed) is distinct from a more distant and un-impacted community. Some studies, however, did not find this pattern and could not detect impacts to invertebrate communities, which has been attributed to factors such as depth, the amount of discharged material, and the toxicity of the material.

The Southern California Planning Area represents a unique opportunity to evaluate the impact from drilling discharges across a range of all three of these factors; depth, volume of discharged material, and toxicity of material. In fact, the only two studies within this area to examine impacts from drilling discharges to invertebrates living in soft-bottom habitats have demonstrated this range of results. A platform installed before 1965 in shallow waters contained a clearly impacted seafloor community while a study of active discharging in 1995 concluded that no impacts occurred to soft bottom invertebrate communities. Another key benefit to conducting this study in the Southern California Planning Area is that this region already has a robust and well-defined understanding of what is "normal" or considered un-impacted. The southern California planning area supports more than 5,000 invertebrate species. Interpreting impacts to benthic infaunal assemblages is challenging because

hundreds of species and thousands of individuals are often found in one square meter of sediment. Resource managers across many agencies in this area have developed a single interpretive tool to remove this complexity by converting the complex biological information to a single number that ranks sites on a scale from “good” to “bad”. The BOEM can then use this tool, along with other multivariate analyses, to prioritize impacted sites, track trends over time, or correlate benthic biological responses with data about stressors, such as chemical contaminant concentrations. Identifying the type of chemical or if the change to a community is caused by grain size changes, is important for predicting the recovery time of a community and developing effective mitigations. Many people involved with decommissioning in California assume that large areas of the seafloor surrounding all Federal platforms are impacted. Testing that assumption across platforms with different drilling histories and depths will inform future decommissioning efforts as well as improve current environmental analysis.

Objectives: The objective of this study is to determine the extent that platforms and discharges from platforms may have altered seafloor infauna and epibenthic invertebrate communities. More specifically, this study will compare the community structure of invertebrates near platforms to un-impacted samples collected within the same region to determine if communities near platforms are distinct. Secondly, if communities near platforms are distinct, than invertebrate communities near platforms can be analyzed further to determine if communities near platforms have been impacted differently. To determine if habitat changes (i.e., grain size) or toxicity changes are driving community changes near to platforms, community abundance data can be correlated to physical and chemical parameters.

Methods: To meet the study objective, field sampling, analyses, and reporting are necessary. Box core and trawl samples will be collected of soft-bottom infaunal and megabenthic invertebrates at platforms representing a range of depths and drilling histories in the summer of 2013. The sampling design near to the platform is intended to detect the maximal impact; therefore box core samples will be collected outside any debris formed from cleaning jacket legs (e.g., shell mound) yet within 1 km of the platform. Trawl samples will be taken at the closest distance that is safe, which will be consistent among platforms with similar depths. At least one sample will be taken in the direction of predominant currents as determined by existing videos of shell mound shape and other available oceanographic information. An additional sample will be taken at the same time and location to assess physical and chemical parameters. Collection and laboratory methods will follow established protocols for this area in order to be compared to existing and concurrent sampling events. This sampling will also be subject to the same robust quality assurance protocols as prior regional sampling to ensure that results can be fully integrated with all other past and 2013 sampling events. Analyses will utilize multivariate statistical testing and the Benthic Response Index to test for differences in invertebrate communities near to platforms compared with samples in similar habitats. If differences are found, analyses will test for differences among platforms and for strong correlations with physical and chemical parameters. A report will be written that describes the analysis and makes conclusions as to the degree and extent of impact to invertebrate communities near Federal platforms in the Pacific OCS.

**Revised date:** April 9, 2012

### 2.3 FY 2014 Table

**Table 3.** BOEM Pacific OCS Region Studies Proposed for the Fiscal Year 2014 NSL

Page #	Discipline	Title
39	HE	Influence of Pacific Offshore Platforms on Marine Fish Ecology
41	MM	Nearshore Marine Bird Surveys from Southern California Points and Beaches: Baseline for Offshore Renewable Energy and Post-lease Oil and Gas Projects
AQ = Air Quality		FE = Fates and Effects
HE = Habitat and Ecology		IM = Information Management
IN = Interdisciplinary		MM = Marine Mammals and Protected Species
PO = Physical Oceanography		SE = Social and Economic Sciences

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## ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2014–2016

**Region:** Pacific OCS Region

**Planning Area(s):** Southern California

**Title:** Influence of Pacific Offshore Platforms on Marine Fish Ecology

**BOEM Information Need(s) to be Addressed:** The long-term fate of offshore platforms off California continues to be a subject of considerable debate and 15 years of scientific surveys funded by BOEM. Much of this work has been focused on the potential importance of the fish populations at offshore platforms. All 23 Federal and one State platform have been surveyed at least once, and many over 10 times. In addition, site-fidelity and transplantation acoustic studies have been completed for fish at several Federal platforms. The BOEM needs to have the resulting peer-reviewed BOEM OCS reports, various USGS reports, and scientific literature material compiled in a single source, professionally published reference, to support environmental reviews associated with decommissioning and for public outreach purposes.

**Cost Range:** (in thousands) \$140-\$210

**Period of Performance:** FY 2014-2016

### **Description:**

**Background:** Since 1995, USGS, BOEM and the California Artificial Reef Enhancement Program (CARE) have provided funding to conduct research on the fishes that live around the platforms and on natural rock outcrops of central and southern California. To our knowledge, over the past 15 years, DOI is the only public agency (Federal or State) that has funded research at the offshore platforms. The study proposed for FY 2012, *Biological Productivity of Offshore Oil and Gas Structures in the Pacific OCS*, if approved and funded, will be completed before the start of this project and from that study we expect a manuscript submittal and work *in press* to a scientific journal well within time to be included in this present effort. The BOEM needs to have the resulting peer-reviewed BOEM OCS reports, various USGS reports and scientific literature material compiled into a single, professionally published reference to support environmental reviews associated with decommissioning and for public outreach purposes. There are many peer-reviewed papers and reports. The goal is to publish a book or special issue of a respected peer-reviewed journal on the influence of Pacific offshore platforms on marine fish ecology based on information obtained through these studies. An identical effort in the Gulf of Mexico resulted in a 2003 special publication from the American Fisheries Society titled “Fisheries, Reefs, and Offshore Development,” which addressed the influence of Gulf of Mexico platforms on marine fish (see <http://www.afsbooks.org/x54036xm>). Permission was requested and received from multiple sources to reprint and compile published peer-reviewed literature.

**Objectives:** Publish a reference book containing peer-reviewed literature, summaries of BOEM OCS reports, various USGS reports, and other scientific literature material pertaining to OCS platforms in southern California.

Methods: Methods include forming an editorial review board, collecting and compiling the peer-reviewed papers and BOEM and USGS reports, as appropriate, and choosing and working with a publisher such as the California University Press, the American Fisheries Society, or a journal such as the Bulletin of Marine Science.

**Revised date:** April 9, 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2014-2016**

**Region:** Pacific OCS Region

**Planning Area(s):** Southern California

**Title:** Nearshore Marine Bird Surveys from Southern California Points and Beaches: Baseline for Offshore Renewable Energy and Post-lease Oil and Gas Projects

**BOEM Information Need(s) to be Addressed:** The BOEM regulates post-lease oil and gas activities on platforms off the southern California coast. In addition, BOEM will likely receive renewable energy proposals within this area. The proposed study will provide up-to-date information on species composition, distribution, abundance and seasonal variation of nearshore marine birds along this section of coast. The data generated will be used for environmental review of both renewable energy and oil and gas projects proposed in the area.

**Cost Range:** (in thousands) \$200-\$300

**Period of Performance:** FY 2013-2015

### **Description:**

**Background:** The BOEM funded aerial seabird surveys offshore southern California from 1999-2002. The results of that study were published (Mason et al. 2007), comparing the results to those obtained 20 years earlier by Briggs et al. (1987). In addition, BOEM funded shorebird surveys on Ventura County beaches from 1994-1997 (McCrary and Pierson 2002) and again from 2007-2010, report pending. While these surveys provide valuable information regarding the status and distribution of birds at-sea and on local beaches, little information has been collected regarding species composition and abundance of marine birds in the nearshore environment where platforms exist and renewable energy facilities will be installed.

The shoreline of Los Angeles, Ventura and Santa Barbara Counties in California is closest to the oil platforms off southern California and most likely to be affected by a spill. In addition, these waters are expected to attract renewable energy proposals due to their proximity to urban centers. The birds found in nearshore areas (including loons, grebes, scoters, pelicans, cormorants, etc.) are among the birds most affected by oil spills in California and species that could be affected by offshore renewable energy development. There are anecdotal indications that the distribution and abundance of some of these species has changed over the past decade.

The proposed study will provide up-to-date information and establish a more robust data set from which to draw on for marine spatial planning, environmental analyses and oil spill responses. Shore-based surveys, with the possibility of being supplemented by small-boat or aerial surveys, will provide a more thorough assessment of bird distribution and abundance than previous aerial surveys including the ability to detect migration movements along the coast. The latter will be valuable for assessing the placement of offshore wind turbines and hydrokinetic devices. Marbled Murrelets have been observed off the Ventura County coast during recent National Audubon Society Christmas Bird Counts and the proposed surveys

may help refine the status of this federally threatened species where it is poorly known south of its regular range.

Objectives: 1) To observe and characterize the distribution, abundance and migratory passage of nearshore marine birds along the mainland coast of Los Angeles, Ventura and Santa Barbara Counties in California; 2) to characterize the current marine bird diversity, distribution, abundance and migratory movements within the study area; and 3) to refine the status of the Marbled Murrelet in the study area.

Methods: Monthly surveys will be conducted over a 3-year period. Surveys will be taken from shore-based observation sites using binoculars and spotting scopes and possibly supplemented with some small-boat or aerial surveys. Survey sites will include coastal promontories and other areas that provide sufficient visibility to survey areas up to 500 m from shore. Known shore-based seabird watching locations will be used for the surveys including Point Fermin, Point Dume, Mugu Rock, Pitas Point and Goleta Point.

To ensure that the coast is adequately surveyed, additional survey sites will be established by reviewing historical information and consulting with local experts on nearshore bird distribution, migratory pathways and sites that provide an elevated and wide view of the coast. Access to Naval Base Ventura County and Vandenberg Air Force Base may be necessary to survey key points along large expanses of coastline under military ownership.

Survey methodologies from similar studies will be reviewed and modified, as necessary, to account for site-specific considerations and equipment availability. The exact methodology will be determined later, but will be similar to other land-based survey methodologies and incorporate the most applicable protocol. Examples of applicable protocols include:

The Puget Sound Seabird Survey protocol:

[http://www.seattleaudubon.org/sas/Portals/0/Science/Puget\\_Sound\\_Seabird\\_Survey/PSSS\\_Protocol\\_10-11.pdf](http://www.seattleaudubon.org/sas/Portals/0/Science/Puget_Sound_Seabird_Survey/PSSS_Protocol_10-11.pdf)

The nearshore distribution of terns and other seabirds in relation to EnCana's Deep Panuke natural gas pipeline construction in Stormont Bay, Nova Scotia:

<http://www.bsc-eoc.org/organization/images/news/ternrpt.pdf>

The survey results and data analysis will be published in a report to BOEM. Compiled data will be in a format compatible with other BOEM database requirements (e.g., Multipurpose Marine Cadastre and Environmental Studies Program Information System).

**Revised date:** April 9, 2012

## **SECTION 3.0 TOPICAL AREAS for FISCAL YEAR 2015**

### Renewable Energy and Alternate Use

Implementation of the BOEM Renewable Energy and Alternate Use Program from offshore wind and wave facilities remains a priority for the Pacific Region. Each of the Pacific Coast States has adopted renewable portfolio standards, and the OCS will likely be one area that will be tagged for contributing to the States' renewable energy goals. Studies are currently being performed to gather information for future projects along the Pacific Coast – to assess new technology opportunities for offshore California, Oregon, Washington and Hawaii; identify suitable areas and conditions; and examine regional environmental effects. These include marine mammal and seabird surveys, benthic surveys offshore potential renewable energy sites, and updated marine archaeological and cultural sites digitized databases. Additional studies will be needed as renewable energy and alternate use activities increase. Future studies will be needed to consider the impacting agents of proposed deepwater wind and wave energy devices, to identify suitable areas and conditions, and to examine environmental effects for the entire Pacific OCS Region of Washington, Oregon, California and Hawaii.

### Shorebird Surveys of the Channel Islands off Ventura and Santa Barbara Counties

The ESP presently funds a cooperative agreement with California State University Channel Islands to survey shorebirds along the Ventura County coastline. This study provides a long-term data set of shorebird populations and allows BOEM to assess real or potential effects of adjacent existing or potential offshore energy operations on sensitive shorebird species and to better assess the effects of long-term climate change in the region. Similar information for the Channel Islands would be beneficial in the event of an oil spill, and the National Park Service has indicated an interest in partnering with BOEM on this effort.

### Comprehensive Geodatabase and Geospatial Mapping of Seabird and Marine Mammal Data for the Pacific OCS

The Pacific Region has sponsored the collection of data on seabirds on the OCS for several decades. Recently, major strides have been made towards collecting seabird survey data in additional areas and in the form of improved survey design (e.g., Seabird and Marine Mammal Surveys off the Northern California, Oregon and Washington Coasts) with USGS and USFWS. As a result, we have a large collection of knowledge about seabirds and marine mammals and it continues to grow. Some projects are near completion (e.g., Shorebird Survey of Ventura County), or will complete field collection in about 2 years (e.g., Seabird and Marine Mammal Surveys off the Northern California, Oregon and Washington Coasts). A final compendium of information in the form of geodatabase expressed as geospatial mapping will augment our understanding of the seabird and shorebird and marine mammal species that are potentially at risk from offshore energy development and provide maps that illustrate the results in a way that is understandable to decisionmakers and the public. As new information becomes available, the data can be folded into the existing database once work is completed.

## Decommissioning

The Pacific Region faces a variety of environmental information needs related to decommissioning and probable creation of artificial reefs from some oil and gas platforms. The focus of this topical area continues to be the study of potential environmental impacts due to decommissioning OCS facilities off California, many of which are in exceptional water depths. Review of the 2004 Proceedings of the Decommissioning Workshop ([http://www.boemre.gov/omm/pacific/lease/Decommissioning/Summary\\_Recommendations\\_to\\_MMS.htm](http://www.boemre.gov/omm/pacific/lease/Decommissioning/Summary_Recommendations_to_MMS.htm)) and comparison to studies that have been accomplished since that time, show that most of the recommendations have been completed or are underway. The 2012 Studies Development Plan included two recommended studies from the workshop; one on productivity of platforms under two decommissioning options and one on sea lion use of offshore structures. However, a few issues related to marine mammals and onshore dismantlement, disposal and recycling remain. Specific areas of potential future studies may include assessment of removal and disposal of marine growth, development of criteria/factors in assessing potential onshore processing sites, and a review of the effects from the most current methods of severing platform legs applicable to Pacific Region platforms.

## SECTION 4.0 LITERATURE CITED

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